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ARE SWEDISH HOUSE PRICES TOO HIGH?  
WHY THE PRICE-TO-INCOME RATIO  
IS A MISLEADING INDICATOR

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Lars E.O. Svensson  
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### **ABSTRACT**

According to ECB (2023) and European Systemic Risk Board (2022), Swedish owner-occupied housing (OOH) was overvalued by about 55% in 2021q2, the largest overvaluation in the EU and EEA; according to European Commission (2023c), by about 30% in 2022. These assessments affect warnings and recommendations issued for Swedish economic policy and the shocks in EBA stress tests of Swedish banks.

But these large overvaluation assessments are due to the use of misleading indicators: the deviations of price-to-income (PTI) and price-to-rent ratios from their historical averages. It is shown that according to the appropriate indicator, the user-cost-to-income (UCTI) ratio, Swedish owner-occupied houses have since 2010 instead become increasingly undervalued (not overvalued), by about 30% in 2019q4. Due to rising mortgage rates, they are less undervalued in 2023q2, but still about 20%.

For Sweden, the UCTI and PTI indicators are in fact strongly negatively correlated and have opposite signs. If the UCTI indicator is right, the PTI indicator is consistently wrong. Taking the average of the two indicators is not a good idea.

The PTI ratio disregards mortgage rates and other housing costs and lacks scientific support. According to a large housing literature, it is not the purchase price but the user cost that is the appropriate measure of the cost of living in OOH, the cost of the housing services that the OOH delivers. New improved estimates of the user cost are constructed, including an adjustment for a preference shift during the coronavirus crisis in favor of larger and better housing.

The valuation assessments of the ECB, the ESRB, the Commission, the OECD, and the IMF are scrutinized and compared. The problem of misleading indicators and overvaluation assessments—and resulting distorted warnings and recommendations—is not restricted to Sweden but concerns several other countries in the European Union.

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# 1 Introduction and summary

Several international organizations that monitor and comment on Swedish economic policy have for many years maintained that Swedish house prices are too high and that Swedish (owner-occupied) housing thus is overvalued. The European Systemic Risk Board (ESRB)—with the help of estimates provided by the ECB—has concluded that Swedish housing was overvalued by about 55% in 2021q2 (ECB, 2023, ESRB, 2022b). This is the largest reported overvaluation in the European Economic Area (the EU as well as Iceland, Liechtenstein, and Norway). More recently, the European Commission has concluded that Swedish housing was overvalued by about 30% in 2022 (European Commission, 2023c).

These assessments of housing overvaluation affect the warnings and recommendations that these organizations issue for Swedish economic policy (European Commission, 2023c, ESRB, 2022a). They also affect the stress tests of the European Banking Authority that Swedish banks are subject to (ESRB, 2021). Because Sweden is considered having the largest overvaluation, Swedish banks are subject to more demanding stress tests than other EU banks. Nevertheless, Swedish banks have managed the tests quite well (FI, 2021).<sup>1</sup>

This paper demonstrates that these large overvaluation assessments are mainly due to the use of unreliable and misleading indicators, more precisely, the deviation of price-to-income (PTI) and price-to-rent (PTR) ratios from their historical averages. These indicators disregard the crucial role of interest rates and other costs of owner-occupied housing. They lack any scientific support. A simple and robust indicator that has scientific support in a large housing literature is the so-called *user cost of housing*. It is the actual cost of living in owner-occupied housing and takes into account mortgage interest; the cost of housing equity; costs of operation, maintenance, repair, and depreciation; taxes; capital gains; and so on.<sup>2</sup>

The deviation of the user-cost-to-income (UCTI) ratio from a benchmark is a natural indicator of the valuation and affordability of owner-occupied housing. The benchmark can be a reasonable fraction of disposable income, an index of the UCTI ratio set at 100 for a given base year (for example, a year at which the housing market is considered to have been neither over- nor undervalued), or a historical average. Here, the “UCTI indicator” will refer to a historical average as the benchmark. There will also be a few figures with indices somewhat arbitrarily set to 100 for 2010.<sup>3</sup>

The deviation of the user-cost-to-rent (UCTR) ratio from a benchmark is a natural indicator of the relative affordability of owner-occupied to rental housing. The benchmark can again be a

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<sup>1</sup> To provide serious and relevant tests of the resilience of EU banks, the tests need of course assume substantial negative shocks, including negative house-price shocks. But the results of these tests are more informative if the magnitude of these house-price shocks—and any differentiation across countries—beyond a substantial minimum size is determined in the light of *relevant* indicators instead of the deviations of PTI and PTR ratios from their historical averages.

<sup>2</sup> Boije (2019) has previously criticized the overvaluation assessments of European Commission (2019), including its disregard of the downward trend in real mortgage rates and its comparisons with rents that are subject to rent-control and differ from market rents.

<sup>3</sup> A historical average has the advantage that a bias in the UCTI may have little or no effect on deviations from the average. On the other hand it has the disadvantage that real-time indicators differs from full-sample ones. This is because the real-time average varies with the sample.

reasonable ratio (for example, unity for similar owner-occupied and rental dwellings), an index set to 100 for a given base year, or a historical average. Here, the “UCTR indicator” will refer to a historical average as the benchmark, but there will also be a few figures with indices set at 100 for 2010. However, for Sweden, the UCTR ratio is less informative and need to be interpreted with special care, because the rental market is deeply dysfunctional due to rent control.

For Sweden, the UCTI and PTI indicators turn out to be strongly negatively correlated and even of opposite signs after 2014. Both can therefore not be right. If we accept that the UCTI indicator is the right one, it follows that the PTI indicator is not only irrelevant but after 2014 consistently wrong in indicating over- or undervaluation. When the PTI indicator after 2014 signals overvaluation, the UCTI indicator signals undervaluation.<sup>4</sup>

According to the UCTI indicator, Swedish owner-occupied houses has since 2010 become increasingly undervalued, not overvalued, with a trough in late 2019 of about  $-30\%$ . Since then, taking into account a preference shift during covid toward larger and better homes as well as rising interest rates from 2022, the UCTI indicator has risen to about  $-20\%$  in 2023q2, still indicating a significant undervaluation.

## 1.1 The price-to-income indicator

The main results of this paper can be summarized with the help of figure 1.1. The solid blue line shows the PTI indicator—the percentage deviation of the PTI ratio from its historical average, where the PTI ratio is Swedish house prices divided by disposable income per capita.<sup>5</sup> The peak value is about 46% and occurs in 2022q1. According to the PTI indicator, Swedish houses were thus overvalued by almost 50% in 2022q1. The PTI indicator has since fallen to about 17% in 2023q2, still indicating overvaluation but less so.<sup>6</sup>

Several international organizations use the percentage deviation of the PTI ratio from a benchmark as one of the indicators of overvaluation of (owner-occupied) housing. The benchmark is typically a historical average from the mid 1990s until the latest available observation.<sup>7</sup>

The rationale for the PTI indicator has been expressed as follows:

Another statistical indicator relates house prices to income. Similar to the house price-to-rent ratio, such indicators are generally related to their long-term average. If the ratio lies above its long-term average, prospective buyers may find purchasing a home, and servicing the associated debt, more difficult, which should reduce demand and lead to downward pressures on house prices. (ECB, 2015b)

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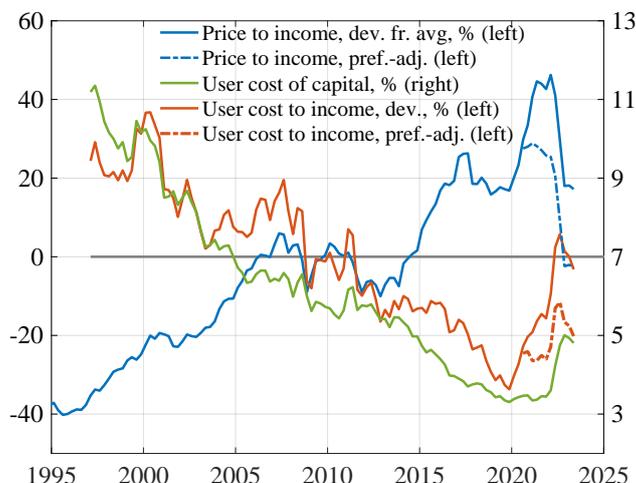
<sup>4</sup> The correlation coefficient for the PTI and UCTI indicators is  $-0.8$ .

<sup>5</sup> The house prices are an index of current prices of one- and two-dwelling owner-occupied houses. Disposable income is a 4-quarter trailing moving sum of quarterly net disposable income at current prices. Disposable income per capita is this sum divided by the population in the quarter. The historical average is from 1997q1 to the latest available observation. See appendix A for details.

<sup>6</sup> This paper focuses on owner-occupied houses and excludes owner-occupied apartments, because the price series on houses is longer. At the end of 2021, houses formed about 70% and apartments about 30% of the value of Swedish owner-occupied housing for permanent living (Statistics Sweden, 2023a).

<sup>7</sup> ECB and ESRB use the historical averages from 1996 until the latest available observation; the European Commission from 1995 until the latest available observation.

Figure 1.1: Price-to-income and user-cost-to-income ratios (percentage deviation from historical averages) and the user cost of capital (percent), Swedish houses.



Source and note: Own calculations. See appendix A and figure 3.5 for the underlying data. The “preference-adjustment” is explained in the text. The user cost of capital is from figure 3.4. The latest observation is 2023q2.

We may note that the rationale presented is an affordability argument: A PTI ratio above its historical average would imply that houses are less affordable for prospective buyers, which should reduce demand and lead downward pressure on house prices.

## 1.2 The user-cost-to-income indicator

However, there is a big problem with the PTI ratio as an indicator of affordability. The price of a dwelling is not at all the same as the annual cost of owning and living in the dwelling (Himmelberg et al., 2005, Mulheirn, 2019, for example). A simple thought experiment is sufficient to prove this statement: Assume for simplicity that taxes and operation, maintenance, repair, and depreciation costs are zero. Assume also that the house price is constant so there are no capital gains or losses. Assume finally that the buyer of a house can finance the purchase with an interest-only mortgage equal to the purchase price, that is, with a zero down payment and thus a loan-to-value ratio of 100%. Then the purchase of the dwelling results in an annual interest expenditure of just the interest on the mortgage. The relevant cost and the relevant measure of affordability is in this case the annual interest expenditure, not the purchase price. If the purchase price is twice as large, but the mortgage rate is half as large, the interest expenditure is unchanged.<sup>8</sup>

The last sentence in the quote above is thus misleading. A PTI ratio above its long-term average does not by itself imply that prospective buyers will find purchasing a home, and servicing the associated debt, more difficult.<sup>9</sup>

<sup>8</sup> However, the PTI ratio—preferably expressed in the years of disposable income for the average dwelling—would be most appropriate as measure of housing affordability on the island of Sark in the English Channel, on which mortgages are forbidden (Kelly, 2019). But it is not suitable as such an indicator if mortgages are available.

<sup>9</sup> Interestingly, the rationale for the PTI indicator in the above quote is directly followed by a warning that the interest rate matters:

Given a strong prevalence of mortgage financing, such indicators are often transformed into “affordability” measures, which are adjusted to reflect the prevailing average interest rate on bank loans for house

More generally, a dwelling is a durable good, an asset, which delivers a flow of services, housing services. It is the housing services that are consumed by the owner-occupier, not the dwelling.<sup>10</sup> It is therefore important to distinguish between the purchase price of the dwelling and the annual cost of the housing services that the dwelling delivers. The latter is the annual cost of living in the dwelling, the *user cost of housing* (services) (UC). It is the user cost, by itself or relative to income or rents, that is the relevant metric for valuation assessments, not the purchase price.

For rental housing, it is obvious that it is the rent that is the cost of the housing services consumed and that the rent is the appropriate measure of the cost of living in rental housing. To assess the affordability of rental housing, it is then natural to look at the rent-to-income (RTI) ratio.

For owner-occupied housing, it should be equally obvious that it is the user cost, not the purchase price, that is the appropriate measure of the cost of living in owner-occupied housing. To assess the valuation and affordability of owner-occupied housing, it should then be equally natural to examine the user cost-to-income (UCTI) ratio.

Furthermore, the user-cost-to-rent (UCTR) ratio is a natural measure of the relative affordability of owner-occupied and rented housing. In a hypothetical perfectly functioning market for rented and owner-occupied housing without transactions costs and any differences in taxation, the UCTR ratio should be equal to unity for similar dwellings.

As explained in some detail in section 3, the (annual) user cost equals the sum of the annual operation, maintenance, repair, and depreciation (OMRD) costs; the real after-tax interest on the mortgage; the real cost of the housing equity; the taxes on the property and on imputed rental income; transactions costs; possibly a risk premium; and the negative of the real after-tax annual net capital gains on the house. Positive capital gains reduce the user cost and therefore enter with a negative sign.

The user cost can be calculated for a particular dwelling size or per square meter (sqm). It can also be calculated as a percentage of the dwelling value. Then it can be called the *user cost of (housing) capital* (UCC). The  $UCC_t$  in quarter  $t$  is thus defined as

$$UCC_t \equiv UC_t/P_t, \tag{1.1}$$

where  $UC_t$  and  $P_t$  denote, respectively, the user cost and house price (for a given dwelling size or per sqm) in quarter  $t$ .<sup>11</sup>

It follows that the UCTI ratio can be calculated as the product of the UCC and the PTI ratio,

$$UCTI_t \equiv UCC_t PTI_t, \tag{1.2}$$

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purchase.

The affordability ratio can be adjusted for interest rate developments in a number of ways. An interest rate variable, derived from a standard annuity formula, can be incorporated directly into the affordability ratio. (ECB, 2015b)

Unfortunately, this warning is apparently easily forgotten.

<sup>10</sup> Conceptually, the owner-occupier combines the two roles of a landlord and renter; the owner-occupier is both a landlord owning the dwelling and renting it to herself and a renter renting from herself (for details, see Svensson, 2022b, section 4.2). Haffner and Heylen (2011) provides a thorough conceptual discussion of the user cost.

<sup>11</sup> What is called the “user cost of capital” here is called the “user cost” or “user cost of (owner-occupied) housing” in some papers, and what is called the “user cost” here may be called the “price of housing services” or “imputed rental price” (Prescott, 1997).

where  $PTI_t$  denotes the PTI ratio in quarter  $t$ .<sup>12</sup> As we shall see, it is practical to first calculate the UCC and then calculate the UCTI ratio according to (1.2).

The green line in figure 1.1 shows the UCC (measured along the right axis). It falls substantially from about 11% in 1997q1 to a trough close to 3% in 2021. It stays down until 2022q1 and then rises to almost 5% in 2023q2. As is explained in section 3, the fall and rise of the UCC is explained by the fall and rise in mortgage rates as well as a fall and rise in the OMRD rate, the ratio of OMRD costs to house prices.

The solid red line shows the resulting UCTI indicator—the percentage deviation of the UCTI ratio from its historical average. The UCTI ratio is the product of the UCC and PTI ratio as in (1.2). We see that the large fall in the UCC dominates over the substantial rise in the PTI ratio. This makes the UCTI ratio fall from about 25% *above* its historical average in 1997 to a trough of about 30% *below* its historical average in 2019q4. It then rises to slightly below the historical average in 2023q2.<sup>13</sup>

Thus, according to the UCTI indicator, Swedish houses were *undervalued* by about 30% in 2019q4, not overvalued by about 18% as suggested by the PTI indicator. Furthermore, by the UCTI indicator, in 2023q2 Swedish houses were neither under- nor overvalued, not overvalued by about 18% as suggested by the PTI indicator.

However, figure 1.1 shows that the PTI ratio rose particularly fast during the coronavirus crisis in 2020 and 2021. A similar development can be seen in several comparable countries. As discussed further in section 2, this price rise is best explained by a household preference shift in favor of larger and better homes, due to widespread working from home. That is, this price rise is consistent with fundamental factors and is not by itself any indication of overvaluation (Sveriges Riksbank, 2021).

Given this, for the purpose of assessing over- or undervaluation of housing over time, one may want to use “preference-adjusted” house prices and user costs, corresponding to approximately unchanged preferences. The dash-dotted blue line in figure 1.1 shows the percentage deviation from the historical average of a PTI ratio for preference-adjusted housing prices. The simple assumption is that 75% of the price increases during 2020q2–2022q1 were due to the preference shift, so the preference-adjusted house prices are simply the observed house prices less those price increases.

The dash-dotted red line shows the corresponding preference-adjusted UCTI indicator, the UCTI ratio’s deviation from its historical average. It stays down in 2021 well below the historical average and thereafter only rises to about 20% below the historical average in 2023q2.

### 1.3 The PTI and UCTI indicators are strongly negatively correlated

Furthermore, in figure 1.1, the preference-adjusted PTI and UCTI indicators appear to be approximately the mirror image of each other. This is confirmed in figure 1.2, where the PTI indicator is replaced by its negative. That is, the *negative* of the preference-adjusted PTI indicator gives essentially the same message about over- and undervaluation in Sweden as the preference-adjusted

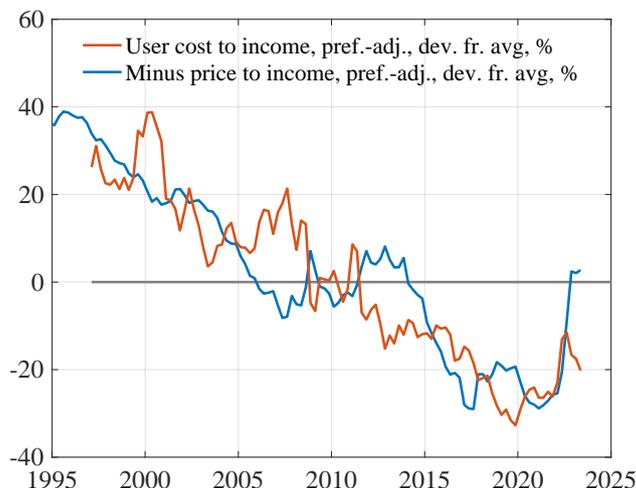
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<sup>12</sup> Given the identity (1.1), (1.2) is also an identity.

<sup>13</sup> The historical average of the UCTI ratio is from 1997q1 to the latest observation, because the mortgage rates used are only available from 1997q1.

UCTI indicator. If we accept that the UCTI indicator is the relevant indicator, it follows that for Sweden the PTI indicator is not only irrelevant but after 2014 consistently wrong. This is a pretty devastating result for the PTI ratio as an indicator of over- and undervaluation. Taking the average of the two indicators is not a good idea.<sup>14</sup>

Figure 1.2: The preference-adjusted user-cost-to-income ratio and the negative of the preference-adjusted price-to-income ratio (percentage deviation from historical averages).



Source and note: The deviation from historical averages of the preference-adjusted UCTI and PTI ratios, the latter with opposite sign, from figure 1.1. The correlation coefficient is 0.8. The latest observation is 2023q2.

In summary, the PTI and UCTI indicators deliver opposite messages about housing valuation. According to the preference-adjusted PTI indicator (adjusted from 2020q2), Swedish houses were undervalued by about 35% in 1997, neither over- nor undervalued in 2010, overvalued by about 26% in 2021q4, and neither over- nor undervalued in 2023q2.

According to the UCTI indicator, Swedish houses were *overvalued* by about 25% in 1997, neither over- nor undervalued in 2010, *undervalued* by about 25% in 2021q4, and still *undervalued* by about 20% in 2023q2 (see table 1.1 for details).

Table 1.1: Price-price-to-income and user-cost-to-income ratios. Preference-adjusted, percentage deviations from historical means, and percentage-point differences.

	PTI	UCTI	PTI–UCTI
1997	–34%	+25%	–58 pp
2010	+2%	–3%	+4 pp
2019q4	+17%	–34%	+51 pp
2021q4	+26%	–26%	+52 pp
2023q2	–3%	–20%	+17 pp

Source and note: Figure 1.1, preference-adjusted (during 2020q2–2021q1) PTI and UCTI deviations from historical means.

<sup>14</sup> Appendix B provides some cointegration analysis of the logs of the UCC and preference-adjusted house prices and PTI and UCTI ratios. The hypothesis of no cointegration for the log UCC and preference-adjusted PTI ratio is rejected at a significance value of close to 1%, with a p-value of 1.3%. A linear relation between the demeaned logs of the preference-adjusted log PTI and UCTI ratios is estimated to be  $\log \text{PTI} = -0.93 \log \text{UCTI} + \varepsilon_t$ , consistent with figure 1.2.

The reason for these different messages is that the PTI indicator ignores movements in the UCC, but these movements are large and negatively correlated with the PTI ratio. This makes the UCTI and PTI indicators negatively correlated in figures 1.1 and 1.2. The international organizations mentioned prefer a valuation indicator that—at least for Sweden—is strongly negatively correlated with the more relevant indicator, the indicator that has scientific support in a large housing literature.<sup>15</sup>

#### 1.4 The user-cost-to-rent indicator

The international organizations also use the percentage deviation of the price-to-rent (PTR) ratio from a historical average as another indicator of overvaluation. The rationale for the PTR indicator is similar to that of the PTI indicator:

[The price-to-rent indicator] relates house prices to rents based on an arbitrage assumption. Accordingly, if house prices rise beyond what is justified by fundamentals then households will postpone purchasing a house and rent instead, thereby producing downward pressure on house prices. The validity of this assumption rests on households having a viable alternative in the rental market. (ECB, 2015b)

The PTR indicator is subject to the same problem as mentioned above for the PTI indicator, namely, that the price of a dwelling is not at all the same as the annual cost of owning and living in the dwelling. The same simple thought experiment as above applies. Instead, the user-cost-to-rent ratio and its deviation from a historical average are the appropriate indicators.

In a similar way to the UCTI ratio, it is practical to calculate the UCTR ratio as the product of the UCC and the PTR ratio,

$$\text{UCTR}_t \equiv \text{UCC}_t \text{PTR}_t. \quad (1.3)$$

Importantly, the UCTR ratio is an appropriate indicator only with a well-functioning rental market, so some arbitrage between renting and owning is practically possible. In a well-functioning market for rented and owner-occupied housing with moderate transactions costs and differences in taxation, the UCTR ratio should not deviate too much from unity for similar dwellings.<sup>16</sup>

However, Sweden has a dysfunctional rental market for apartments due to rent control, with regulated rents substantially below market rents. Queuing time to get a rent-controlled apartment in the major cities is often ten years or more. Furthermore, there is no functioning rental market for houses.<sup>17</sup> The UCTR ratio is therefore hardly an appropriate indicator of over- or undervaluation of owner-occupied housing in Sweden. It is briefly discussed in section 4.<sup>18 19</sup>

<sup>15</sup> See footnote 30 for references to this literature.

<sup>16</sup> The equality of the user cost and the rent for similar dwellings is the rationale for the method of Owner Equivalent Rents (OER)—also called the rental-equivalence method. It uses observed rents on similar rented dwellings as an estimate of the user cost of owner-occupied housing in national accounts and consumer price indices. However, we can see in figure 4.3, p. 22, that there can be a substantial difference between rents and user costs, due to inertia, frictions, rent control, and other imperfections in the housing market. This means that the OER method can be quite misleading.

<sup>17</sup> Buy-to-let for houses is very rare or non-existing in Sweden. Buy-to-let for apartments is quite rare, because tenant-owner associations normally restrict subletting. Tenant-ownership is the dominant type of ownership for Swedish owner-occupied apartments.

<sup>18</sup> There is no rental market to speak of for houses, only owner occupation (including some tenant-ownership also of houses). Therefore, the calculation of UCTR ratios here use rents of rental apartments in apartment buildings.

<sup>19</sup> The rationale in quoted above for the PTR indicator is directly followed by several warnings:

In 2006, a reform of the Swedish rent-control system was implemented to stimulate the construction of new rental housing. It had been rather limited after the dismantling of construction subsidies in 1990. The reform consisted of introducing a special option for new rental housing, namely, to negotiate and set rents before the construction start. These rents were “presumed” to be exempt for fifteen years from the standard rent-control of the existing housing stock. They are therefore called “presumption rents” (Lind, 2021). As a result, rents in newly constructed buildings are set at a substantially higher level than rent-controlled rents. The presumption rents are arguably close to free-market levels. They may thus be used as indicators of market rents as distinct from rent-controlled rents. Therefore, UCTR ratios for presumption rents can arguably be used for assessing valuation of owner-occupied housing, although only a small minority of rented housing has presumption rents.

In practice, Swedish presumption rents have increased over time in line with per capita disposable income (figure G.2, p. 48) so the deviation from a historical average of the UCTR ratio for presumption rents looks rather similar and provides similar information as the UCTI ratio.

## 1.5 Absolute comparisons of user cost

The house price used in this paper is only available in index form. With more specific data, over- and undervaluation can be determined with more precisions. Suppose there is data available so that the user cost can be calculated in SEK for a specific type of owner-occupied dwelling of a given quality. Suppose that there is also data on the rent in SEK on rented dwellings of the same type and quality. Then we can say that the owner-occupied dwelling is over- or undervalued depending on whether the user cost is lower or higher, respectively, than the rent. This is a case when it is possible to make absolute comparisons of the user cost and rent for similar dwellings. It is also possible to express UCTI ratios as percentages of income, providing in this sense absolute measures of affordability.

As an example of such an absolute comparison, Svensson (2020) shows that the monthly user cost for an owner-occupied average studio (an apartment with a single multipurpose room) in Stockholm Municipality 2017 was substantially lower than the monthly rent for a similar rent-controlled apartment: SEK 2,800 vs. SEK 5,300, respectively (about EUR 280 vs. EUR 530 at the time). Furthermore, the queue to get a rent-controlled apartment was about 10 years, and the free-market rent for a secondary rental would be double the rent-controlled rent or more.<sup>20</sup> Another example is presented in Flam (2016). For 2000–2015, he compared owner-occupied user costs to

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The validity of this assumption rests on households having a viable alternative in the rental market. The extent to which this holds differs across euro area countries and largely depends on the scale and composition of national rental and owner-occupied markets. . . . Further complicating this, rents may not always be set at market rates given considerable regulation of the sector. Last but not least, the house price-to-rent indicator typically assumes a constant long-term average, but there may be important structural breaks arising from policy changes. For these reasons, the house price-to-rent indicator, although commonly used as a benchmark for house price valuation, may not be a reliable metric for assessing valuations in some euro area countries. (ECB, 2015b)

Again, these warnings seem to be easily forgotten.

<sup>20</sup> The user cost is lower despite excluding substantial positive real after-tax capital gains.

presumption rents in Stockholm’s inner city, the hottest housing market in Sweden. He found that presumption rents exceeded the user cost. Thus, there was no indication of overvaluation even in this hot market (see footnote 70).

## 1.6 What is new?

Even though there is a large literature on various aspects of user costs (see footnote 30 for references), I believe that a few things are special or new in this paper:

1. The UCTI ratio relative to its historical average is used as a main indicator of overvaluation.<sup>21</sup>
2. It is shown that the PTI and UCTI indicators are strongly negatively correlated, at least for Sweden. Thus, they cannot both be right.
3. The comparison between the PTI, PTR, UCTI, and UCTR ratios is undertaken in a few informative figures. The reasons why the PTI and PTR ratios are misleading are clearly demonstrated in these figures.
4. A simple and transparent method is used to adjust for the household preference shift during the coronavirus crisis in favor of larger and better homes.
5. An essential part of the paper is a comparison with the valuation results for Sweden of the ECB, the ESRB, the European Commission, the OECD, and the IMF. The valuation results of the ECB, ESRB, and the Commission to a large extent rely on the PTI and PTR indicators. To that extent, they are essentially misleading and negatively correlated with the UCTI results of this paper. However, the Commission’s own Housing Taxation Database reports a UCC for Sweden (Grünberger et al., 2023). When this UCC is used, the UCTI results are similar to the ones of this paper. The OECD and the IMF do not maintain that Swedish housing is overvalued. The OECD has done substantial work on housing affordability and uses a set of reasonable affordability measures.
6. A separate companion note (Svensson, 2022b)—with a simple frictionless theoretical model—shows with a simple rewriting of an owner-occupying household’s budget constraint why the user cost is the appropriate measure of the cost of living in owner-occupied housing. Furthermore, with Cobb-Douglas preferences, the frictionless equilibrium UCTI ratio may be quite stable over time and therefore a reasonable benchmark.
7. I use National Accounts data for operation, maintenance, and repair (OMR) costs and consider that OMR concerns the structures but not the land (following Hansson, 2019). The share of land in house prices has increased substantially in Sweden. This is handled by weighing these costs and the depreciation with the share of structures in the value of housing. I go beyond Hansson in looking at UCTI ratios rather than just user costs and in relying explicitly on the methods of Statistics Sweden and the US Bureau of Economic Analysis to calculate the depreciation of owner-occupied housing (Svensson, 2022a). It is shown that the common practice of assuming a constant rate of OMR and depreciation is quite misleading for Sweden.

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<sup>21</sup> Only a few papers (Office of Policy Development and Research, 2000, Dermiani et al., 2016, Svensson, 2019, 2020) have to my knowledge emphasized the role of the user-cost-to-income ratio rather than the user-cost-to-rent ratio or the level of the user cost as an indicator of affordability or overvaluation.

8. A convenient and conservative assumption is that the expected real after-tax capital gains on houses are zero. This implies that the calculated user cost is exclusive of any speculation about capital gains. This introduces a bias toward higher user costs. This in turn introduces a bias toward higher UCTI and UCTR ratios and thereby toward overvaluation, thus stacking the cards in favor of finding overvaluation. However, when overvaluation is measured by the deviations of UCTI and UCTR ratios from their historical averages, there is less or no bias, because the historical averages are also higher.<sup>22</sup>

## 1.7 Not a theory of house-price determination

Importantly, the user-cost approach presented here is a method to assess the valuation of housing in terms of the cost of living in owner-occupied housing relative to household incomes and to rents on similar available rental housing. It is not a theory of house-price determination, how house prices depend on fundamentals. The user-cost approach is sometimes used as a simple house-price theory, where the user cost is assumed to be always equal to rents—often referred to as the “rent arbitrage” or “asset pricing” theory of house prices. Alternatively, the UCTI ratio can be assumed to be exogenous or even constant. These simple theories for frictionless and perfect housing markets theory are rejected in this paper by the simple observation that user costs differ from rents for long periods and that UCTI ratios are far from constant. House prices do not adjust sufficiently fast to keep the UCTI or UCTR ratios constant. Put differently, a good theory of housing prices should explain why and how user costs deviate from rents and why UCTI ratios fluctuate. Such a theory needs to take into account the supply of housing, the liquidity and credit constraints facing households, the role of housing cash payments for liquidity-constrained households as distinct from user costs, and other frictions and imperfections in the housing and mortgage markets (Greenwald, 2018, Bäckman and Khorunzhina, 2019, Svensson, 2019, Mølbak Ingholt, 2022).<sup>23 24</sup>

## 1.8 Outline

The rest of the paper is organized as follows: Section 2 discusses the PTI and PTR indicators and reports what overvaluation they would indicate. Section 3 defines the user cost of housing and the user cost of capital (UCC), which is the user cost divided by price of the dwelling in SEK (or the

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<sup>22</sup> The conservative assumption has performed well on US data, in the sense that, with this assumption, Garner and Verbrugge (2009b) found that the resulting user costs tracked market rents rather well. See the quote from Diewert (2013, appendix, para. 3.67). The assumption is also used in Iceland (Guðnason and Jónsdóttir, 2009).

<sup>23</sup> Almenberg et al. (2022) is an example in which the user cost is assumed to be exogenous and growing at a constant rate when house-price changes are predicted. FI (2022a, In-depth analysis, pp. 22–25, and Appendix 2, pp. 45–47) is an example where the UCTI ratio is assumed to be constant when house-price changes are predicted.

<sup>24</sup> Duca et al. (2021a,b) have criticized the simple rent-arbitrage (asset-price) theory for being misleading, inconsistent with empirical estimates, and not taking into account inertia, frictions and other imperfections in housing and mortgage markets. These include that fact that rented apartments are imperfect substitutes to houses with more land per occupant, rents are stickier and less cyclical than house prices, different characteristics of renters and owner-occupiers, unobserved costs and benefits of owning versus renting, and the combination of large transactions costs, risk aversion, and house-price volatility making it difficult to arbitrage between renting and buying. Furthermore, credit constraints and entry barriers in the form of affordability tests; limits on debt-service-to-income, loan-to-income and loan-to-value ratios imposed by lenders and macroprudential authorities restrict the demand for owner-occupied housing.

local currency in another country in focus). It also calculates the UCC and displays its components. Section 4 discusses the UCTI and UCTR ratios and their implication for any overvaluation of Swedish housing, taking into account the household preference shift. Section 5 scrutinizes the calculations of and comments on Swedish housing overvaluation by the ECB and the ESRB, the European Commission, the OECD, and the IMF. It also briefly compares the ECB and Commission model results with those of the staff of the Riksbank and of the National Debt Office. Section 6 concludes.

The companion note Svensson (2022b) and a few appendices present a theoretical background and some details. Appendix A lists the data used. Appendix B provides some cointegration analysis of the logs of the UCC and preference-adjusted house prices and PTI and UCTI ratios. Appendix C examines whether Swedish households have overoptimistic mortgage-rate expectations or not. Appendix D provides some details of Riksbank and National Debt Office empirical models of Swedish house prices. Appendix E reports the actual capital gains on owner-occupied houses. Appendix F reports data on housing-expenditure-to-income ratios by tenure. Appendix G includes additional figures.

## 2 The price-to-income and price-to-rent ratios

The *price-to-income* (PTI) and *price-to-rent* (PTR) ratios are defined as  $PTI_t \equiv P_t/DI_t$  and  $PTR_t \equiv P_t/R_t$ . Here,  $P_t$  denotes the price of a dwelling of standardized size (or per sqm) in period  $t$ ,  $DI_t$  denotes net disposable income per capita, and  $R_t$  denotes rents.<sup>25</sup> Figure G.1 shows Swedish house prices, disposable income, disposable income per capita, rents, presumption rents, and population.

For house prices, the longest available series is a quarterly price index for one- and two-dwelling houses for permanent living provided by Statistics Sweden (2023h). It excludes apartments. It is also reported with a lag of 2–3 months because it uses the date of the deed rather than the earlier date of the contract. From 2005 a monthly index, the HOX index, is provided for houses and apartments by Valueguard (2023). Figure G.17 shows the different price indices.<sup>26</sup> I use a linked quarterly price index consisting of the Statistics Sweden price index up to 2005q1 and a quarterly mean of the HOX index from 2005q1 (figure G.7).

Figure 2.1 shows the PTI and PTR ratios and their averages during 1997q1–2023q2. Figure 2.2 shows their percentage deviations from their averages. According to the PTI indicator, Swedish houses were overvalued by 46% in 2022q1 and 17% in 2023q2.<sup>27</sup> According to the PTR indicator, they were overvalued by 70% in 2022q1 and by 39% in 2023q2. For presumption rents, the PTR ratio is similar to the PTI ratio and thus indicates a similar degree of overvaluation.

<sup>25</sup> There is a choice between using disposable income or disposable income per capita, and between gross and net disposable income (the latter is net of the depreciation of households’ fixed capital. Here I use net disposable income per capita. International organizations often use gross in international comparisons, because countries calculate fixed-capital depreciation differently. Figure G.10 shows that for Sweden the difference between gross and net disposable income is small.

<sup>26</sup> SBAB Booli (2023) has a monthly price index for apartments and houses from 2013.

<sup>27</sup> In contrast, ESRB (2022b, table 1, Scoreboard), reproduced as figure G.25, reports that the PTI ratio in 2021q2 exceeds its average during 1996q1–2021q2 by no less than 66%, a number difficult to explain (section 5.1).

Figure 2.1: Price-to-income and price-to-rent ratios. Index 2010 = 100.

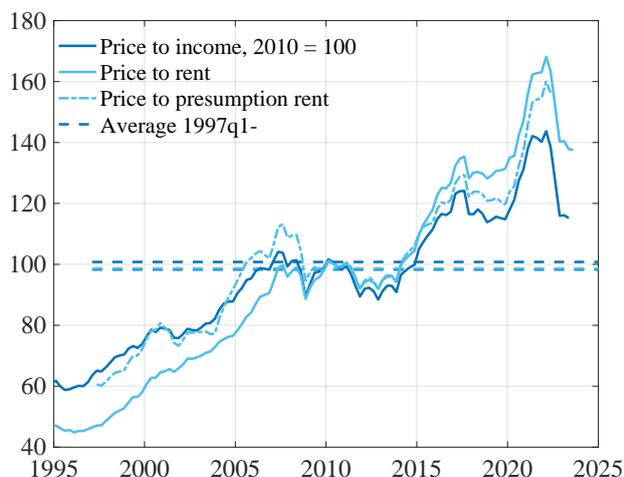
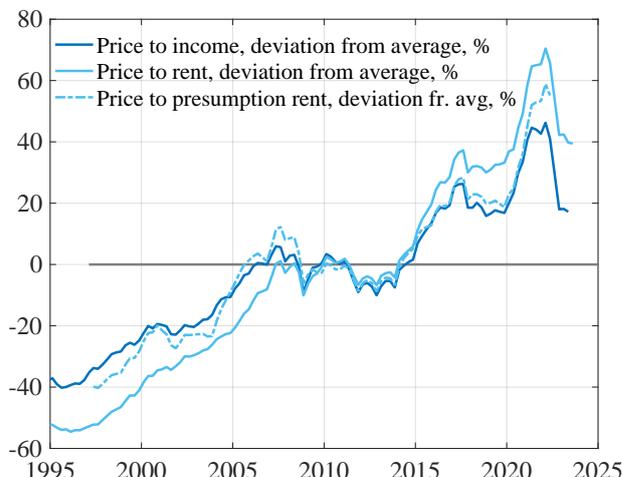


Figure 2.2: Price-to-income and price-to-rent ratios. Deviation from historical average.



Source and note: [Statistics Sweden \(2023e,h\)](#), [Valueguard \(2023\)](#), and own calculations. Income is disposable income per capita. Presumption rents are rents in newly constructed buildings exempt from rent control.

In this paper, variables are expressed as percentage deviations from historical averages or indexed to 100 for the base year 2010. The former have the advantage that they do not depend on the indexation base year. They do have the disadvantage that there is a (decreasing) difference between full-sample and real-time estimates.<sup>28</sup>

### 3 User cost and user cost of capital

The (annual) *user cost of housing* (services) can be defined as the annual cost of buying a dwelling at the beginning of a year; paying operating, maintenance, and depreciation costs as well as taxes during the year; and selling the dwelling at the end of the year, paying any capital-gains tax at the end of the year.<sup>29</sup> More precisely, a simple version of the user cost of housing (UC) equals the sum of the operating, maintenance, repair, and depreciation costs (OMRD), the real after-tax mortgage interest, the real cost of housing equity, property taxes, possibly a risk premium, and the negative of the (expected or realized) real after-tax capital gains.<sup>30</sup>

The note [Svensson \(2022b\)](#) presents a simple frictionless model that explains why the user cost is the appropriate measure of the cost of owner-occupied housing. It also explains why the UCTI

<sup>28</sup> The historical average moves with the recent deviation from it. One could consider real-time deviations from a historical average or from the average over a moving constant-length window. See figure [G.5](#) for the PTI deviation from a real-time historical average. See figure [G.6](#) for the real-time and full-sample deviations of the adjusted UCTI ratio. The difference between the real-time estimates and the full-sample estimates is decreasing over time but substantial early in the sample.

<sup>29</sup> Annual average transactions cost associated with the purchase and sale of the dwelling over a typical ownership period can be added.

<sup>30</sup> The user cost of housing is discussed by, for example, [Dougherty and Van Order \(1982\)](#), [Poterba \(1984\)](#), [Prescott \(1997\)](#), [Office of Policy Development and Research \(2000\)](#), [Himmelberg et al. \(2005\)](#), [Poterba and Sinai \(2008\)](#), [Díaz and Luengo-Prado \(2008\)](#), [Verbrugge \(2008\)](#), [Garner and Verbrugge \(2009a,b\)](#), [Englund \(2011, 2020\)](#), [Haffner and Heylen \(2011\)](#), [Muellbauer \(2012\)](#), [Diewert \(2013, appendix\)](#), [Fox and Tulip \(2014\)](#), [Duca et al. \(2016, 2021a,b\)](#), [Hansson \(2019\)](#), [Mulheirn \(2019\)](#), and [Svensson \(2019, 2020, 2022b\)](#).

and UCTR ratios rather than the PTI and PTR ratios are appropriate indicator of overvaluation. In particular, the model shows that, for an economy with households that have Cobb-Douglas preferences, the equilibrium UCTI ratio is likely to be approximately constant whereas the equilibrium PTI and PTR ratios are not.

The user cost can be calculated for a particular dwelling size or per square meter. It can also be calculated per SEK dwelling value and expressed as percentage of the house price. Then it can be called the *user cost of (housing) capital* (UCC) and is given by

$$UCC_t \equiv UC_t/P_t, \quad (1.1 \text{ repeated})$$

where  $UC_t$  denotes the (annual) user cost in quarter  $t$  and  $P_t$  denotes the house price.<sup>31</sup>

It is often practical to first calculate the UCC, and then calculate the user cost as

$$UC_t = UCC_t P_t. \quad (3.1)$$

The user-cost-to-income (UCTI) and user-cost-to-rent (UCTR) ratios are defined as  $UCTI_t \equiv UC_t/DI_t$  and  $UCTR_t \equiv UC_t/R_t$ , respectively. Given the UCC and the PTI and PTR ratios, the UCTI and UCTR ratios can then conveniently be calculated as

$$UCTI_t \equiv UCC_t PTI_t, \quad (1.2 \text{ repeated})$$

$$UCTR_t \equiv UCC_t PTR_t. \quad (1.3 \text{ repeated})$$

Here, (1.2) and (1.3) (and (3.1)) are actually identities, given the definitions of each variable in them.

Following [Poterba \(1984\)](#), [Poterba and Sinai \(2008\)](#), and [Barrios et al. \(2019\)](#), the UCC can be written as

$$UCC_t = [LTV_t(1 - \tau_t^M)i_t + (1 - LTV_t)(1 - \tau_t^{ci})i_t^{eq}] + m_t + \tau_t^p + \rho_t - (1 - \tau_t^{cg})\pi_t^{he}. \quad (3.2)$$

Here, the term in square brackets is the nominal after-tax *financing cost*. The first term within the squared brackets is the LTV-weighted after-tax nominal mortgage rate. The second term is the housing-equity-to-value-weighted after-tax nominal cost of housing equity. The before-tax mortgage rate,  $i_t$ , may differ from the before-tax cost of housing equity,  $i_t^{eq}$ , as may the rates of mortgage tax relief,  $\tau_t^M$ , and capital-income tax,  $\tau_t^{ci}$ .<sup>32</sup>

The variable  $m_t = OMRD_t/P_t$  (the OMRD rate) denotes the ratio of the operation, maintenance, repair, and depreciation costs to the house price;  $\tau_t^p$  denotes the property tax rate; and  $\rho_t$  denotes a risk premium, representing that housing ownership may be perceived to be risky relative to a safe alternative investment.<sup>33</sup>

<sup>31</sup> What is called the “user cost of capital” here is called the “user cost” or “user cost of (owner-occupied) housing” in some papers, and what is called the “user cost” here may be called the “price of housing services” or “imputed rental price” ([Prescott, 1997](#)).

<sup>32</sup> The financing cost can obviously be extended to include the cost of unsecured loans that finance deposits, the return on a diversified portfolio of financial assets as the cost of housing equity, and so on.

<sup>33</sup> Any tax on imputed rental income should be added. Sweden had such a tax before 1991 ([Englund, 2020](#)).

Finally, the last term in (3.2) is the negative of the expected rate of nominal after-tax capital gains. Here,  $\pi_t^{he}$  denotes the expectations held in quarter  $t$  of the rate of future nominal house-price appreciation, and  $\tau_t^{cg}$  denotes the nominal capital-gains tax rate.<sup>34</sup> The expected nominal after-tax capital gains reduce the user cost and therefore enter with a negative sign in the UCC.

Let the variable  $\pi_t^e$  denote the homeowner's (not necessarily rational) expectations in quarter  $t$  of the rate of future CPI inflation. Following Svensson (2019, 2020) by subtracting and adding this term in (3.2), the UCC can be written as

$$\text{UCC}_t = r_t + m_t + \tau_t^p + \rho_t - [(1 - \tau_t^{cg})\pi_t^{he} - \pi_t^e], \quad (3.3)$$

where

$$r_t = \text{LTV}_t(1 - \tau_t^M)i_t + (1 - \text{LTV}_t)(1 - \tau_t^{ci})i_t^{eq} - \pi_t^e. \quad (3.4)$$

denotes the *real* after-tax financing cost. The term in square brackets in (3.3) is the expected rate of *real* after-tax capital gains.

Under the conservative assumption that the expected real after-tax capital gains are zero, the expression for the UCC simplifies to

$$\text{UCC}_t = r_t + m_t + \tau_t^p + \rho_t. \quad (3.5)$$

This assumption is conservative in the sense that it is biased toward lower capital gains and higher user costs. In the absence of any capital-gains tax, it amounts to assuming that nominal house prices follow the CPI, that is, that expected future real house prices are constant.<sup>35</sup>

More precisely, this assumption is conservative when the actual level in SEK of the user cost is considered, in comparison with rents or as a share of the level of disposable income. It need not affect the percentage deviation from historical averages, since the assumption will affect the level of the historical average.

The European Commission has collected a database, the Housing Taxation Database, of comparable time series of the main features of home ownership taxation and user cost of housing in the EU and the UK (Barrios et al., 2019, Thiemann et al., 2022, Grünberger et al., 2023). The purpose of the database is not to assess any overvaluation of housing but to display the distortions of housing choices caused by taxation. However, the database is very useful also for estimating user costs of housing and user-cost-to-income ratios for valuation assessments in the EU. Expression (3.3) is a somewhat simplified variant of the expression of the UCC presented there. The database and its results regarding Swedish housing valuation is further discussed in section 5.2 below.<sup>36</sup>

<sup>34</sup> According to Barrios et al. (2019), only Cyprus and Sweden have such a capital-gains tax in the EU.

<sup>35</sup> The assumption is quite conservative, given that the average annual rate of the ex-post real after-tax capital gains has been 1.5% during 2010q1–2023q2 and 3.3% during 1997q1–2023q2 (appendix E). These numbers furthermore disregard that the capital-gains tax can be postponed, which increases the effective capital gains.

The conservative assumption has performed well on US data, in the sense that, with this assumption, Garner and Verbrugge (2009b) found that the resulting user costs tracked market rents rather well. See the quote from Diewert (2013, appendix, para. 3.67). The assumption is also used in Iceland (Guðnason and Jónsdóttir, 2009).

<sup>36</sup> What is called the user cost of capital (UCC) here is called the user cost of owner-occupied housing (UCOH) indicator in Barrios et al. (2019) and Grünberger et al. (2023).

### 3.1 The components of the UCC

**The real after-tax financing cost** It remains to determine the components of the UCC in (3.5) and (3.4). I use a mortgage rate with a 5-year fixation period from SBAB (2023) (figure G.19). These are “listed” rates. Actual rates are lower by a rebate. SBAB listed rates have the advantage that they seem much closer to actual rates than the average listed rates, see figure G.24. Any resulting upward bias in the financing user cost should in any case have little or no effect on the deviation from a historical average.

Using a 5-year rate implies considering the user cost as being perceived as a longer-run annual average, which seems appropriate given that house purchases are longer-run decisions. Five-year rates are also normally higher than short rates, which implies a bias toward higher UCCs.<sup>37 38</sup>

For Sweden, the rates of mortgage tax relief and capital-income tax are the same and equal to 30%. Furthermore, for simplicity, for most of the sample, I assume that the cost of housing equity equals the mortgage rate,  $i_t^{eq} = i_t$ . In this case, the LTV ratio does not matter for the financing cost.

However, the rapid increase in mortgage rates in 2022 from a situation of generally very low interest rates has not been accompanied by increased rate of return of alternative investments. Swedish mortgagors have substantial financial assets, including substantial bank deposits with safe but very small rates of return (FI, 2022a, Statistics Sweden, 2023j). These have not increased in parallel with the mortgage rates. Given this, I assume that the cost of equity is constant starting from 2021q3 and equal to the mortgage rate of that quarter, which happens to be 3%. Furthermore, I assume a constant LTV ratio of 70%, which is equal to the average LTV ratio for mortgagors that bought a new dwelling in 2021 (FI, 2022a, p. 11). The 5-year mortgage rate, the cost-of-house equity, and the resulting financing cost is shown in figure G.20.

For inflation expectations, I use 5-year inflation expectations (expectations of 12-month inflation in 5 years) collected by Kantar Sifo (2023) and available for downloading from Refinitiv Datastream.<sup>39</sup>

**Household expectations of future mortgage rates** In this context, it is relevant to consider whether households’ expectations of future mortgage rates are realistic or unrealistically low, for example, lower than what is consistent with a 5-year mortgage rate offered by lenders. Any such lower expectations can be considered a separate indicator of overvaluation. However, as shown in appendix C, households do not expect higher future mortgage rates than banks. For most of the sample, households expect significantly higher rates than banks. Because banks are likely to

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<sup>37</sup> The SBAB 5-year rate is similar to the average 5+years rate for all mortgage lenders published by Statistics Sweden but available for a longer sample; see figure G.19. Another option would be to use the Statistics Sweden rate from September 1995 and the SBAB rate before. Very few loans would have as long a fixation period as 10 years.

<sup>38</sup> As noted in the introduction, a bias toward higher user costs implies a bias toward higher UCTI and UCTR ratios and thereby toward overvaluation, thus stacking the cards in favor of finding overvaluation. However, when overvaluation is measured by the deviations of UCTI and UCTR ratios from their historical averages, there is less or no bias, because the historical averages are also higher

<sup>39</sup> Figures G.13 and G.14 show the components of the UCC and the UCTI indicator if instead the expected average inflation over the next 5 years is used.

be better informed than households, this indicates that households do not have unrealistically low mortgage-rate expectations.

**The OMRD rate** The OMRD includes nominal operation, maintenance, and repair costs, as well as any remaining depreciation when the maintenance and repair is not full. The OMRD is often for simplicity assumed to be a constant fraction of the house price, but these costs are not directly related to the house price.<sup>40</sup> Some of the operation and maintenance (including repair) are rather real costs that follow the CPI index or wages, or disposable income per capita. Furthermore, any repair and remaining physical depreciation would apply to the structure of the dwelling but not the land it sits on, whereas the house price is the sum of the value of the structure and the value of the land (Diewert, 2013, appendix).<sup>41</sup> One way to deal with this issue would be to assume that the OMRD cost is a fixed share  $\mu$  of the value of the structure, which implies that the OMRD share of the value of the house, the OMRD rate, is given by

$$m_t = \mu \frac{P_t^{sh}}{P_t}, \quad (3.6)$$

where  $P_t^{sh}$  denotes the value of the structure of the house.

However, I follow Hansson (2019) in using National Accounts data in Statistics Sweden (2023g) on operation, maintenance, and repair costs of Swedish owner-occupied houses.<sup>42</sup> Hansson furthermore assumes that the rate of depreciation is 2% of the value of structures. However, as discussed in Svensson (2022a), Statistics Sweden follow a method of the US Bureau of Economic Analysis—described in Katz and Herman (1997)—together with additional assumptions that result in a depreciation rate of approximately 1.5% of the price of the structures. I follow this method.<sup>43</sup>

Figure 3.1 shows the value of the structures of and land under owner-occupied houses in Sweden, as well as the share of structures in the house price,  $P_t^{sh}/P_t$ . Land values have risen more rapidly than the value of structures, and the share of the structures in the house price has fallen from almost 80% in the late 1990s to 44% at the end of 2022.

Figure 3.2 shows the OMR together with the value of structures and land. We see that the share of the OMR in the value of structures varies a bit and falls over time. In figure 3.3 the dashed dark red line shows the OMR share of structures. In line with Statistics Sweden practice and details explained in Svensson (2022a), the depreciation rate is assumed to be 1.5% of the value of structures, resulting in an OMRD share of structures given by the solid dark red line. Multiplying this OMRD share by the share of structures in the price of the house results in the OMRD share of the house price—the OMRD rate—given by the solid yellow line in figure 3.3. The OMRD rate drops from 6.7% at the end of 1995 to 2.7% in 2019q2. It then rises to a peak in 2022q4 and then falls again. Assuming a constant OMRD rate is thus a bad approximation, at least for Sweden.

<sup>40</sup> Harding et al. (2007) estimate the depreciation rate for US housing during 1983–2001 to 2.5% gross of and 2.0% net of maintenance.

<sup>41</sup> There are of course some operating and maintenance costs associated with the land the dwelling sits on, but they are disregarded relative to the substantial OMR associated with the dwelling.

<sup>42</sup> I thank Peter Buvén of Statistics Sweden for providing updated data, table G.1 and Statistics Sweden (2023g).

<sup>43</sup> I thank Michael Wolf of Statistics Sweden for explaining the methods used.

Figure 3.1: Values of structures and land.

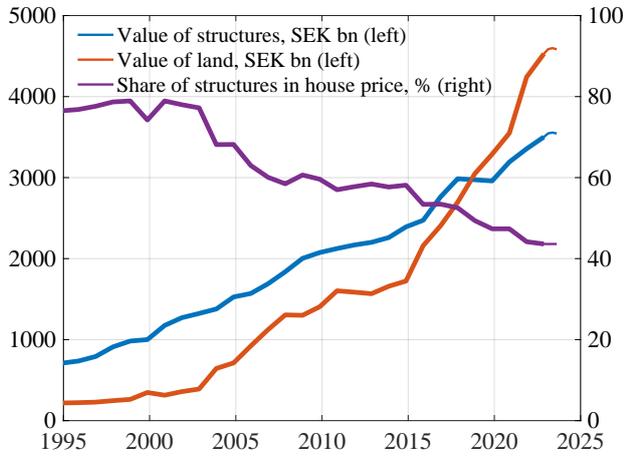
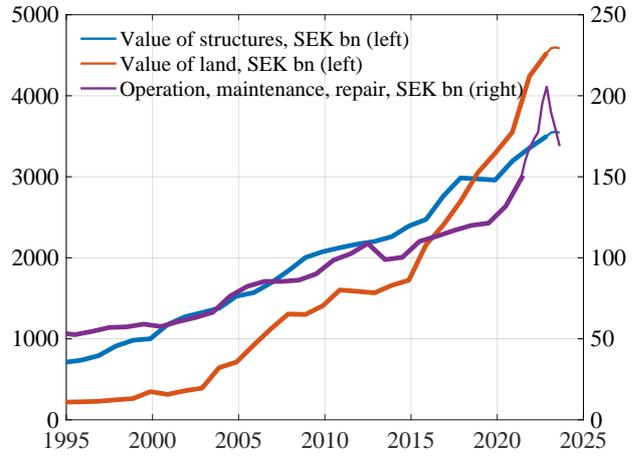


Figure 3.2: Value of structures and land; and operation, maintenance, and repair costs.



Source and note: [Statistics Sweden \(2023a,g\)](#), summarized in table [G.1](#). The values of structures and land are slightly smoothed; see figure [G.11](#). The thick lines are data. Figure [3.1](#): The thin lines are values extrapolated with the house-price index under the assumption of a constant share of structures in 2023. Figure [3.2](#): The OMR costs for 2022 and 2023 of heating, insurance, and maintenance and repair are extrapolated with the prices of electricity; repair goods; water, sewage, and waste; and home insurance in figure [G.21](#). See figure [G.12](#) for details.

Even assuming a constant OMRD share of the value of structures, as in [\(3.6\)](#), is only a moderately good approximation, as shown by the solid dark red line in the figure. The UCC and the UCTI indicator for a constant OMRD rate equal to its mean is shown in figures [G.15](#) and [G.16](#).

Figure 3.3: Operation, maintenance, repair, and maintenance; shares of the value of structures and of the house price.

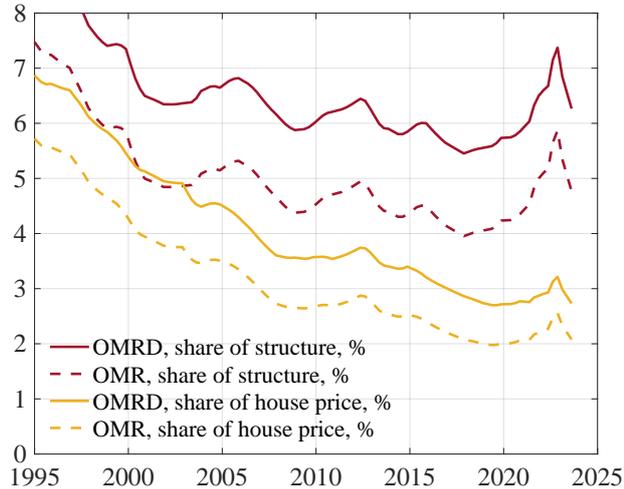
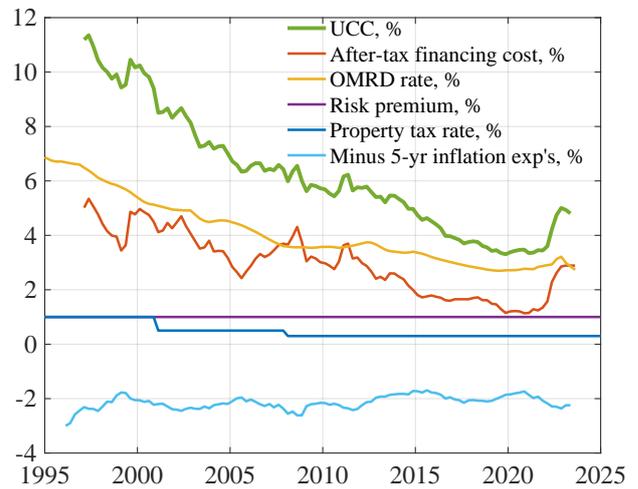


Figure 3.4: The UCC and its components.



Source and note: Figure [3.3](#): Annual OMR and value of structures and land from figure [3.2](#). The depreciation rate is in line with Statistics Sweden set to 1.5% of the value of structures ([Svensson, 2022a](#)). Figure [3.4](#): The 5-year mortgage rate is from [SBAB \(2023\)](#), the OMRD rate is from figure [3.3](#), the risk premium is 1%, the property tax rate is a piecewise constant approximation of [Englund \(2020\)](#), and 5-year inflation expectations are from [Kantar Sifo \(2023\)](#) and Refinitiv Datastream. Own calculations. The latest observation is 2023q2.

**The property tax rate** [Barrios et al. \(2019, pp. 48–49\)](#) reports property tax rates for EU

countries that are implicit and calculated as the revenues from property taxes on households divided by the net stock of dwellings of households. Englund (2020, diagram 14) provides an explicit calculation of property tax rates for Sweden. This results in somewhat lower numbers than for Barrios et al. (2019, pp. 48–49), but the difference is small.

On January 1, 2008, the property tax was reduced substantially. In particular, a low ceiling was introduced, currently about SEK 8,500 per year, about EUR 1,000 at the time of writing. This is binding for most homeowners, effectively turning the property tax into a modest lump-sum tax.<sup>44</sup> I use a piecewise constant approximation to the Englund numbers.

**The risk premium** Barrios et al. (2019) follow Poterba and Sinai (2008) in assuming a before-tax risk premium  $\beta$  equal to 2%, that is, for Sweden an after-tax risk premium of  $(1 - 0.3)2 = 1.4\%$ .<sup>45</sup> A risk premium has been derived by Flavin and Yamashita (2002) in a household optimal portfolio setting, but it may be too large (Himmelberg et al., 2005). It ignores that, relative to renting, owner-occupation provides a hedge against future rent increases (Sinai and Souleles, 2005). Also, owner-occupation have benefits in terms of more control over the housing than renting.

Three additional circumstances for Sweden have a bearing on the risk-premium assumption. First, there is hardly any buy-to-let of houses and apartments in Sweden. That is, there is hardly any pure investor demand for houses and apartments, where the risk and return on the investment naturally is compared to that of other investments. Thus, there is mainly buy-to-live, in which case the comparison is mainly between owner-occupied housing and other tenure alternatives.

Second, the rental market is dysfunctional due to rent-control. This means that rental housing is not very accessible. In the major cities, ten years or more of queuing is normally required to get a rent-controlled apartment. For those who have got a rented apartment, there is a strong lock-in effect because moving is difficult and require a kind of barter or exchange with other rented apartments, sometimes in complicated multi-apartment chains.<sup>46</sup> Given the high moving costs, renting is therefore quite risky. From this perspective, owner-occupied housing brings considerable flexibility and control, with freedom to sell and move, and is from this point of view less risky than rented housing.

Third, Swedish mortgages to a large extent have variable rates, that is, with a fixation period of 3 months, and many of the remaining ones have relatively short fixation periods of one or two years. The variable rates follow the Riksbank’s policy rate with an average lag of 1.5 months and a relatively fixed spread. With floating exchange rates and flexible inflation targeting, policy rates and thus variable mortgage rates generally become procyclical, as do also the mortgage rates with relatively short fixation periods.<sup>47</sup> This means that mortgagors normally get lower interest

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<sup>44</sup> This means that the property tax is regressive—the more expensive properties have a lower tax rate. Below the ceiling, the property tax is approximately 0.5% of market value. With a ceiling about EUR 820, the ceiling is then binding for properties with market value exceeding EUR 16,400.

<sup>45</sup> Diewert (2013) does not consider an explicit risk premium.

<sup>46</sup> Side-payments for getting a lease on a rent-controlled apartment occur but are illegal.

<sup>47</sup> In contrast, with fixed exchange rates, during the banking crisis in the 1990s, mortgage rates became very high, when the Riksbank defended a speculative attack on the krona with a policy rate as high as 500%. Thus, with a fixed exchange-rate regime with insufficient credibility, interest rates may be countercyclical.

payments in recessions and crises, when the marginal utility of the reduced payments is higher. Mortgagors effectively get insurance against bad times. Renters don't get any such insurance. This may actually justify a negative risk premium on owner-occupied housing.<sup>48</sup>

The above insurance against bad times obviously refer to “normal” bad times, which excludes rare shocks such as the recent global supply disturbances after covid and the shocks to inflation and corresponding central-bank responses due to the Russian attack on Ukraine.

Thus, for Sweden, a zero or even negative risk premium on owner-occupied housing may be appropriate. Nevertheless, here I follow the convention and include a positive risk premium, set to 1%, which increases the user costs and its correlation with house prices somewhat. In any case, the results do not seem very sensitive to a modest level of the risk premium.<sup>49</sup>

**The UCC and its components** Figure 3.4 shows the resulting UCC and its components, namely, the after-tax nominal mortgage rate, the OMRD rate, the risk premium, the property tax, and the negative of inflation expectations. We see that the UCC falls from about 10% in 2000 to about 3.5% in the beginning of 2022. The fall in the UCC is caused by the fall in the after-tax mortgage rate, in the OMRD rate, and in the property tax rate. The subtraction of inflation expectations of about 2% increases the *relative* fall of the UCC. From 2022q2 the UCC quickly rises to about 5%, due mainly to the rise in the financing cost but also to the rise in the OMRD rate and the rise in inflation expectations.

Hansson (2019, figure 7) calculates a UCC without a risk premium and with a depreciation rate of 2%, whereas my UCC is calculated for a 1% risk premium and a 1.5% depreciation rate. Hansson uses other interest rates than those used here, but the difference should be small. The UCC is calculated with and without capital gains. The UCC calculated in this paper is slightly higher than Hansson's UCC without capital gains, as is shown in figure G.22. Englund (2020, diagram 9) provides a calculation of the UCC with a more detailed calculation of the relevant taxes but without any OMRD and risk premium. This results in a lower UCC than the one calculated in this paper, as shown in figure G.22.

## 3.2 The user cost

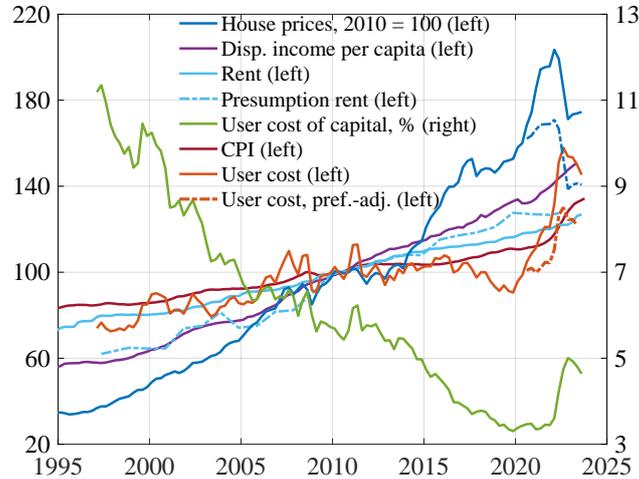
Figure 3.5 shows an index of the user cost (2010 = 100), the UCC in percent, and indices of house prices, disposable income (per capita), rents, presumption rents, and the CPI. The user cost

<sup>48</sup> The Riksbank and the National Debt Office have also demonstrated that they have the tools—in particular, purchases of mortgage bonds—to keep the spread down in crises. See figure G.23. Furthermore, during most of the coronavirus crisis, Finansinspektionen, the Swedish financial supervisory authority, temporarily abolished the mandatory amortization requirements, to further reduce the debt service of mortgagors. Thereby, it has created a precedence to do so again in future crises. This arguably adds to the insurance benefits of mortgages.

<sup>49</sup> Let  $UCTI_t = (UCC_t + \rho)PTI_t$ , where  $UCC_t$  here denotes the UCC for a zero risk premium and  $\rho$  denotes a constant risk premium. The covariance between the UCTI and PTI ratios is given by  $Cov(UCTI, PTI) = Cov(UCC, PTI) + \rho Var(PTI)$ . For the Swedish data,  $Cov(UCC, PTI)$  and  $Cov(UCTI, PTI)$  are negative. However, a larger  $\rho$  increases  $Cov(UCTI, PTI)$  and a sufficiently large  $\rho$  would make  $Cov(UCTI, PTI)$  positive. Thus, a larger risk premium makes the covariance between UCTI and PTI less negative and a sufficiently large risk premium would make the covariance and correlation positive.

is calculated according to (3.1). The figure shows indexed levels instead of the deviations from historical averages shown in figure 1.1.

Figure 3.5: House prices, disposable income per capita, rents, user cost of capital, user cost, and the CPI. User cost of capital in percent; all other series indexed to 100 for 2010.



Source and note: [Statistics Sweden \(2023b,d,e,h\)](#), [Valueguard \(2023\)](#), and own calculations. See note to figure G.2 for details.

Both actual and preference-adjusted house prices and user costs are shown. As briefly discussed in section 1, house prices increased substantially during the coronavirus crisis 2020 and 2021, despite the negative effect of the crisis on the Swedish economy. As discussed in detail in [Sveriges Riksbank \(2021\)](#), a similar development can be seen in many other comparable countries. The price upturn deviates from historical correlations and is difficult to explain with factors traditionally used to shed light on housing demand, such as interest rates and disposable income. Instead, the most important explanations probably have to do with the unusual economic effects of the pandemic. Households being partially forced to save because of restrictions has freed up scope for housing consumption. At the same time, widespread working from home has probably sparked a desire among households for a larger and better homes and a willingness to spend more money on their housing. In addition, the negative effects of the crisis on the labor market have only affected households with permanent employment to a minor extent and these households normally find it easier to obtain a mortgage. This may have helped prices resist the generally weak development in the real economy. In figure G.18, we see that the relative price of houses in terms of apartments increased substantially during 2020 and 2021. The conclusion is that the house price rise during 2020-2021 can be seen as the result of a preference shift toward larger and better homes, with more or less a fixed supply of homes. Thus, it is due to fundamental factors and not in itself an indicator of overvaluation.<sup>50</sup>

The dash-dotted dark blue line shows “preference-adjusted” house prices, for which the 75% of the of the cumulated actual price increases during 2020q2–2022q1 have been deducted from the actual house prices. This reflects the assumption that 75% of the price increases are due to the preference

<sup>50</sup> See also [Igan et al. \(2022, graph 2, left panel, SE\)](#).

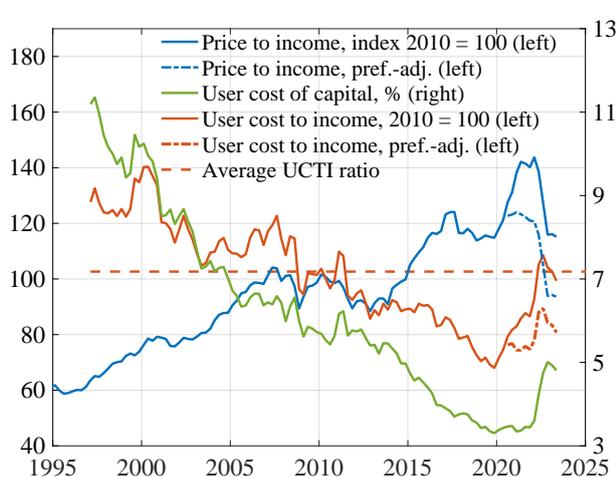
shift. Given the preference shift, for the purpose of assessing over- or undervaluation of housing over time, one may want to use a “preference-adjusted” user cost, corresponding to approximately unchanged preferences. The dash-dotted red line is the corresponding preference-adjusted user cost, calculated using the preference-adjusted housing prices after 2020q2 instead of the actual housing prices.

We see that the dramatic downward trend of the UCC neutralizes the dramatic rise of the house prices and results in a relatively stable user cost until 2020. The preference-adjusted user cost is relatively stable until the spring of 2022, when the UCC starts to rise. As already discussed in section 1, it falls relative to and stays below disposable income. It also falls relative to rents and the CPI, except towards the end where it rises to reach about the same level as the rents and the CPI. Thus, the UCTR ratio and the real user cost is 2023q2 at about the same level as in 2010, whereas the UCTI ratio is at a significantly lower level. Clearly, Swedish house are by these indicators not overvalued but undervalued relative to 2010.<sup>51</sup>

#### 4 The user-cost-to-income and user-cost-to-rent ratios

Figure 4.1 shows the PTI and UCTI ratios in index form, with 2010 = 100. The UCC is in percent. The UCTI ratio is calculated according to (1.2).

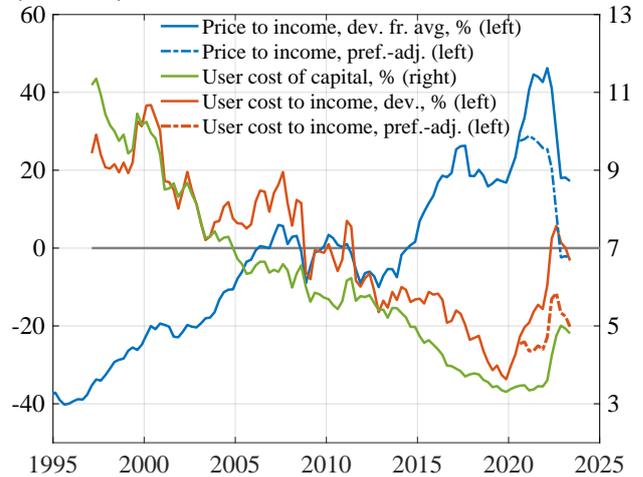
Figure 4.1: Price to income (index), user cost of capital (percent), and user cost to income (index). Index 2010 = 100.



Source and note: Figures 2.1 and 3.4 and own calculations. The “preference-adjustment” is explained the text.

Figure 1.1 (repeated above) shows the corresponding percentage deviation of the PTI and UCTI ratios from their historical averages, which measure is independent of the base year of the indexation. This is discussed in section 1. According to this measure, in 2023q2, the actual and preference-

Figure 1.1 (repeated). Price-to-income and user-cost-to-income ratios (percentage deviation from historical averages) and the user cost of capital (percent).



<sup>51</sup> The estimate of the user cost in figure 3.5 rejects the assumption made in Almenberg et al. (2022) that the user cost is exogenous and grows at a steady rate of 2%.

adjusted UCTI ratio were, respectively, 3% and 20% below their historical average. In 2019q4, the UCTI ratio was 34% below its current historical average.<sup>52</sup>

Figure 4.2: Price-to-rent ratio (index), user cost of capital (percent), and user-cost-to-rent ratio (index). Index 2010 = 100.

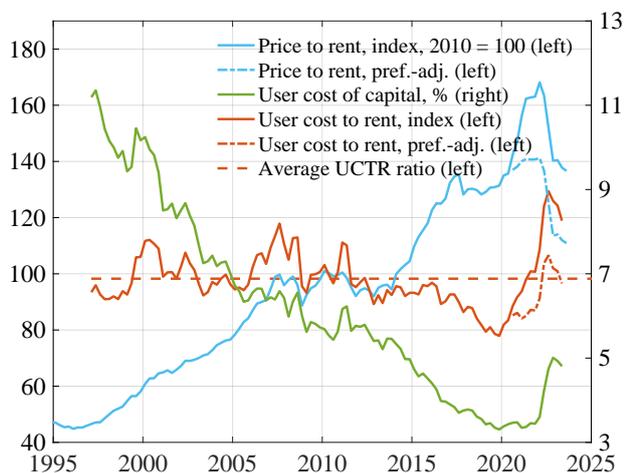
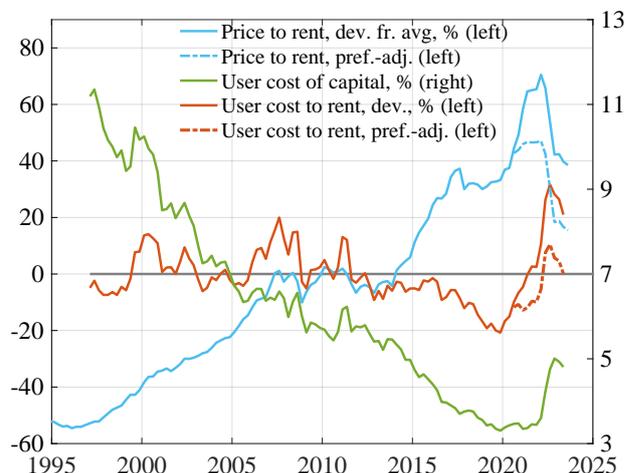


Figure 4.3: Price-to-rent and user-cost-to-rent ratios (percentage deviation from historical averages) and user cost of capital (percent).



Source and note: Figures 2.1 and 3.4 and own calculations. The historical average refers to 1997q1–. The “preference-adjustment” is explained the text.

Figure 4.2 shows the UCC and indices of the PTR and UCTR ratios for rents—the analog of figure 4.1. Ratios for presumption rents are not shown—they are similar to the UCTI ratios because the presumption rents follow disposable income relatively close. The UCTR ratios are calculated according to (1.3). The contrast between the large overvaluation indicated by the PTR ratio and the lack of any significant overvaluation by the preference-adjusted UCTR ratio is stark.

Figure 4.3 shows the deviation of the UCTR ratios from their historical averages—the analog of figure 1.1. The preference-adjusted UCTR ratio indicates neither over- nor undervaluation in 2023q2. In 2019q4, the UCTR ratio indicated undervaluation of 21%.

## 5 International organizations on overvaluation of Swedish housing

Several international organizations that monitor and comment on Swedish economic policy have for many years maintained that Swedish house prices are too high relative to fundamentals and that Swedish (owner-occupied) housing thus is overvalued. This section reports what the ECB and the ESRB, the European Commission, the OECD, and the IMF have said about Swedish housing overvaluation in their previous and recent reports. The assessments of overvaluation by the ECB and the ESRB also affect the magnitude of the negative house-price shocks assumed in the EBA stress tests of Swedish banks.

The ECB, ESRB and the European Commission have consistently maintained that Swedish housing is substantially overvalued as late as 2022. The OECD and the IMF have previously, in

<sup>52</sup> The variability of the estimated UCTI ratio in figure 4.1 rejects the assumption made in FI (2022a, In-depth analysis, pp. 22–25, and Appendix 2, pp. 45–47) when price changes are predicted that the UCTI ratio is constant.

2017–2019, warned about Swedish housing being overvalued. However, in recent reports of 2021–2023 they have not mentioned any overvaluation. The OECD has done substantial work on measures of housing affordability in the OECD countries. This work has expressed some skepticism of the suitability of the PTI indicator. The OECD has also concluded the Swedish “mortgage burden” costs (the interest and amortization payments on owner-occupied housing) have been among the lowest in the OECD. This is not consistent with Sweden housing being overvalued.

Separately, the European Commission has constructed a database of user costs of capital for the European Union countries, for the purpose of discussing housing-tax distortions (Barrios et al., 2019, Grünberger et al., 2023). The Commission’s UCC for Sweden is similar to the UCC calculated in this paper. As we shall see, the implied Commission UCTI indicator thus indicates undervaluation rather than overvaluation and contradicts the Commission’s official position on Swedish housing overvaluation. The implied UCTI indicator is also strongly negatively correlated with the PTI indicator. Implied UCTI indicators for several other European Union countries suggest that the problem of misleading indicators and overvaluation assessments—and resulting distorted warnings and recommendations—is not restricted to Sweden but concerns several other European Union countries.

## 5.1 The ECB and the ESRB

The ECB calculates four measures of housing overvaluation for several countries. It calculates deviations of the PTI and PTR ratios from benchmarks equal to their historical averages (from 1996 to the latest available observation) (ECB, 2015b) and the deviations of current prices from the estimates of two models, an inverted-demand model described in ECB (2015a) and ESRB (2022b, box 2) and a model based on an “asset-pricing” approach (ECB, 2011). The latter has to my knowledge not been published or described in any detail in these references. The results are reported in the form of the maximum and minimum valuation, the inverted-demand model valuation, and the average of the four in ECB (2023).<sup>53</sup>

Overvaluation measures for Sweden, downloaded in June 2023 from ECB (2023), are shown in figure 5.1. According to the ECB’s measures, for 2022q4 the average of the valuation measures indicated an overvaluation of Swedish housing of 31%, with a maximum overvaluation of 54%, a minimum of 12%, and the inverted-demand-model overvaluation of 17%. If the inverted-demand model’s estimates fall strictly between the minimum and maximum measures, three indicators (two of which are unnamed) and the average of the four indicators are reported. Then one can infer that the unreported indicator. It is shown as the black line in figure 5.1, equal to 42% in 2022q4.<sup>54</sup>

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<sup>53</sup> Does the “asset-pricing approach” assume unrealistic equality between rents and user costs? Duca et al. (2021a) provide an extensive discussion and literature review of research on and models of the determination of house prices. In particular, they argue that the “asset pricing approach from finance” with a simple price-to-rent or rent-arbitrage approach in the form of an equality between rent and user cost is misleading (also Duca et al., 2021b) and exaggerates the sensitivity of house prices to mortgage rates. (What is called the user cost of capital (UCC) here is just called the user cost by Duca et al.)

Muellbauer and Murphy (1997) provide a detailed discussion of the inverted-demand model.

<sup>54</sup> Estimates of the inverted-demand model seem unstable. Figure G.26 shows the valuation measures also for data downloaded in September 2023, with one additional data point, 2023q1 (dash-dotted lines). We see that the

Figure 5.1: ECB estimates of residential property overvaluation: Sweden. latest observation 2022q4.

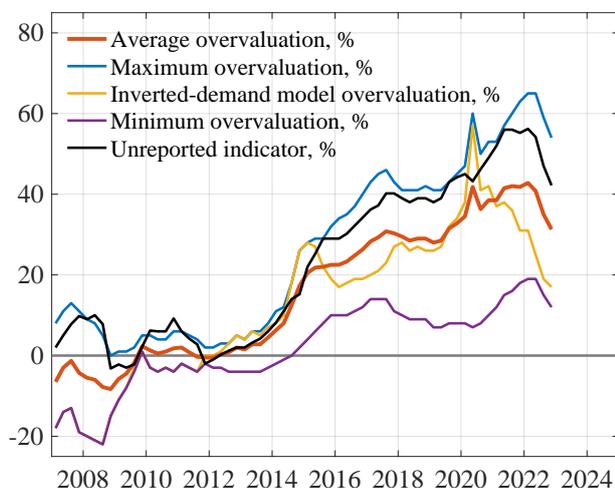
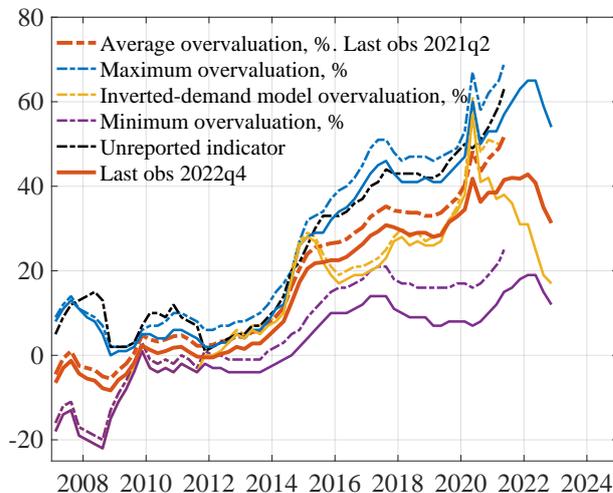


Figure 5.2: ECB estimates of residential property overvaluation: Sweden. Also real-time estimate with latest observation 2021q2.



Source and note: ECB (2023). Figure 5.1. Data downloaded in June 2023, with latest observation 2022q4, with inferred unreported indicator. Figure 5.2: Added dashed-dotted lines referring to real-time estimates with latest observation 2021q2. See figure G.26 for data downloaded in September 2023, with latest observation 2023q1, and very different model estimates (footnote 53).

The most recent assessment of the ESRB of the overvaluation of Swedish housing is contained in ESRB (2022b), which assesses RRE vulnerabilities in the EEA countries (the EU27 as well as Iceland, Liechtenstein, and Norway). The ESRB to a considerable extent relies on ECB calculations of overvaluation.

ESRB (2022b, table 1, Scoreboard), reproduced as figure G.25, reports overvaluation measures estimated by the ECB, with latest observation 2021q2. For Sweden, it reports a PTI deviation from its historical average of 66% (row SE, column 3). How the ECB could arrive at such a large PTI deviation is not explained. In figure G.5, the real-time PTI deviation in 2021q2 was 49%, substantially less than the scoreboard number.<sup>55 56</sup>

The scoreboard also reports an econometric model estimate of overvaluation of 51% (row SE, column 4). The latter is consistent with the dashed-dotted yellow line in figure 5.2, the estimated from the inverted-demand model. ESRB (2022b, figure 10) (reproduced here as figure 5.3) reports Swedish overvaluation for 2021q2 at 59%, the average of the scoreboard's 66 and 51.<sup>57</sup>

inverted-demand overvaluation estimate for 2022q4 drops from +17% to -17% (34 pp!), and the average overvaluation estimate drops from 31% to 16% (15 pp). This is difficult to explain.

Because the model valuation becomes the minimum valuation from 2021q4 onwards, the unreported indicator cannot be inferred for those quarters.

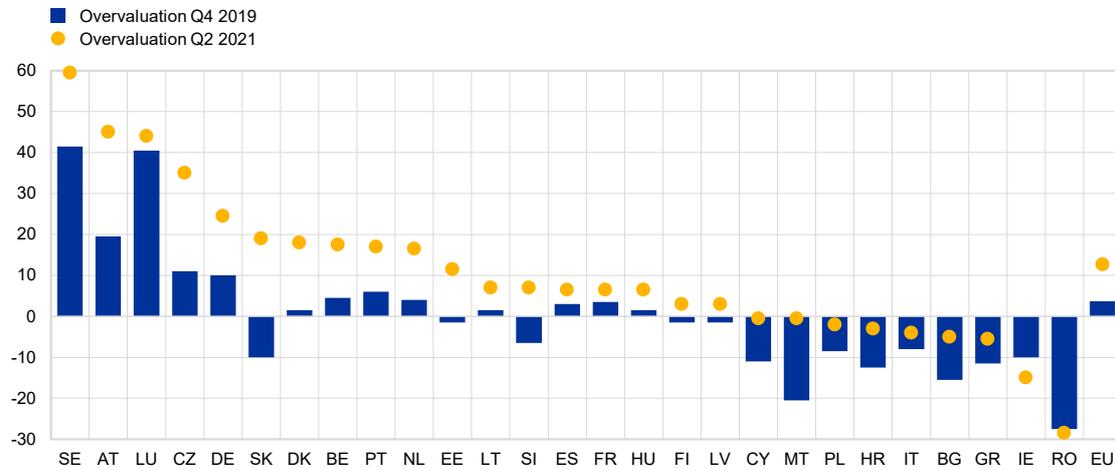
<sup>55</sup> A possible explanation can be inferred from the ECB's real-time estimates in 2021q2, the dashed-dotted lines added in figure 5.2. The maximum overvaluation in 2021q2 was 69% and that of the unreported indicator was 63%. Perhaps the maximum overvaluation refers to the PTR indicator and the unreported indicator is the PTI indicator (the PTR indicator is above the PTI indicator in figure 2.2). Then we are close to 66%, but still much above the real-time PTI indicator in figure G.5.

<sup>56</sup> Also, in figure 5.1, for 2020q2, there is a peak in the blue and yellow line but no such peak in figure 2.2, and no big drop in disposable income in figure G.2. This may indicate that the PTI ratios have not been calculated with disposable income per capita but perhaps with GDP per capita.

<sup>57</sup> ESRB (2022b, box 2, figure) reports additional estimates, including external ones, for the EEA countries for

Figure 5.3: ESRB house-price overvaluation (ESRB, 2022b, figure 10).

(percentages)

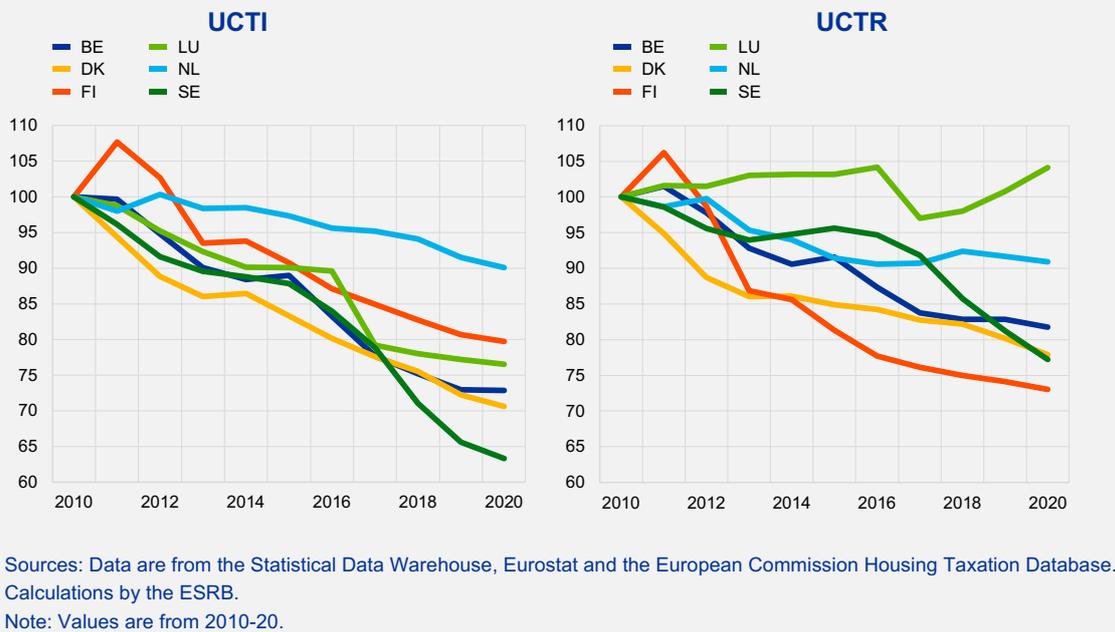


Source: ECB estimates.

Notes: The last data point is the second quarter of 2021, except for CY (the fourth quarter of 2020), DK, FI, HU, IE (the first quarter of 2021). The overvaluation is the simple average for the price-to-income and an inverted demand-based model estimates. The EU overvaluation is computed as the simple average across all EU countries.

Figure 5.4: ESRB estimates of user-cost-to-income and user-cost-to-rent ratios (ESRB, 2022b, box 4, figure B).

(percentages, base year set to 2010)



2020q4. For Sweden, the inverted-demand ECB-model here reports 43% overvaluation. The European Commission model of Philipponnet and Turrini (2017) reports -1.9% (consistent with the European Commission (2021, table 2.2) numbers mentioned below in section 5.2). The Commission PTI ratio in terms of years, not much above 10, is also reported. (More on this in section 5.2.)

### 5.1.1 The ESRB’s calculation of UCTI and UCTR ratios<sup>58</sup>

Interestingly, ESRB (2022b, box 4) reports ESRB calculations of the UCTI and UCTR ratios for the six countries (one of which is Sweden) that received ESRB recommendations in 2019. The calculations use the Commission’s Housing Taxation Database (Barrios et al., 2019, Grünberger et al., 2023). The results from these indicators differ substantially from those of the PTI ratio and the other indicators. For Sweden, the dark green lines in the box’s figure B (reproduced as figure 5.4) shows that both the UCTI and the UCTR ratio have fallen substantially between 2010 and 2020. This indicates undervaluation rather than overvaluation.<sup>59</sup>

The mixed results on overvaluation may have somewhat moderated the ESRB conclusions about Swedish overvaluation (my emphasis):

House price growth has been picking up recently and residential property is still significantly overvalued **based on some estimates**, eroding the affordability of housing for households. . . . Rising RRE prices stemming from population and economic growth, supply shortages, tax incentives for home ownership, and a low interest rate environment over an extended period have led to overvalued house prices. . . . The house price-to-income-ratio was 56% above its average in 2020, and model-based evidence suggests that house prices were overvalued by 43% in 2020, although **these estimates are surrounded by uncertainty and will alter in accordance with the underlying assumptions made, the model chosen and the time period, or if the low interest rate environment is taken into account.** (ESRB, 2022b, pp. 77–78)

Overall, the ECB’s real-time estimate of the average overvaluation for Sweden in figure 5.2 is 52% for 2021q2. The ESRB reports several different numbers for different times, but it seems that its estimate of the average overvaluation for 2020 and 2021 is around 55%.

Figures 5.1 and 5.4 again illustrate the negative correlation between the PTI and UCTI ratios for Sweden in figure 1.2 (and with Commission estimates of the UCC and the PTI ratio in figure 5.11 below). Furthermore, from a comparison of figures 5.3 and 5.4, it is apparent that the problem of misleading overvaluation assessments is not restricted to Sweden. It concerns several countries in the European Union. Of the six countries in figure 5.4, according to figure 5.3 all except Finland have overvalued housing, by between 17% and 60%. But according to figure 5.4, with more reliable and relevant indicators, all six have undervalued housing relative to 2010.

Accordingly, the negative correlation between PTI and UCI ratios seems likely to hold for several EU countries. This is easy to check with the help of the Housing Taxation and HouseLev databases (Barrios et al., 2019, Grünberger et al., 2023, Bricongne et al., 2019). This issue will be further examined in Svensson (2023).

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<sup>58</sup> Full disclosure: As a member of the ESRB’s Advisory Scientific Committee from April 2019 to March 2023, I had some insight into the work on ESRB (2022b) and recommended—with reference to early versions of the present paper—the inclusion of and emphasis on the UCTI and UCTR indicators rather than the PTI and PTR indicators.

<sup>59</sup> The ESRB calculation of user costs takes into account that the OMRD need not be a constant share of house prices. It assumes that the OMRD initially is 2.5% of the house price—as in Poterba and Sinai (2008)—but then over time follows the HICP excluding energy and food. This results in the OMRD share falling over time for Sweden (ESRB, 2022b, figure A, panel Sweden).

### 5.1.2 The European Banking Authority EU-wide stress tests

The ECB and ESRB assessments of housing overvaluation have consequences for the EBA stress tests. The stress tests for Sweden have one of the largest negative house-price shocks among the EU countries. The reason is apparently that house-price shocks in the EBA stress tests are set according to the negative of ECB’s average overvaluation measure. ESRB (2020, p. 41) provides some details on how the house-price shocks are determined:

#### 3.7 Residential real estate price shocks

The scenario entails an adverse adjustment of residential real estate prices. This assumption is consistent with a narrative where, despite the low level of interest rates, a repricing of assets is envisaged due to both an adverse demand effect and an increase in risk aversion. The calibration of the shocks to residential real estate prices started from a measure of over/undervaluation of residential real estate prices with respect to their fundamentals as evaluated by ECB staff.<sup>39</sup> The main valuation measure is the average of four indicators of house price valuations.<sup>40</sup> These measures were calculated on the basis of models and a comprehensive house price dataset provided by the ECB.<sup>41</sup> This choice is consistent with the ECB’s internal assessment of residential real estate risks and it is also aimed at aligning the size of the shocks with the ESRB’s risk assessment of the residential real estate market.

<sup>39</sup> The data considered are public and can be found in the Statistical Data Warehouse. Pre-2007 data available at the ECB was also used in the calibration. [This apparently refers to the SDW overvaluation data shown in figure 5.1.]

<sup>40</sup> In a few cases, alternative house price valuations measures, also from [ECB (2023)], were considered in order to improve the alignment of the house price shock with the ESRB’s risk assessment of the residential real estate market.

<sup>41</sup> Further methodological details are given, for instance, in ECB (2018) and further sources cited therein.

According to (ESRB, 2023, table 4.1.4, p. 15), the Swedish house-price shock for the 2023 EU-wide stress test was  $-33.3\%$ . This is the largest in the EU, see figure 5.5. Nevertheless, Swedish banks managed the stress test quite well (FI, 2023).

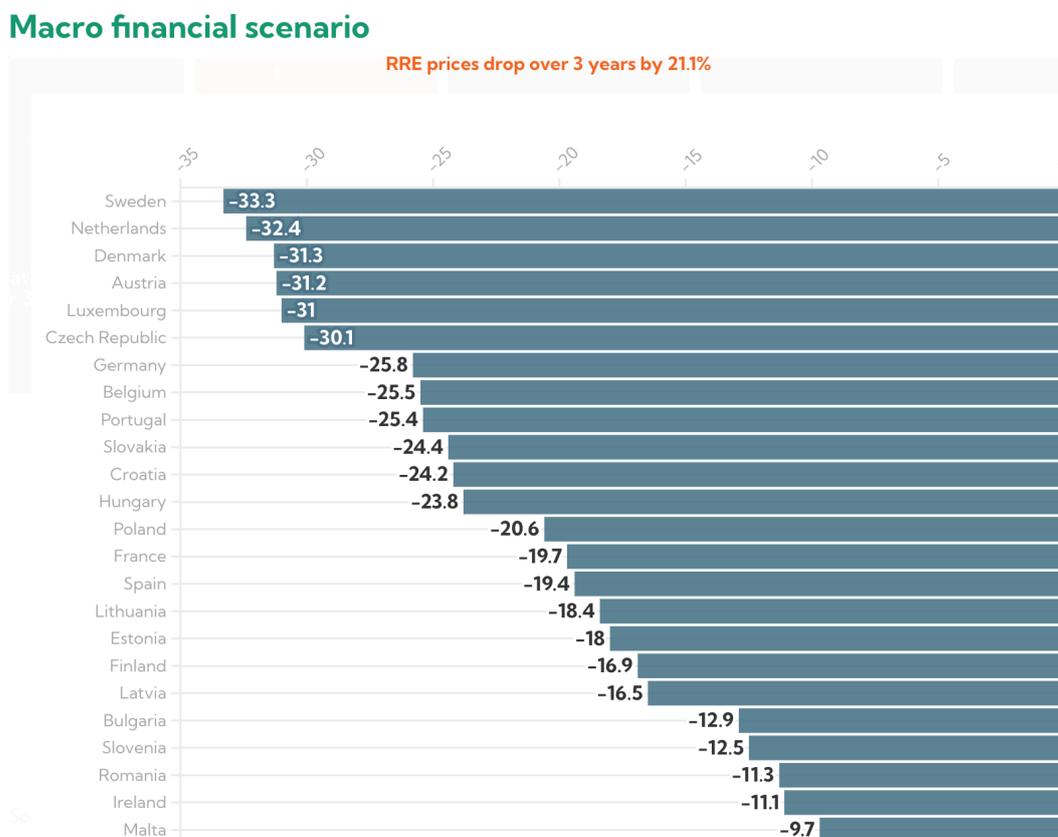
If the reported house-price shocks is supposed to eliminate an existing overvaluation, the overvaluation is 50%, quite consistent with ESRB’s average overvaluation estimate of about 55% mentioned above.<sup>60</sup>

Importantly, to provide serious and relevant tests of the resilience of EU banks, the EBA EU-wide stress tests need of course to assume substantial negative shocks, including negative house-price shocks. But the results of these tests are more informative if, beyond a substantial minimum size, the magnitude of these house-price shocks—and any differentiation across countries—is determined in the light of *relevant* indicators instead of the PTI and PTR ratios from their historical averages.

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<sup>60</sup> If  $s$  denotes the negative price shock, the corresponding overvaluation  $v$  is the solution to the equation  $v/(1+v) = s$ .

Figure 5.5: EBA Macro Financial Scenario 2023, Residential Real Estate Prices (EBA, 2023), with Sweden being subject to the largest RRE price fall in the EU, 33.3%.



Source and note: Slide found on interactive web site EBA (2023) by clicking on “Macrofinancial scenario” and “RRE prices drop over 3 years by 21.1%”.

## 5.2 The European Commission

The European Commission has maintained that Swedish housing is substantially overvalued, more precisely by 29% in 2022.

The Commission regularly assesses any macroeconomic vulnerabilities and Swedish economic policy within its Macroeconomic Imbalance Procedure (IMP) (European Commission, 2023d). The recent in-depth review for Sweden (European Commission, 2023c) presents the main findings, including those for the Swedish housing market. The Swedish housing market is also discussed in a background horizontal thematic note on housing-market developments in the European Union (European Commission, 2023b). The Commission’s final assessment in the IMP is published in the 2023 Country Report for Sweden (European Commission, 2023a).

Regarding the assessment of any overvaluation of Swedish housing, the Commission uses the average of three indicators. More precisely, it uses the percentage deviation of the current price-to-income (PTI) and price-to-rent (PTR) ratios from benchmarks equal to their historical averages (from 1995 until the latest available observation). The third indicator is a model-based valuation gap, the percentage deviation of the current price from the price estimated by a model developed

Figure 5.6: European Commission house-price valuation gaps: Sweden.

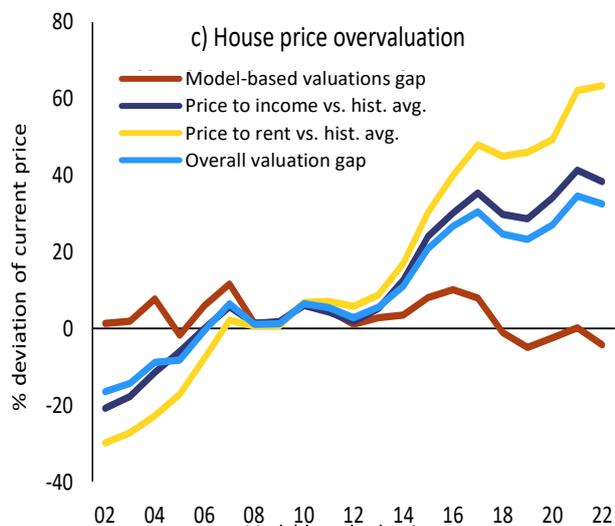
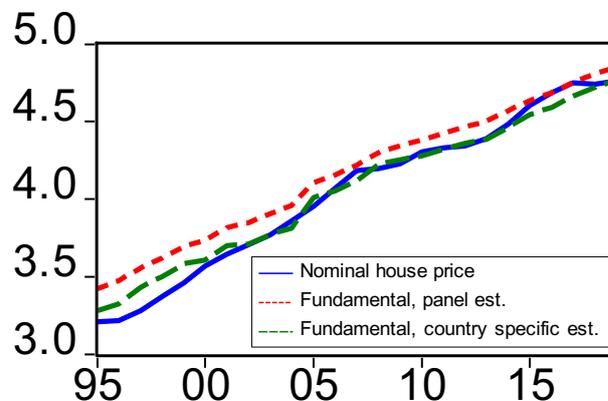


Figure 5.7: Log nominal house prices indices and Commission model benchmarks (panel and country specific estimate): Sweden.



Source and note: Figure 5.6: [European Commission \(2023c, chart 2.3c\)](#). The price-to-income and price-to-rent gaps are measured in deviation from the long-term average (from 1995 to 2022). The average house price gap is the simple average of the price-to-income, price-to-rent, and model-based valuation gaps. Figure 5.7: [European Commission \(2020, graph 3, panel SE\)](#). The latest observation is 2019.

by [Philipponnet and Turrini \(2017\)](#) and improved in [European Commission \(2020\)](#). The average of these three valuation gaps is then a summary measure of the degree of overvaluation.<sup>61</sup>

Figure 5.6 reproduces [European Commission \(2023c, graph 2.3c\)](#) and shows the valuation gaps. Table 2.2 in [European Commission \(2023c\)](#) reports that, for 2022, the average overvaluation gap is 29% and the price-to-income gap is 34.5%. The PTR and model-based gaps are not reported. From the figure, the model-based valuation gap appears to be about  $-5\%$ . It follows that the PTR gap is about  $3 \times 29 - 34.5 + 5 = 57.5$ .<sup>62</sup>

Interestingly, the model-based valuation gap in figure 5.6 is very different from the (misleading) PTI and PTR gaps. It indicates only some modest average overvaluation before 2018 and some modest undervaluation after. Figure 5.7 reproduces [European Commission \(2020, graph 3, panel SE\)](#) and shows the log of an index of Swedish house prices and the Commission model estimates, for an EU-wide panel estimation and a country-specific estimation with latest observation 2019. For the country-specific estimation, there is hardly any indication of over- or undervaluation. For the EU-wide estimation, there is some indication of undervaluation.<sup>63</sup>

<sup>61</sup> In contrast to the ECB models, the Commission model is well documented in [Philipponnet and Turrini \(2017\)](#) and [European Commission \(2020\)](#); the latter is available upon request. The model valuation gap is estimated in a cointegration framework with nominal house prices as the dependent variable and five fundamental explanatory variables: total population, real housing stock, real disposable income per capita, real long-term interest rate and price deflator of final consumption expenditure.

<sup>62</sup> Closer inspection of the y-axis in graph 2.3c (figure 5.6) reveals that it is not quite consistent with the numbers in table 2.2, although the absolute discrepancy for the model-based gap should be small because the gap is small.

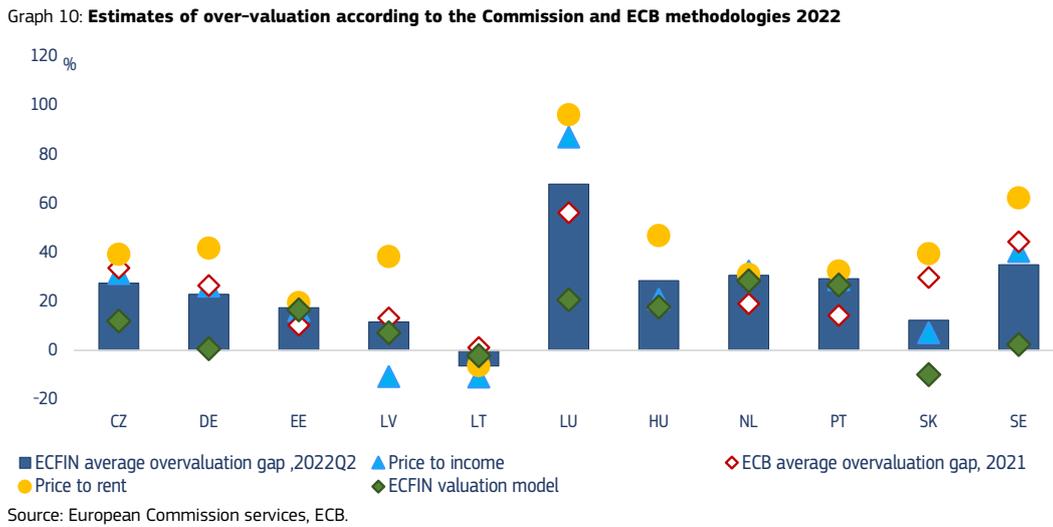
<sup>63</sup> The EU-wide estimation makes the completely unrealistic assumption that the model parameters are the same for all EU countries.

In summary, according to the Commission ([European Commission, 2023c](#), p. 5):

Swedish house prices still seem overvalued. ... house prices were estimated to be around 29% overvalued... in 2022 (graph 2.3c [figure 5.6]).

For information, figure 5.8 reproduces [European Commission \(2023b, graph 10\)](#) in the background note and shows the Commission’s and the ECB’s estimates of overvaluation (the latter discussed in section 5.1) for several EU countries.

Figure 5.8: Estimates of over-valuation according to the Commission and ECB methodologies 2022 ([European Commission, 2023b, Graph 10](#)).



Source and note: [European Commission \(2023b, Graph 10\)](#)

In conclusion, is rather obvious from the results in the present paper that there is a strong case for replacing the misleading PTI and PTR ratios in the Commission’s valuation methodology by the UCTI and UCTR ratios.

However, for Sweden the UCTR ratio is more or less irrelevant, given the dysfunctional rental market. This leaves the UCTI ratio for Sweden. In figure 1.1, the unadjusted and adjusted percentage deviation of the UCTI ratios during 2022 are  $-5\%$  and  $-20\%$ , respectively. If they would be combined with the Commission’s model-based gap of about  $-5\%$ , the corresponding average valuation gap in 2022 would be  $-5\%$  and  $-12.5\%$ , respectively. The difference from the Commission’s average valuation gap of  $+29\%$  is substantial, namely 34 and 41.5 pp, respectively.

### 5.2.1 The Commission’s UCC calculation and the corresponding UCTI results

Separately, as mentioned in section 3, the Commission has collected a database, the Housing Taxation Database (HTD), of comparable time series on the main features of home ownership taxation and the resulting user cost of capital in the EU and the UK ([Barrios et al., 2019](#), [Thiemann et al., 2022](#), [Grünberger et al., 2023](#)).<sup>64</sup> The purpose of the database is not to assess any overvaluation of

<sup>64</sup> What is here called the user cost of capital (UCC) is in [Barrios et al. \(2019\)](#) and [Grünberger et al. \(2023\)](#) called the user cost of owner-occupied housing (UCOH) indicator. As mentioned, expression (3.3) above is a somewhat simplified variant of the expression of the UCC presented in [Barrios et al. \(2019\)](#).

housing but to display the distortions of housing choices caused by taxation.

However, the database can directly be used for estimation of the user cost and the UCTI ratios for valuation assessments in the EU. For example, the UCTI ratios can be constructed by multiplying the UCC estimates with the PTI ratios in the Commission’s HouseLev database (Bricongne et al., 2019). Indeed, the calculations of the UCTI ratios in ESRB (2022b, box 4) and figure 5.6 use these two Commission databases.

Figure 5.9: The European Commission’s user cost of capital for Sweden.

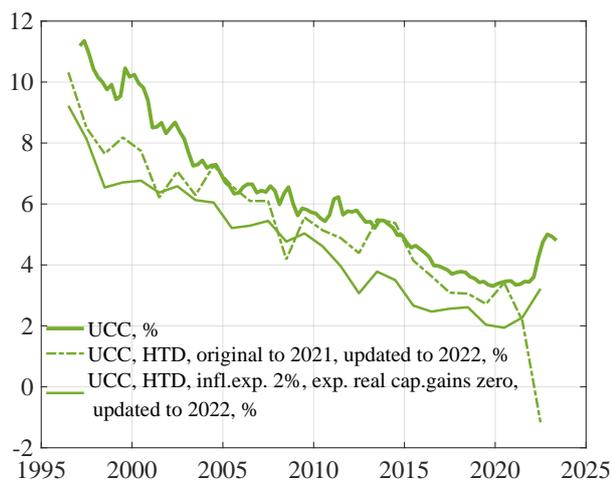
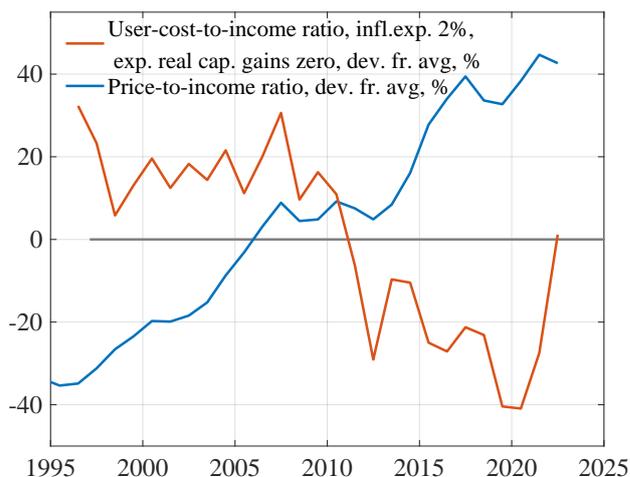


Figure 5.10: The Commission price-to-income and user-cost-to-income ratios for Sweden. Percentage deviation from historical average.



Source and note: Barrios et al. (2019), Grünberger et al. (2023), Bricongne et al. (2019), and own calculations. Figure 5.9: The thick solid line is the UCC from figure 3.4. The dashed-dotted line is the original HTD UCC for Sweden updated to 2022. The thin solid line is a modified HTD UCC calculated with 2% inflation expectations and zero expected real after-tax capital gains. Figure 5.10: The PTI ratio is from HouseLev. The UCTI ratio is the product of the PTI ratio and the modified HTD UCC with 2% inflation expectations and zero expected real after-tax capital gains.

Figure 5.9 shows the HTD’s original estimate for Sweden of the UCC (dash-dotted line), updated by me for the year 2022.<sup>65</sup> The rise in HICP inflation in 2022 makes the UCC drop to the negative range, corresponding to an expected large nominal capital gain. The thin solid line shows a modified HTD UCC, for which I assume that inflation expectations are 2% and that the expected real after-tax real capital gains are zero (thin solid line). The figure also shows the UCC estimated in this paper (thick solid green line).<sup>66</sup>

There is a similarity between the modified HTD estimates of the UCC and the estimate used in this paper. This means that, if the Commission would use these UCC estimates to calculate the user cost and the UCTI and UCTR ratios to assess the valuation of housing in Sweden, it would get results similar to the ones I get in this paper. Thus, the Commission results using the HTD would

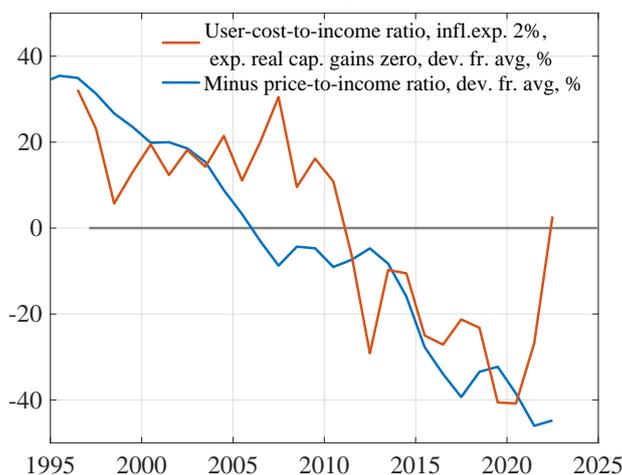
<sup>65</sup> The update is explained in appendix A.

<sup>66</sup> I interpret Barrios et al. (2019, pp. 13–14) to assume that housing-price inflation in year  $t + 1$  equals HICP inflation in year  $t$ . This is equivalent to assuming that inflation expectations are equal to current HICP inflation and that expected real capital gains are zero. In terms of equation (3.2), the original HTD assumes that  $\pi_t^{he} = \pi_t^{HICP}$ , where  $\pi_t^{HICP}$  denotes HICP inflation in year  $t$ . This makes for a volatile real interest rate, equal to the interest rate minus current HICP inflation, and thus a volatile UCC. The reasons for instead using 5-year inflation expectations or constant 2% expectations are discussed in section 3.1.

contradict its conclusions from figure 5.6.

If the Commission would use its original UCC estimates, the negative UCC for 2022 would make the UCTI ratio fall and become negative in 2022. The modified UCC, which rises in 2022, makes more sense, in my mind.

Figure 5.11: The Commission user-cost-to-income ratio and the negative of the price-to-income ratio for Sweden, % deviation from historical average.



Source and note: See figures 5.9 and 5.10.

Figure 5.10 shows the PTI ratio for Sweden (from the HouseLev database) and the UCTI ratio, both in percentage deviation from their historical average. The UCTI ratio is the product of the PTI ratio and the modified HTD UCC in figure 5.9, to be compared with the unadjusted PTI and UCTI ratios in figure 1.1.

Figure 5.11 shows the same negative correlation between the Commission PTI and UCTI ratios as figure 1.2. The correlation coefficient is  $-0.8$ . If the UCTI indicator is right, the PTI indicator is completely wrong, at least for Sweden.

### 5.3 The OECD

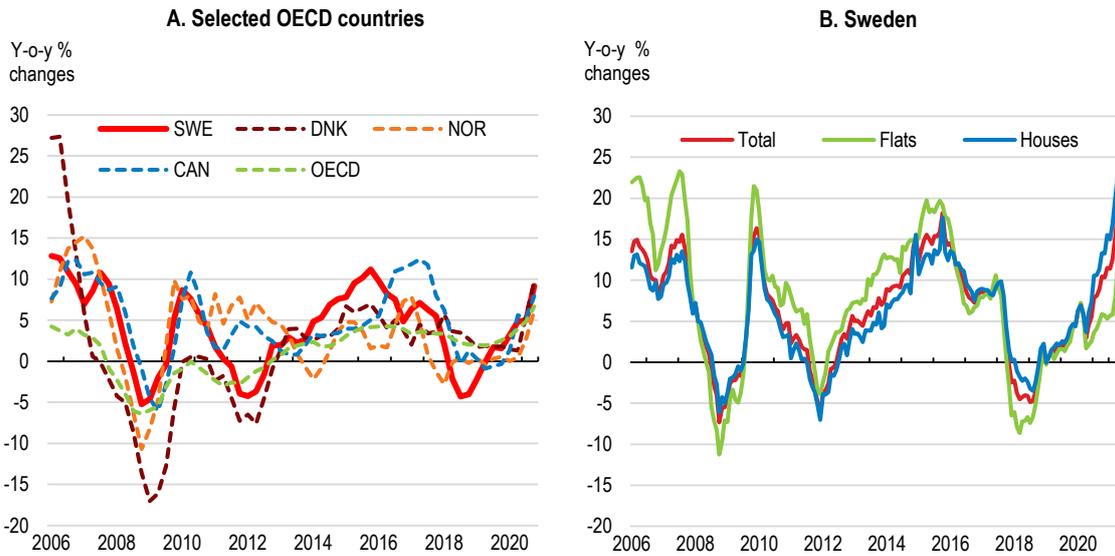
Previously, the OECD has warned about overvaluation of Swedish housing. For example:

#### **Buoyant house prices in some economies raise concerns about financial stability**

...Some advanced economies have experienced rapid house price growth, including Canada, Sweden, Australia and the United Kingdom. In these countries, house prices are elevated relative to rents (i.e. rental yields are low), suggesting overvaluation. As past experience has shown, rapid house price gains can be a precursor of an economic downturn, especially when they occur simultaneously in a large number of economies. (OECD, 2017, pp. 43–44)

However, in the most recent OECD economic surveys of Sweden, OECD (2021b, 2023c), I have not found any suggestions of overvaluation:

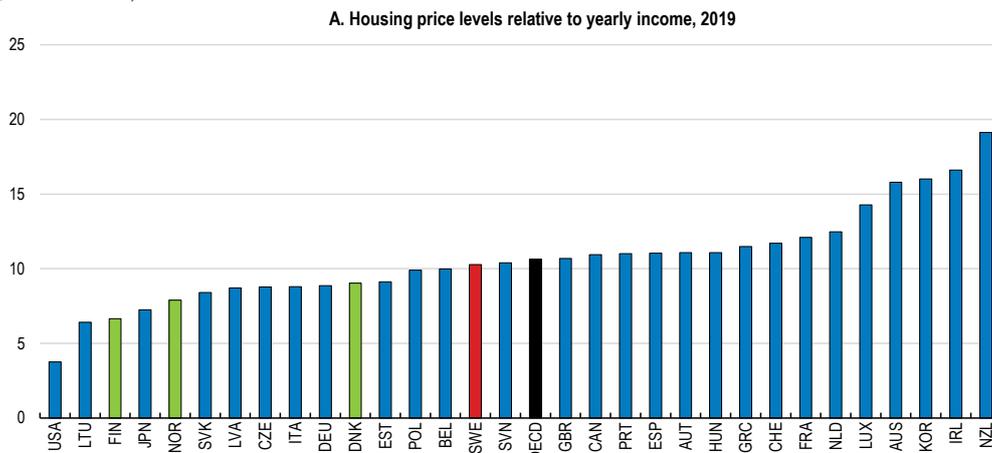
Figure 5.12: House prices have been rising at a fast pace (OECD, 2021b, figure 1.13).



Note: Panel A displays quarterly data adjusted for inflation using the private consumption deflator, up to 2020q4. Panel B displays nominal monthly data, up to April 2021. Source: OECD, House Price database and Valueguard.

Like in several other OECD countries, easy financing conditions and changing preferences have pushed up housing prices sharply during the pandemic (Figure 1.13, Panel A) [reproduced as figure 5.12]. In contrast with previous recent upswings, houses have gained more value than apartments in 2020, likely reflecting demand for space, as people spend more time at home than before the pandemic (Panel B). **Average housing prices relative to income are close to the OECD average, but higher than in the other Nordics** (Figure 1.14, Panel A) [reproduced as figure 5.13]. (OECD, 2021b, p. 29–30, my emphasis)

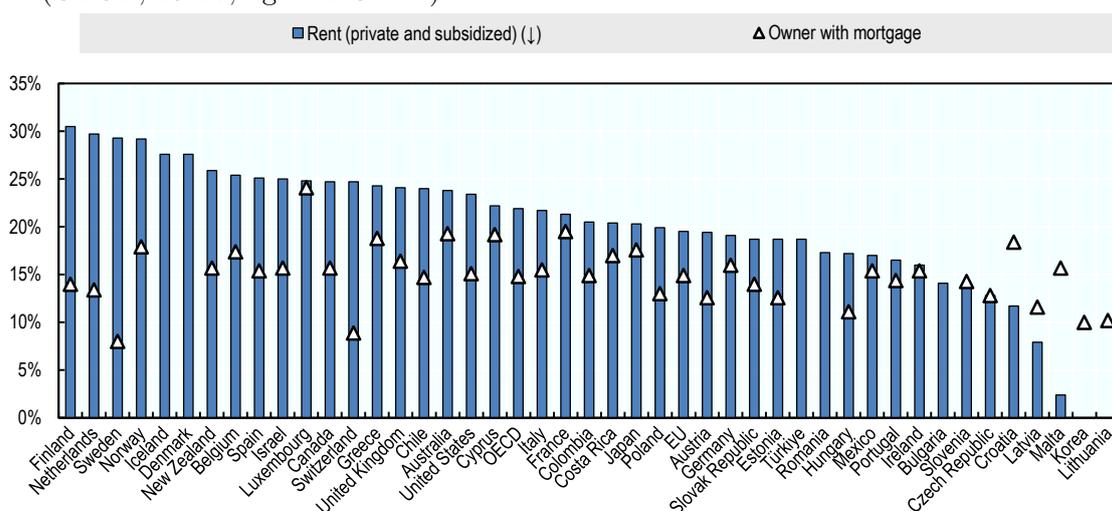
Figure 5.13: The Swedish house-price-to-income ratio is close to the OECD average ... (OECD, 2021b, figure 1.14A).



Note: The number of years of per capita gross disposable income needed to buy a 100 sqm dwelling (for more detail, see Bricongne et al., 2019). ... Source: HouseLev; OECD, House price database and OECD, National Accounts database.

Real housing prices increased sharply during the pandemic. A number of factors are estimated to have contributed, including the easing of financial conditions, a temporary lifting of the amortisation requirement for borrowers who applied for an exemption, and a shift in demand towards larger apartments and houses outside of the city centres on the back of the expansion of teleworking. Swedish [real] home prices have fallen around 19% from their March 2022 peak, one of the steepest falls in the OECD, amid tightened financial conditions, and are likely to fall further this year. (OECD, 2023c, p. 24)

Figure 5.14: Households’ housing cost burden (mortgage and rent cost) as a share of disposable income (OECD, 2022a, figure HC1.2.1).



Note: Median mortgage burden (principal repayment and interest payments) or rent burden (private market and subsidized rent) as a share of disposable income, in percent, 2020 or latest year available. See (OECD, 2022a, figure HC1.2.1) for extensive notes.

### 5.3.1 Housing affordability

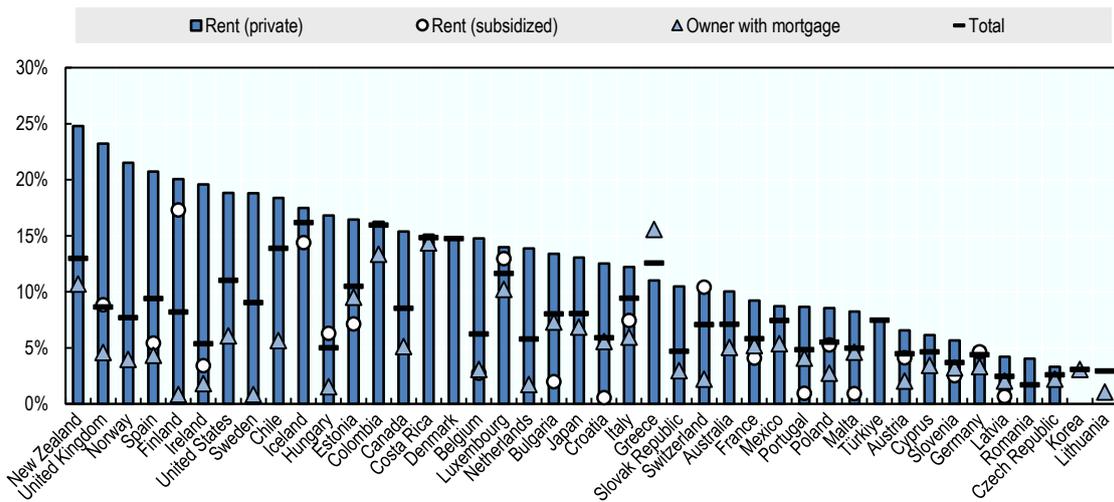
The OECD has done considerable work on housing affordability and constructed the OECD Affordable Housing Database (OECD, 2023b,a), with several indicators of housing affordability (OECD, 2021a), summarized in OECD (2021a, table HC.1.5.1). Interestingly—and much justified, in my opinion—in this work there is some skepticism against the use of price-to-income ratios.

However, from a policy perspective, price-to-income ratios have their limits. Because they are calculated at the aggregate level, they say little about the distribution of housing costs and housing affordability. **They do not take into account household borrowing costs to acquire housing.** They do not provide information on who does and does not have access to affordable housing, or why, nor do they provide any indication of the quality of housing that households are paying for. Because these measures provide only a general indication of the extent to which housing is (un)affordable for a (median) household, they are ill suited to support policy makers in targeting housing supports to different groups. (OECD, 2021a, p. 1, my emphasis)<sup>67</sup>

<sup>67</sup> This to some extent contradicts (OECD, 2022b, p. 1): “[H]ouse prices can be compared to income (price-to-income ratio) as a measure of the affordability of owning a dwelling. If the price-to-income ratio is above (below) their long-term average, house prices are considered to be overvalued (undervalued).”

Instead, OECD (2021a) suggests expenditure-to-income ratios, for example, with a threshold of 30% of gross income, below which housing is considered “affordable”. A related measure is the housing overburden rate, which captures the share of households spending an unacceptably large share of income on housing (that is, above a given threshold); both Eurostat and the OECD set the overburden threshold at 40% of household disposable income (net of housing allowances). Residual-income measures are also discussed.<sup>68</sup>

Figure 5.15: Housing cost overburden rate for owners (with mortgage) and tenants (private rent and subsidized rent) (OECD, 2022a, figure HC1.2.3b).



Note: Share of population spending more than 40% of disposable income on mortgage and rent, by tenure, in percent, 2020 or latest year. In Denmark, the Netherlands, New Zealand and Sweden tenants at subsidized rate are included into the private market rent category due to data limitations. See (OECD, 2022a, figure HC1.2.3b) for extensive notes.

Regarding Sweden, the owner-occupiers’ median mortgage burden (principal repayment and interest payments) as a share of disposable income, it was at 8% the lowest in OECD in 2020 (OECD, 2022a, figure HC1.2.1, reproduced as figure 5.14). As for the owner-occupiers’ housing overburden rate, that of Sweden and Finland was at 0.9% the lowest in OECD in 2020 (OECD, 2022a, figure HC1.2.3b, reproduced as figure 5.15). See also appendix F and figures F.1 and F.2 on Swedish housing expenditure shares and disposable income by tenure.

It is difficult to see that these low numbers would be consistent with considerable overvaluation of Swedish housing. Rather they are consistent with some undervaluation.<sup>69</sup>

<sup>68</sup> The OECD housing costs (OECD, 2022a) can refer to: (1) a narrow definition based on rent and mortgage costs (principal repayment and mortgage interest); or (2) a wider definition that also includes the costs of mandatory services and charges, regular maintenance and repair, taxes and utilities, which are referred to “total housing costs”. They differ from user costs and rather represent households’ cash payments for housing.

<sup>69</sup> A recent European Commission discussion paper, Frayne, Szczypińska, Vašíček, and Zeugner (2022), discusses housing developments in the euro area with a focus on housing affordability, thus not including Sweden. It suggests three different indicators of housing affordability, namely, the price-to-income ratio, the housing-cost overburden rate, and measures of the household borrowing capacity. Regarding the borrowing capacity, it makes the important distinction between the loan-service capacity and the capacity to buy the equity portion of the housing (p. 18). Nevertheless, it presents and appears to give equal weight to PTI ratio as to the other indicators, without commenting on the fact that the PTI ratios may give opposite messages from the other more relevant indicators and may even be negatively correlated with them, as for Sweden in figure 1.2. As mentioned, taking the average of the PTI and UCTI

## 5.4 IMF

Previous IMF Article-IV reports have warned about Swedish house prices being too high. For example, in the 2019 report:

**24. High housing prices and high market rents increase vulnerabilities and inequality.** Despite their recent moderation, house prices have tripled in real terms since the mid-1990s, lifting the price-to-income (PTI) ratio to almost 30 percent above its 20-year average, with Stockholm’s PTI nearly twice the national average and among the highest worldwide. New purchasers must take on high debts relative to income (DTI), typically at floating rates, a macrofinancial vulnerability. (IMF, 2019, pp. 13–14)

However, the 2021 Article-IV report of the IMF on Sweden, IMF (2021), does not mention any overvaluation of Swedish housing:

**19. As in many countries, residential housing prices continued to strengthen, potentially raising some risks.** Easing of macroprudential regulation and monetary policy, coupled with fiscal support and likely changes in housing preferences, have contributed to rising demand. Although the 2020 price increase was higher than in most countries, it was relatively mild compared to the experience over the past decade. Recent stress tests suggest that most households have sufficient buffers to service their debt in case of income loss or mortgage rate increases, and the loan-to-value ratio is quite low (at below 70 percent, an average). However, with continued price increases, a slow recovery, and the recent acceleration of consumer credit, the number of highly indebted borrowers could increase. Staff advised that more comprehensive data collection on households’ balance sheets would help improve monitoring these risks and welcomed the recently launched government inquiry on household balance sheet statistics. (IMF, 2021, p. 17)

Furthermore, the 2023 Article-IV and FSAP reports, IMF (2023a,b), do not mention any overvaluation of Swedish housing.

## 5.5 Model estimates: The Riksbank and the National Debt Office

As noted, in addition to the statistical indicator PTI and PTR ratios, the ECB uses two empirical models. The ESRB reports the results of one of those models, the inverted-demand model, in its valuation assessment. As noted in section 5.1 this model seems problematic. We also see in figure 5.2 (yellow lines) that the estimates are quite volatile with some very high estimates and a substantial difference between real-time estimates. The inverted-demand model and its coefficient estimates are not documented in any detail. The “asset-pricing model” is not documented at all. It is therefore difficult to assess the models’ relevance and the appropriate weight on their results.

As mentioned, the Commission uses the model of Philipponnet and Turrini (2017), which is improved in European Commission (2020, available upon request). This model is well documented. It indicates some modest average overvaluation before 2018 and some modest undervaluation after (figure 5.6).

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indicators is not a good idea.

It is relevant to compare with the results of two other relatively recent, well-documented models of house prices in Sweden. They are constructed by Riksbank staff ([Dermani et al., 2016](#)) and National Debt Office staff ([Bjellerup and Majtorp, 2019](#)). The models and their results are discussed in appendix D. The models do not find any indication of overvaluation.<sup>70</sup>

It makes sense to put more weight on the results of models that are well documented. With such a weighting, the average model results do not indicate any significant overvaluation.

## 6 Conclusions

The concluding section summarizes a main but simple methodological point and some factual points made in this paper. It also mentions some possible improvements of valuation assessments and reports some qualifications.

The **methodological point** is, first, that the user-cost-to-income ratio is a natural indicator of valuation and affordability of owner-occupied housing. The user-cost-to-rent ratio is a natural indicator of the relative affordability of owner-occupied housing and rental housing—but it is less informative for Sweden, given rent control and a dysfunctional rental market. The user cost has scientific support in a large housing literature as a measure of the cost of living in owner-occupied housing. The UCTI and UCTR indicators may be expressed as percentage deviations from their historical averages, as indices with a particular base year, or as percentages of income and rents, respectively.

The UCTI and UCTR ratios are the product of the user cost of capital and, respectively, the price-to-income and price-to-rent ratios. The UCC is the user cost as a percentage of the house price. It summarizes crucial information about the housing costs: the financing cost (mortgage and equity); the operation, maintenance, repair and depreciation costs; taxes; any risk premium; and expected capital gains.

Second, the PTI and PTR ratios on their own are misleading indicators of valuation and affordability. This is because house prices do not at all represent the cost of living in owner-occupied housing. The PTI and PTR ratios disregard the crucial information in the UCC and the resulting considerable variability in the UCC.

More precisely, if the elasticity of the PTI ratio with respect to the UCC would be  $-1$ , the product, the UCTI ratio, would be constant. Empirically, the elasticity is negative but the magnitude is less than one, because of inertia, frictions, and other market imperfections. As a result, the correlation between the UCTI and PTI ratios is negative. For Sweden, the UCTI and PTI ratios are strongly negatively correlated, with a correlation coefficient of  $-0.8$ . Their larger percentage

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<sup>70</sup> [Flam \(2016\)](#) has undertaken a detailed survey of previous studies of Swedish housing prices, including [Englund \(2011\)](#), [Claussen \(2013\)](#), [Bergman and Sørensen \(2021\)](#), [Sørensen \(2013\)](#), and [Turk \(2015\)](#). Considering limitations and problems with the methods and data used, he concludes that the studies do not indicate any significant housing bubble or overvaluation. A major problem is the lack of data on free market rents. However, the special system of “presumption rents,” which exempts newly constructed rentals from rent control for a period of 15 years, allows negotiated rents to better reflect market levels. Comparing owner-occupied user costs to presumption rents in Stockholm’s inner city, the hottest housing market in Sweden, Flam finds that presumption rents exceed the user cost and thus do not indicate overvaluation even in this hot market.

deviations from historical averages have opposite signs (figure 1.2). Then they give completely opposite messages about housing affordability and valuation. And the UCTI ratio has strong scientific support, whereas the PTI ratio has none.

This simple methodological point should be obvious and uncontroversial.

Regarding the **factual points**, according to [ECB \(2023\)](#) and the [ESRB \(2022b\)](#), Swedish owner-occupied housing (OOH) was overvalued by about 55% in 2021q2, the largest overvaluation in EU and EEA; according to the [European Commission \(2021\)](#), by at least 30% in 2020q4. These assessments affect warnings and recommendations issued for Swedish economic policy and shocks in EBA stress tests of Swedish banks.

However, this paper demonstrates that these large overvaluation assessments are mainly due to the use of the PTI and PTR valuation indicators. According to the UCTI indicator, Swedish owner-occupied houses has since 2010 become increasingly undervalued, not overvalued, with a trough in 2019q4 of  $-34\%$ . Since then, taking into account a preference shift during covid toward larger and better homes as well as rising interest rates from 2022, the UCTI indicator has risen to reach  $-20\%$  in 2023q2. Thus, according to the UCTI indicator, in 2023q2 Swedish houses were still substantially undervalued.

If the ESRB and the Commission would be right about Swedish housing prices having been overvalued by 30–55%, one might think that a mortgage-rate rise of several percentage points in 2022 would trigger a correction of at least a similar magnitude as the proposed overvaluation, plus an additional adjustment due to the higher mortgage rates and user cost of capital. What has happened and will happen to house prices can thus be seen as a separate test and natural experiment of the ESRB's and the Commission's overvaluation thesis. So far, by monthly data, from a peak in Mars 2022, house prices have fallen steadily by a total of 18% to a trough in December 2022 and then risen back a bit to 15% below the peak in September 2023, far from a crash of 30–50% or more (figures [G.8](#) and [G.9](#)).

From the ESRB's own calculation of the UCTI and UCTR ratios for five other countries than Sweden (figure 5.4), it is clear that misleading assessments of overvaluation from the use of the PTI and PTR indicators is a problem that concerns several other countries in the EU than Sweden. Any misleading assessments may distort ESRB's decisions about which countries should receive warnings and recommendations regarding real-estate vulnerabilities ([ESRB, 2022a](#)) and the relative severity of the EBA's EU-wide stress tests; they may also distort the Commission's decisions about which countries may have macroeconomic imbalances and need special monitoring in the so-called macroeconomic imbalance procedure ([European Commission, 2022](#)).

Dwellings are unique in their location and the land they sit on. Dwelling prices are to a large extent determined by the location and other conditions in the local housing market. There is considerable heterogeneity between the housing market in large cities and in the countryside, in Sweden and in other countries, and the difference in prices between similar structures in different local housing markets can be large. The user-cost approach can easily be applied to local markets, such as, for Sweden, the Stockholm inner city, Municipality, or County. It can also be applied to quite specific types of dwellings, such as the owner-occupied and rent-controlled studios in Stockholm

Municipality and County examined in [Svensson \(2020, 2021a,b\)](#). Studying critical local markets provides more precise information about affordability and any overvaluation, as well as more precise and relevant comparisons between user costs and rents in SEK rather than indices for similar dwellings.<sup>71</sup>

Regarding possible **improvements in housing valuation assessments**, the obvious (and now hopefully uncontroversial) improvement is to use UCTI and UCTR indicators rather than the PTI and PTR ones, with the qualification that the relevance in informativeness of the UCTR indicator depends on the functioning of the rental market. It is easy to improve the housing valuation assessments this way. Figures such as [1.1](#), [4.3](#) (with a functioning rental market), and [3.4](#) (as well as the ESRB’s figure B reproduced as figure [5.4](#)) provide substantial information. The Commission’s existing Housing Taxation and HouseLev databases make it simple to replicate these valuation assessments for most of the EU countries ([Barríos et al., 2019](#), [Grünberger et al., 2023](#), [Bricongne et al., 2019](#)). These databases could be revised and extended to explicitly include UCTI and UCTR ratios for the EU countries. The OECD Housing Affordability database ([OECD, 2023b](#)) could be extended to explicitly include user costs and UCTI ratios as a complement to the current housing expenditure measures for OECD countries. These databases would be even more useful if they included quarterly data and were updated more frequently.

The international organizations also use various econometric models of house prices for valuation purposes. To assess their reliability and appropriateness, external scrutiny is necessary. To allow external scrutiny, the models need to be publicly documented in detail and ideally be accompanied by replication kits, as has become standard in many scientific journals. Such replication kits need to include both code and data, or links to public databases. Then researchers, other organizations, and interested parties can reproduce the results as well as update the results with new data. The use of publicly undocumented models prevents external scrutiny and risks prolonging the use of inappropriate or erroneous models.

Some simple “asset pricing” models assume that UCTR ratios (or UCTI ratios) are constant. These simple models are rejected by the findings that UCTR and UCTI ratios are far from constant but fluctuate substantially due to inertia, frictions, and other market imperfections ([Duca et al., 2021a,b](#)).

Regarding **qualifications** of the analysis and results in present paper, the simple user-cost approach applied here is appropriate for assessing whether a given combination of current and past house prices, user costs of capital, disposable incomes, and rents indicate that owner-occupied housing is overvalued or undervalued—in which case over- or undervaluation is measured in terms of the cost of living in owner-occupied housing relative to disposable incomes and to rents. But it is not a precise theory of how house prices depend on all the relevant fundamentals, and how house prices may change when those fundamentals change. Such a theory needs to take into account the supply of housing, the liquidity and credit constraints facing households, the role of housing cash payments for liquidity-constrained households as distinct from user costs, and other frictions and imperfections in the housing and mortgage markets. Simple house-price theories that assume that

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<sup>71</sup> See also [Flam \(2016\)](#) and footnote [70](#).

UCTI or UCTR ratios are constant are rejected for Sweden by the results of this paper.

Furthermore, the UCTI and UCTR indicators constructed depend on the assumptions made. But the assumptions are transparent and simple. They can easily be modified for sensitivity and robustness tests, or replaced by other assumptions considered more appropriate, depending on the country and housing and mortgage market being examined.

## Appendix

### A Data appendix

For Swedish house prices, the longest series is a quarterly price index for one- and two-dwelling houses for permanent living of [Statistics Sweden \(2023h\)](#). It excludes apartments. It is also reported with a lag of 2–3 months because it uses the date of the deed rather than the earlier date of the contract. From 2005, a monthly index, the HOX index, is provided for houses and apartments by [Valueguard \(2023\)](#). Figure [G.17](#) shows the different price indices. I use a linked quarterly price index consisting of the Statistics Sweden price index up to 2005q1 (adjusted for the lag in reporting) and a quarterly mean of the HOX index from 2005q1, shown in figure [G.7](#).<sup>72</sup>

Income is net disposable income per capita, that is, net disposable income divided by the population ([Statistics Sweden, 2023e](#)). Net disposable income is a 4-quarter trailing moving sum of quarterly net disposable income.

There is a choice between using disposable income or disposable income per capita, and between gross and net disposable income (the latter is net of the depreciation of households' fixed capital). Here I use net disposable income per capita. International organizations often use gross in international comparisons because countries calculate fixed-capital depreciation differently. Figure [G.10](#) shows that for Sweden the difference between gross and net disposable income is small.

In the national accounts, Ukrainian refugees are included in Swedish households and population according to the European Union's activated Temporary Protection Directive ([Council of the European Union, 2001](#)).

The mortgage rate is a quarterly mean of a 5-year monthly rate from [SBAB \(2023\)](#). Mortgage-rate expectations are from [NIER \(2023a\)](#).

The CPI is from [Statistics Sweden \(2023d\)](#) and inflation expectations are from [Kantar Sifo \(2023\)](#) and Refinitiv.

Rents are from [Statistics Sweden \(2023b, 4103 Main rental\)](#). Presumption rents (rents in newly constructed buildings) are from [Statistics Sweden \(2022b, 2023i\)](#).

Values of structures and land are from [Statistics Sweden \(2023a,g\)](#). Operation, maintenance, and repair costs are from [Statistics Sweden \(2023g\)](#). They are summarized in table [G.1](#). The values of structures and land are slightly smoothed; see figure [G.11](#). Prices of electricity; repair goods; home insurance; and water, sewage, and waste services are from [Statistics Sweden \(2023b, 4703 Electricity, 4605 Repair goods, 9801 Home insurance\)](#) and [Statistics Sweden \(2023c, 04.4 Owner-occupied housing: Water and dwelling services\)](#) (figure [G.21](#)).

Some additional data sources are reported in notes to figures and in the appendixes. Data sources from the ECB and the European Commission are reported in sections [5.1–5.2](#).

The Housing Taxation Database 1995–2021 ([Grünberger et al., 2023](#)) has been updated by me for 2022 by setting the parameters for 2022 equal those of 2021. The long-term interest rates and

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<sup>72</sup> [SBAB Booli \(2023\)](#) has a monthly price index for apartments and houses from 2013.

mortgage rates have been updated for 2022 using the same sources (Eurostat and SDW, respectively) that the database uses for 1995–2021.

## B Cointegration and elasticities

Logs of the series PTI, PTR, P, and UCC are nonstationary (with and without the preference adjustment shown in figure 1.1). That is, augmented Dickey-Fuller tests do not reject the hypothesis of a unit root. The first-difference of the logs of the series are stationary. If the levels are nonstationary and the first-differences are stationary, the logs of the series are integrated of order one, I(1). The rest of appendix B uses the preference-adjusted PTI, PTR, and P series.

If the logs of the series are I(1) and have a stationary linear combination, they are cointegrated. The demeaned logs of the series PTI, PTR, and P are cointegrated with the demeaned logs of the series UCC, with p-values for Engle-Granger cointegration tests (1 lag, no constant) equal to, respectively, 1.9%, 0.8%, and 2.5%.<sup>73</sup>

If the series log PTI and log UCC are cointegrated, there is a stationary linear combination,

$$u_t = \log \text{PTI}_t - \beta \log \text{UCC}_t, \quad (\text{B.1})$$

where  $u_t$  equals the residual from a linear regression of log PTI on log UCC. Furthermore, the estimate of the coefficient,  $\beta$ , is superconsistent, meaning that it converges faster than OLS estimates with increasing number of observations (Engle and Granger, 1987, Rajbhandari, 2016).

Table B.1 shows the estimated coefficients for regressions of logs of PTI and PTR on the log of UCC (the coefficient  $\beta$  in (B.1)). These can be interpreted as long-run elasticities with respect to UCC.

Table B.1: The long-run elasticities of preference-adjusted PTI and PTR ratios and house prices with respect to the UCC.

	PTI	PTR	P
UCC	-0.48 (0.016)	-0.85 (0.020)	-1.24 (0.026)
Obs	106	106	106
$R^2$	0.90	0.95	0.96

Source and note: OLS regressions of demeaned logs of preference-adjusted PTI and PTR ratios and house prices P on the demeaned log of UCC. OLS standard errors in parenthesis. The constant is zero for demeaned series. Sample 1997q1–2023q2.

In order to show that in this case the deviation of the UCTI ratio from its average is approximately the negative of the deviation of the PTI ratio from its average, we note that from (1.2) the log of the UCTI ratio satisfies

$$\log \text{UCTI}_t \equiv \log \text{UCC}_t + \log \text{PTI}_t. \quad (\text{B.2})$$

This can be used to eliminate  $\log \text{UCC}_t$  in the linear combination (B.1). This results in the following stationary linear combination,

$$u_t = (1 + \beta) \log \text{PTI}_t - \beta \text{UCTI}_t = 0.52 \log \text{PTI}_t + 0.48 \log \text{UCTI}_t. \quad (\text{B.3})$$

<sup>73</sup> The test is done with the Matlab function `egcitest`, which uses the correct critical values, different from the standard critical values of the augmented Dickey-Fuller test.

Figure B.1: Demeaned preference-adjusted log PTI and UCTI ratios and the stationary linear combination, the residual  $u_t$ .

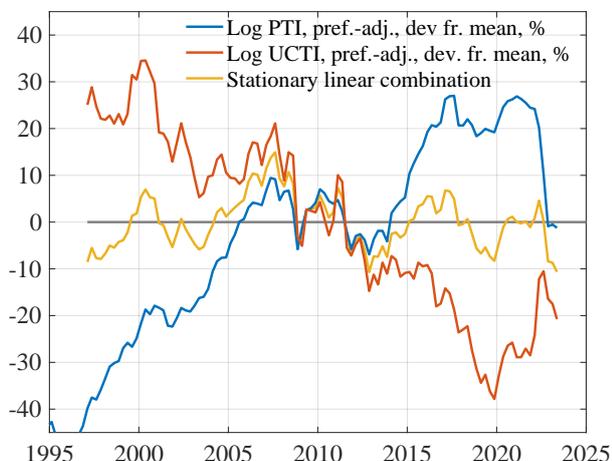
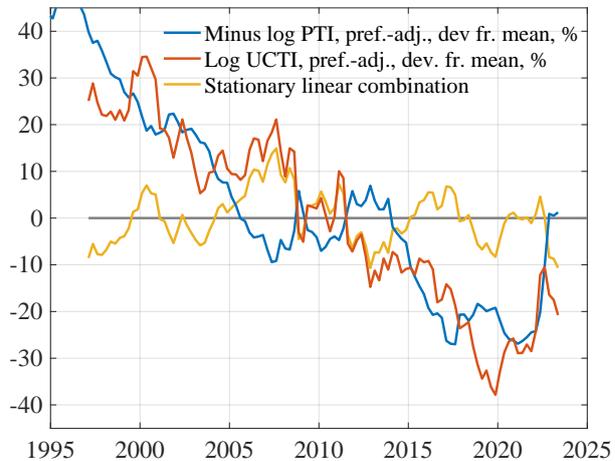


Figure B.2: Demeaned log UCTI ratio, the negative of the demeaned the log PTI ratio, and the stationary linear combination, the residual  $u_t$ .



Source and note: Own calculations. The ratios are preference-adjusted. The stationary linear combination is the  $u_t$  in (B.3).

That is, the stationary residual  $u_t$  is (approximately) the mean of log PTI and log UCTI. Taking the average of the two indicators is not a good idea.

We can rewrite (B.3) as

$$\log \text{PTI}_t = \frac{\beta}{1 + \beta} \log \text{UCTI}_t + \frac{1}{1 + \beta} u_t = -0.93 \log \text{UCTI}_t + \varepsilon_t, \quad (\text{B.4})$$

with  $\varepsilon_t \equiv 1.93 u_t$ .

Figure B.1 shows demeaned log  $\text{PTI}_t$  (blue) and log  $\text{UCTI}_t$  (red). The linear combination, the residuals  $u_t$  (yellow), is the (approximately) the average of the blue and red lines. Figure B.2 shows log  $\text{UCTI}_t$  and the *negative* of log  $\text{PTI}_t$ , to illustrate their negative relation and (B.4). The linear combination  $u_t$  is then (approximately) half the difference between the red and blue curve.

The correlation coefficient between log PTI and log UCTI is  $-0.8$ .

## C Households' expectations of future mortgage rates<sup>74</sup>

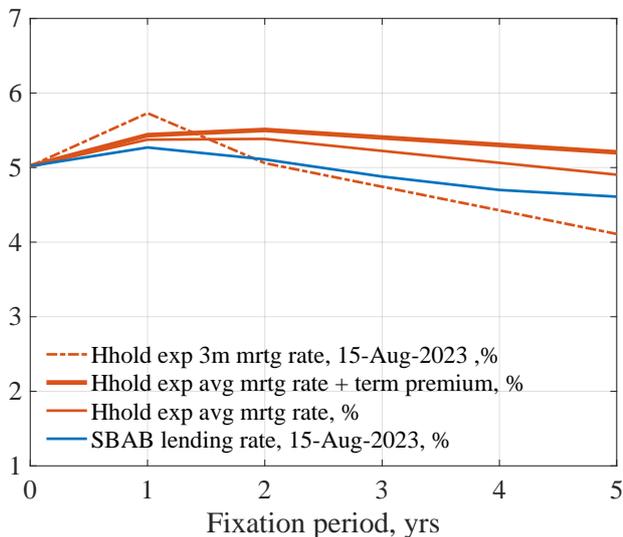
What are Swedish households' expectations of future mortgage rates? Could households have overoptimistic expectations of future mortgage rates?

Figure C.1 shows, for August 2023, Swedish households' expected future 3-month mortgage rates (dash-dotted red), their expected *average* future 3-month mortgage rates (the households' implied "yield curve") with and without an added term premium (solid thick and thin red, respectively), and the SBAB lending rates for different fixation periods up to five years (the SBAB "yield curve," solid blue). The households' implied yield curve represents the households' expectations of average future 3-month rates; the SBAB yield curve represents the SBAB expectations of average future 3-month rates, plus a possible risk premium.

We see that, in August 2023, households expected higher future mortgage rates than SBAB, which can in this paper be considered representative of other Swedish banks. Because banks are

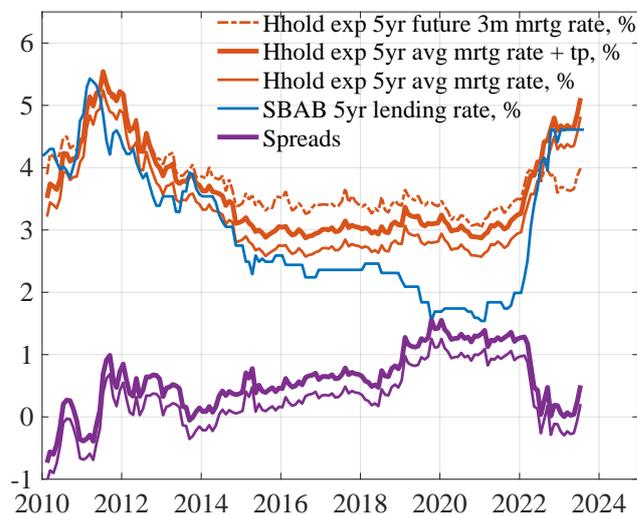
<sup>74</sup> This is an update of Svensson (2019, section 2.4).

Figure C.1: Swedish households' expected future 3-month mortgage rates, expected average future 3-month mortgage rates with and without term premium, and SBAB lending rates for different fixation periods, August 2023.



Source and note: [NIER \(2023a\)](#), [SBAB \(2023\)](#), and own calculations. The term premium is assumed to be 0.5 basis points (bp) per month fixation period, so it is 30 bp for a 5-year fixation period.

Figure C.2: Swedish households' expected 5-year average of future 3-month mortgage rates with and without term premium, the SBAB 5-year lending rate, and spreads, 2010–August 2023.



likely to be better informed than households, this indicates that households do not have overoptimistic mortgage-rate expectations.

Figure C.2 plots a time series of the households' expected 5-year average of future 3-month rates with and without an added term premium, the SBAB 5-year mortgage rate, and the spread between them with and without a term premium. The spreads indicate that since 2011 Swedish households' expectations of future mortgage rates have mostly been substantially higher than SBAB's. However, during July 2022–May 2023 the spread was close to zero, but thereafter it has picked up a bit. Clearly, the spread has not been significantly negative.

Altogether, there is no evidence that households would have overoptimistic expectations of low future mortgage rates, at least not compared to banks.<sup>75</sup>

## D Model-based measures of overvaluation from the Riksbank and the National Debt Office

### D.1 Riksbank staff analysis

[Dermani, Lindé, and Walentin \(2016\)](#) of the Riksbank examine whether Swedish house prices can

<sup>75</sup> Previously, [Hjalmarsson and Österholm \(2017\)](#) and [Österholm \(2017\)](#)—by examining the time series and forecast errors, respectively, of the households' mortgage-rate expectations—have not found any evidence of Swedish households' mortgage-rate expectation being unrealistically low. [Hjalmarsson and Österholm \(2019\)](#) use microdata of the households' expectations. They note that youngest group (16–24 years) has an expectation at the five-year horizon of the 3-month rate that is around 0.38 percentage points lower than the oldest group (65 years and older). However, when the youngest group is compared to the median-age group (35–49 years) and all other groups (25 years and older), the difference is only 0.21 and 0.25 percentage points, respectively (email correspondence with Hjalmarsson). This is not a large difference relative to the differences in figure C.2

be explained by fundamentals. In an international comparison, they estimate real house prices on data for a panel of seven countries: Denmark, Finland, Germany, Norway, Sweden, the UK, and the US. The explanatory variables are real disposable income per capita, real financial wealth, the real mortgage rate, annual CPI inflation, annual population growth, and residential investment as a fraction of GDP. They assume that the coefficients are the same across countries and make assumptions that allow individual countries to be over- or undervalued throughout the sample.<sup>76</sup>

Figure D.1: Actual and estimated house prices: Sweden.

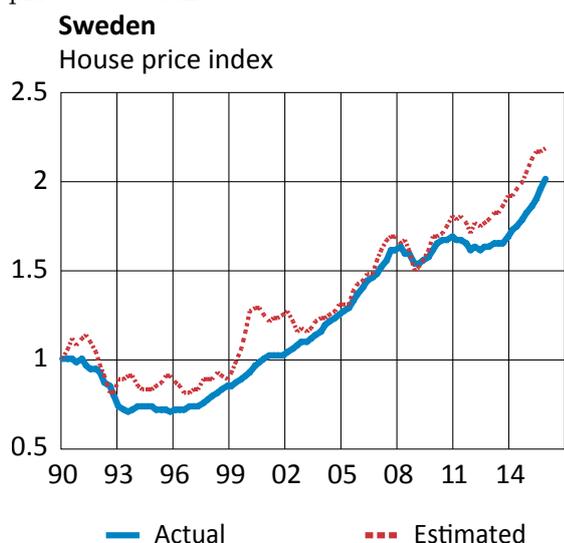
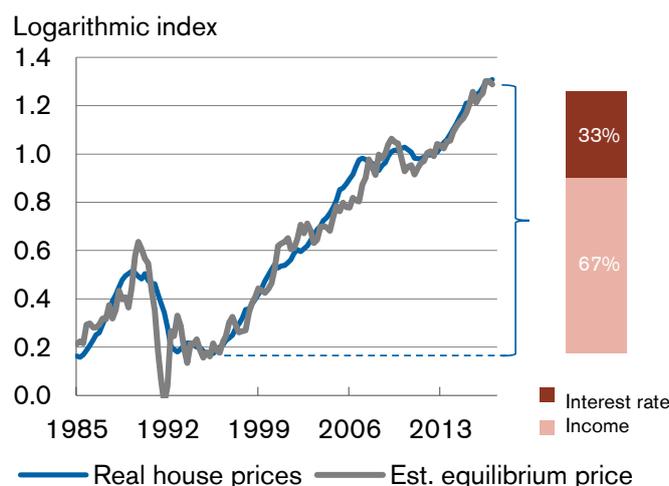


Figure D.2: Driving forces behind the rise in Swedish house prices 1996–2017.



Source and note: Figure D.1: [Dermani et al. \(2016, figure 5, panel for Sweden\)](#). Actual and estimated single-family house prices from the regression model without indebtedness ([Dermani et al., 2016, regression in equation \(1\)](#)). Figure D.2: [Bjellerup and Majtorp \(2019, figure 31\)](#). The calculated driving forces—real after-tax interest rate 33%, real disposable income 67%—relate to the change in the estimated equilibrium price between 1996q1 and 2017q4.

Figure D.1 shows results for Sweden. On average over the sample, Swedish housing has been somewhat undervalued. More recently, it is undervalued after 2011.

[Dermani et al. \(2016\)](#) also examine possible over- or undervaluation in Swedish municipalities, with a different method, namely, by examining the UCTI ratios over time. They thus use the municipality user cost share of median income as an indicator of overvaluation.<sup>77</sup>

Their summary conclusion is:

According to the methods we have used, there is no evident overvaluation of houses in Sweden, either in the country as a whole or in the municipalities for which we have data ([Dermani et al., 2016, p. 42](#)).

<sup>76</sup> They disregard differences in levels of variables that grow over time by converting the relevant variables into index series that are normalized to 1 for the start period in the empirical analysis (1990q1). Specifically, this normalization is done for house prices, disposable income, and financial net wealth. Had they not done this, they would have been forced to allow for a country-specific constant term in the model. A country-specific constant had, however, involved an assumption that house prices in each individual country had been correctly valued on average over the estimation period, something which they wish to avoid in advance in their analysis. The normalization does mean, however, that the average residual for each country contains the deviation in the cointegrating vector between housing prices and the other normalized variables in the first quarter of 1990. [Turk \(2015\)](#) shows that this deviation is small for Sweden. Their results may therefore be interpreted in terms of over- and undervaluation of prices in levels for Sweden.

<sup>77</sup> The user cost in year  $t$  and municipality  $j$  is calculated as the approximation  $(r_t + \tau_t)P_{jt}$ , where  $r_t$  is the real after-tax long mortgage rate,  $\tau_t$  is the property tax rate, and  $P_{jt}$  is the aggregate real purchase price for a house in municipality  $j$ . Thus, the measure of user cost excludes the OMRD and any expected capital gains.

More recently, [Sveriges Riksbank \(2021\)](#) discusses the reasons behind the rapidly rising housing prices during the coronavirus crisis (see figures [G.17](#) and [G.18](#)). It suggests that the price rise is due to a preference shift in favor of larger housing and location outside the large cities. That is, the price rise is considered due to fundamental factors and not any indication of overvaluation.

## D.2 National Debt Office staff analysis

[Bjellerup and Majtorp \(2019\)](#) of the National Debt Office present a thorough and granular analysis of the data and development of Swedish housing prices. In particular, they estimate a simple cointegrating vector of real house prices as a function of real disposable income and the real after-tax interest rate, with a dummy for the introduction of the 85% LTV cap in 2010q4.

Figure [D.2](#) shows actual real house prices and the equilibrium house price predicted by the cointegration vector. It shows that there is no evidence of overvaluation since 2011. Furthermore, the rise in real house prices during 1996–2017 is well explained by the fall in the real after-tax interest rate and the rise in real disposable income.

## E Capital gains on owner-occupied houses

The UCC in section [3](#) is calculated under the assumption that expected real after-tax capital gains are zero. This is a conservative assumption in the sense that average ex-post real after-tax capital gains on Swedish housing have been substantial. The average is 3.3% for 1997q1–2023q2 and 1.5% for 2010q1–2023q2. It is also conservative in the sense of assuming that house buyers do not speculate in high capital gains. With on average positive actual capital gains, assuming they are zero introduces an upward bias in absolute user costs and UCTI and UCTR ratios and in that sense toward overvaluation. Thus, the cards are somewhat stacked in favor of finding overvaluation. However, percentage deviations from historical averages are less or not affected, so there is less or no bias when overvaluation is measured in terms of such deviations.<sup>78</sup>

Figure E.1: Housing prices, the capital-gains tax, and ex-post nominal after-tax capital-gains rates and averages 1997q1–2023q2 and 2010q1–2023q2.

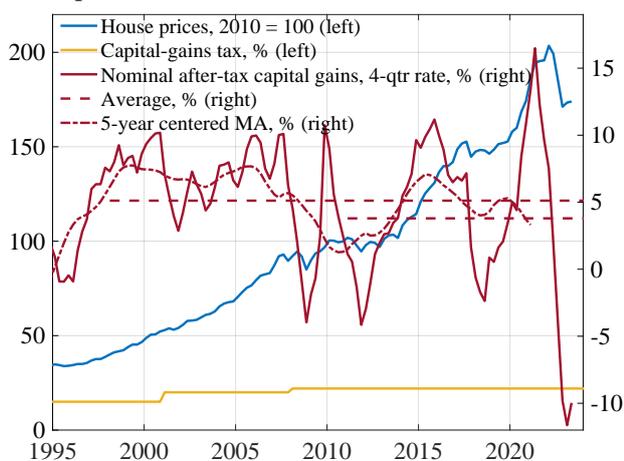
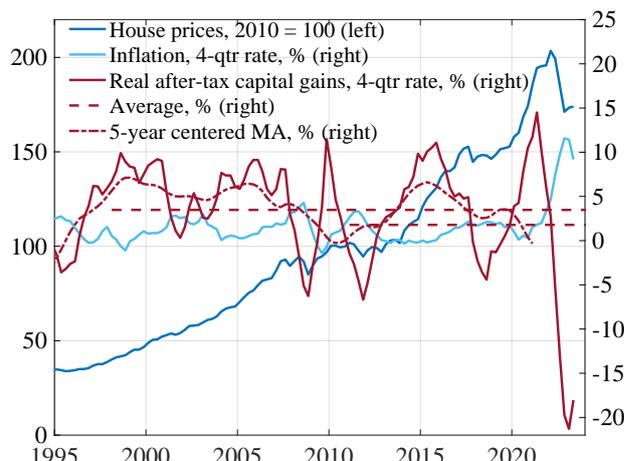


Figure E.2: Housing prices, inflation, and ex-post real after-tax capital-gains rates and averages 1997q1–2023q2 and 2010q1–2023q2.

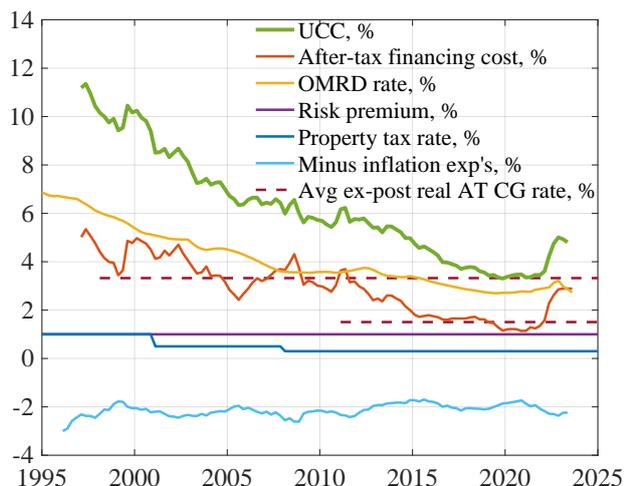


Source and note: [Englund \(2020\)](#), [Statistics Sweden \(2023d,h\)](#), and own calculations.

<sup>78</sup> For simplicity, it is assumed that the capital gains tax is paid every year. In practice, it can be postponed until the sale of the house, which reduces the present value of the tax ([Englund, 2020](#)).

Figure E.1 shows nominal housing prices, the tax rate on nominal capital gains, and the resulting ex-post nominal 4-quarter after-tax capital-gains rate and its average from 1997 and from 2010.<sup>79</sup> Figure E.2 shows the CPI inflation rate and the corresponding ex-post real 4-quarter after-tax capital-gains rates and their averages.<sup>80</sup> We see that, whereas the ex-post real 4-quarter after-tax capital-gains rate has fluctuated substantially and taken both positive and negative values, the 5-year moving averages have never been negative since 1997.

Figure E.3: The UCC and its components, and average real aft22q4er-tax capital-gains rates during 1997q1–2023q2 and 2010q1–2023q2.



Source and note: Sources and notes to figures 3.4 and E.2 and own calculations.

Figure E.4: The UCC excluding and including the ex-post 5-year-ahead real after-tax capital-gains rate.

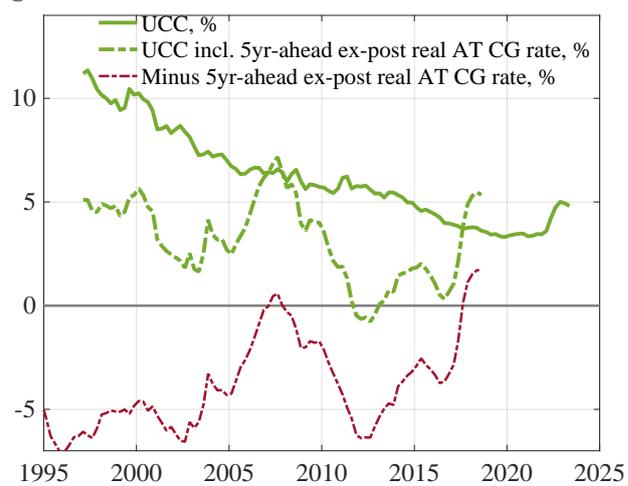


Figure E.3 adds the averages of the ex-post real after-tax capital-gains rate to figure 3.4. We see that expectations of real after-tax capital-gains equal to the average of the ex-post real after-tax capital gains during 1997q1–2022q1 would result in an approximately zero UCC during 2019q2–2021q4, implying that the perceived cost of living in owner-occupied housing would be approximately zero. That is, owner-occupiers would expect to “live for free.” For expectations of capital gains equal to the average during 2010q1–2022q1, the UCC would remain positive.<sup>81</sup>

The dash-dotted dark red line in figure E.4 shows the ex-post 5-year forward real after-tax capital gains at a 4-quarter rate. (Values after 2018q3 are missing because the latest data point of house prices is 2023q3.)<sup>82</sup> A house buyer with perfect foresight and a 5-year horizon—or using a 5-year horizon as an estimate of a longer horizon—could include this capital gains rate in the UCC, resulting in a modified UCC given by the dash-dotted green line. We see that this inclusive UCC is close to zero in 2012 and 2016.

The fact that user costs and UCTI ratios *excluding* capital gains in figures 3.5 and 4.1 are relatively low and for the UCTI ratios even falling up to 2020 indicates that Swedish house buyers

<sup>79</sup> The capital-gains tax rate was 15% during 1994–2001 and 20% during 2001–2007, and is 22% from 2008 (Englund, 2020).

<sup>80</sup> Let  $x_t = (1 - \tau_t^{cg})(P_t/P_{t-1} - 1)$  denote the 1-quarter (ex-post) nominal capital-gains rate in quarter  $t$ . The 4-quarter nominal after-tax capital-gains rate in quarter  $t$  is calculated as  $\prod_{s=-3}^0 (1 + x_{t+s}) - 1$ . Let  $y_t = x_t - \pi_t$  denote the 1-quarter real capital-gains rate in quarter  $t$ , where  $\pi_t$  denotes the one-quarter CPI inflation rate. The 4-quarter real capital-gains rate in quarter  $t$  is calculated as  $\prod_{s=-3}^0 (1 + y_{t+s}) - 1$ .

<sup>81</sup> That owner-occupation in Sweden ex post has resulted in a net profit during some periods has been discussed in Sandelin and Södersten (1978), Hansson (2019) and Englund (2020).

<sup>82</sup> It is calculated as  $[\prod_{s=1}^{20} (1 + y_{t+s})]^{(1/5)} - 1$ .

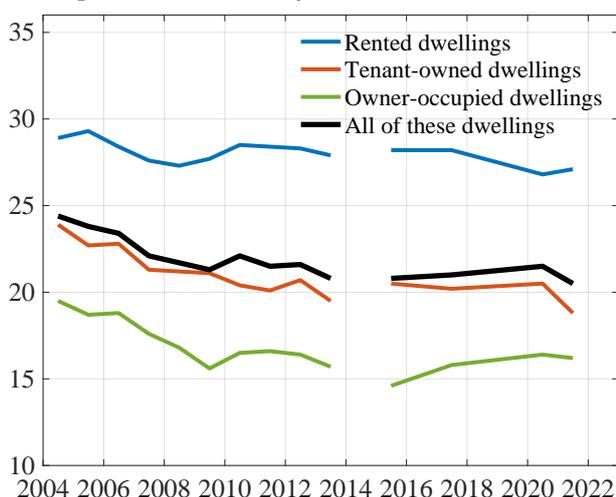
generally do not speculate in receiving large capital gains. High and rising UCTI ratios excluding capital gains might have indicated that such speculation occurs.

Can housing capital gains be positive indefinitely, in a steady state with a constant real interest rate? The price of a dwelling is the sum of the value of the structure and the value of the land the dwelling sits on, including the value of the location of the dwelling. The value of the structure should be determined by the cost and productivity of and competition in the construction of structures. Depending on these factors, the real value of structures may very well be approximately constant in the long run, making nominal capital-gains rates positive and approximately equal to the CPI inflation rate. But the real value of land and location need not be constant in the long run. According to the classic Muth-Mills model (DiPasquale and Wheaton, 1996, Brueckner, 1987), the value of land in attractive locations may increase in steady state with real incomes or GDP, resulting in nominal capital-gains rates approximately equal to the growth rate of nominal incomes or GDP, that is, to the sum of the real growth rate and the rate of inflation. In such a steady state, the share of land and location in the value of housing will grow and the share of structures will fall, but nominal and real capital gains on housing will remain positive.

## F Housing expenditures as a percentage of disposable income by tenure

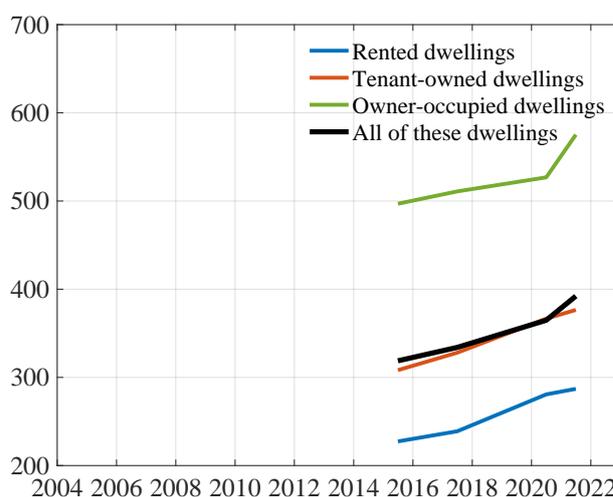
Statistics Sweden (2014, 2022a) reports housing expenditures as a percentage of disposable income for rented, tenant-owned, and owner-occupied dwellings, averages in an older series for 2004–2013 and medians in a new series for 2015, 2017, and 2020. They are shown in figure F.1. For owner-occupied dwellings, these housing expenditures include after-tax interest, amortization, and operation, maintenance, and repair expenditures. They correspond to housing payments (cash outflows) rather than user cost.

Figure F.1: Housing expenditure as a percentage of disposable income by tenure.



Source and note: Statistics Sweden (2014), averages for housing expenditure 2004–2013; Statistics Sweden (2022a), medians for housing expenditure and disposable income for 2015, 2017, 2020, and 2021.

Figure F.2: Disposable income by tenure. SEK thousands.



We see that households in rented dwellings have the highest expenditure shares. The expenditure shares for tenant-owned dwellings and, in particular, owner-occupied dwellings, are substantially lower than those for rented dwellings. This is to a substantial extent because owners have

higher disposable incomes than renters (figure F.2). The expenditure shares of owners are low, do not show any upward trend, and do not indicate any overvaluation in the sense of housing payments becoming large relative to disposable income.<sup>83</sup>

## G Additional figures and table

Figure G.1: Nominal house prices, disposable income, disposable income per capita, and rents, and population.

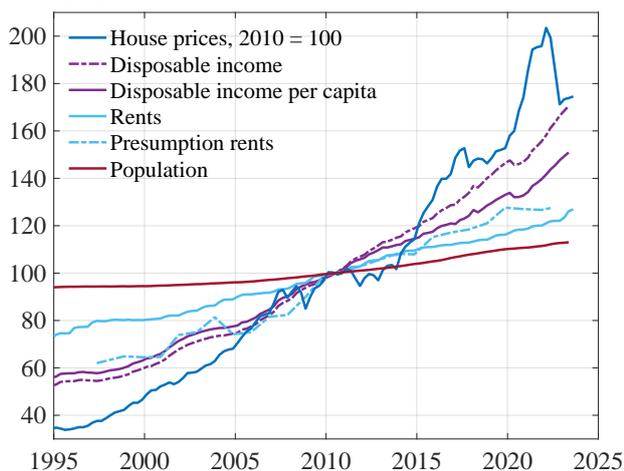
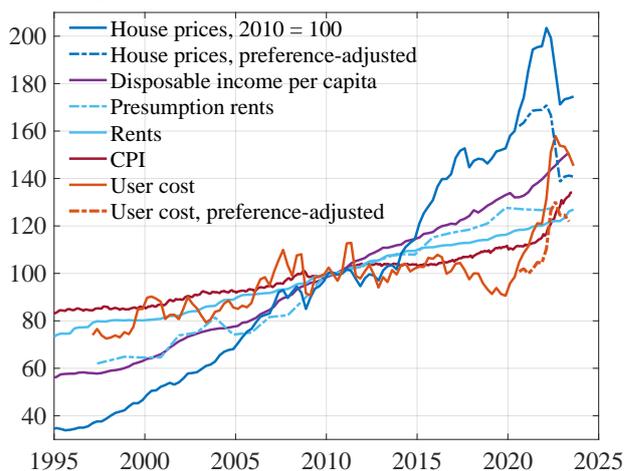


Figure G.2: Nominal house prices, disposable income per capita, rent, user cost, and the consumer price index.



Source and note: Figure G.1: [Statistics Sweden \(2023b,d,e,h\)](#) and own calculations. The linked house-price index is from figure G.7. Disposable income is net and a 4-quarter trailing moving sum. Rents are a 3-quarter centered moving average. Presumption rents, rents in newly constructed buildings, from [Statistics Sweden \(2023i, 2022b\)](#). Missing values for these rents in 2010 and 2012 have been replaced by interpolated values. The “preference-adjustment” is explained the text. Current prices, index 2010 = 100.

Figure G.3: Rent and presumption rent to income, index

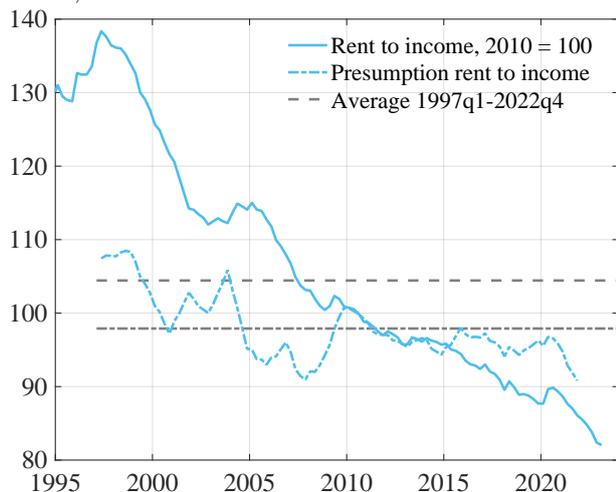
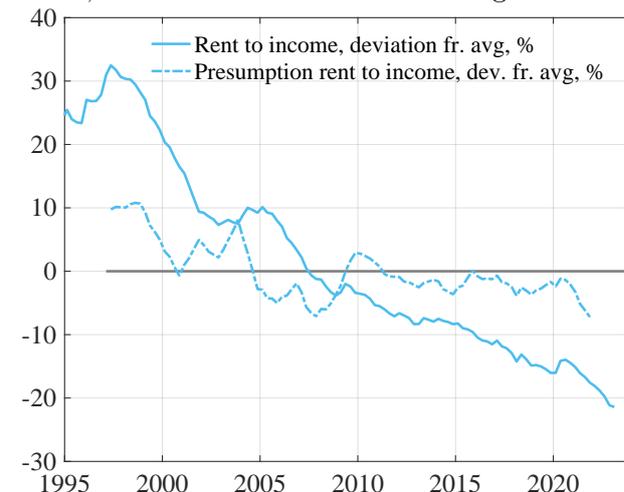


Figure G.4: Rent and presumption rent to income, deviation from historical average.



Source and note: [Statistics Sweden \(2023b,e,h\)](#).

<sup>83</sup> See also section 5.3, figure 5.14, and OECD’s work on housing affordability discussed there.

Figure G.5: Price-to-income ratio. Deviation from 1997q1–2023q2 average and real-time 1997q1– average.

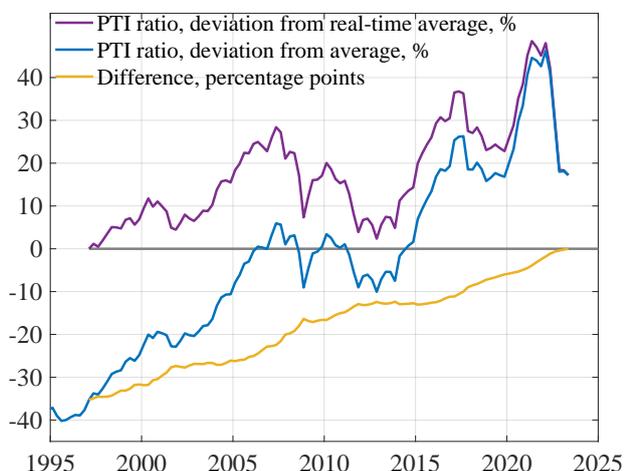
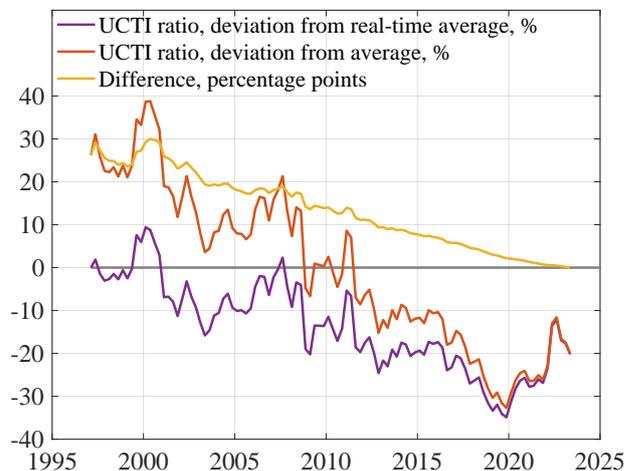


Figure G.6: User-cost-to-income ratio, preference-adjusted. Deviation from 1997q1–2023q2 average and real-time 1997q1– average.



Source and note: Figure G.5: [Statistics Sweden \(2023e,h\)](#), [Valueguard \(2023\)](#), and own calculations. Figure G.6: See note to figure 3.5

Figure G.7: Statistics Sweden house prices, HOX house prices; and the linked house-price index.

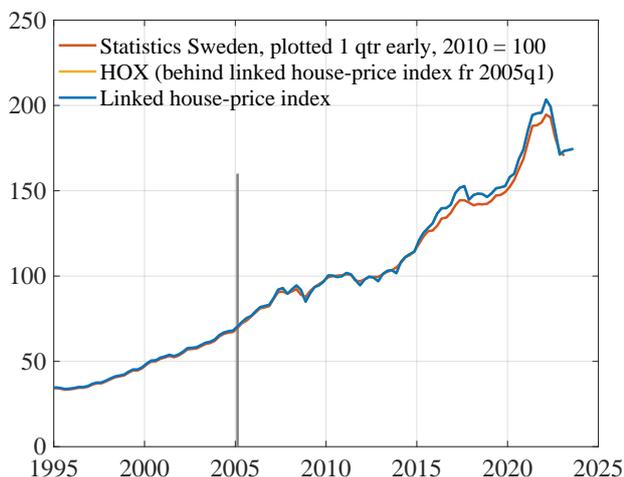
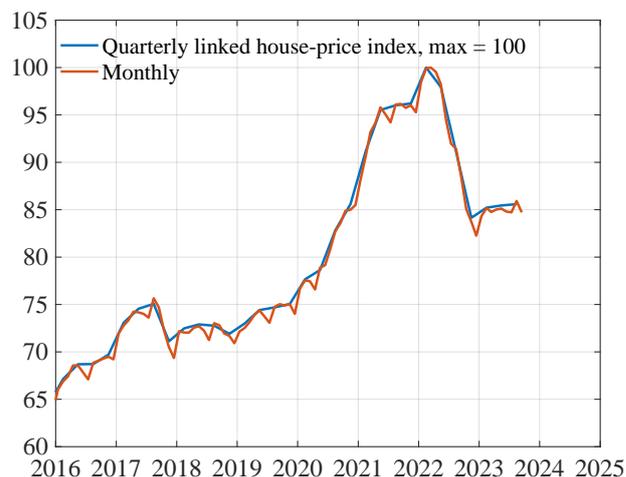
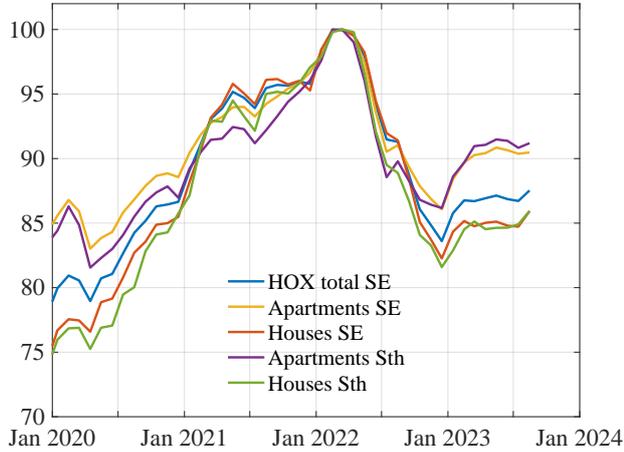


Figure G.8: The quarterly linked and monthly HOX house-price index, max = 100.



Source and note: [Statistics Sweden \(2023h\)](#), and [Valueguard \(2023\)](#). Index = 100 for 2010. The HOX price index is not available before 2005q1 (marked by the vertical gray line). The linked house-price index equals the Statistics Sweden house-price index (led by 1 quarter) up to 2005q1 and the HOX (quarterly) house-price index from 2005q1 (marked by the vertical gray line). The yellow line of the HOX price index is therefore hidden by the blue line of the linked price index. The Statics Sweden index is led by 1 quarter (plotted 1 quarter earlier) because it is dated by the date of the deed, which is normally 2–3 months later than the date of the contract.

Figure G.9: HOX price indices for Sweden and the Greater Stockholm Area. Max = 100.



Source and note: [Valueguard \(2023\)](#) and [SBAB Booli \(2023\)](#).

Figure G.10: Disposable income, gross and net, and percentage difference.

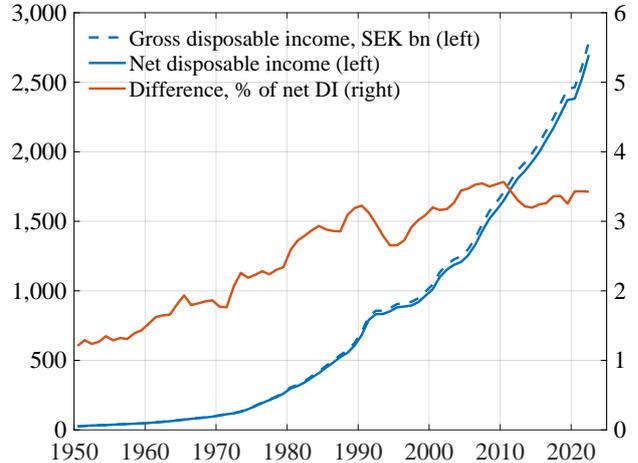


Figure G.11: Value of structures and land and the share of structures in house prices: Original and smoothed.

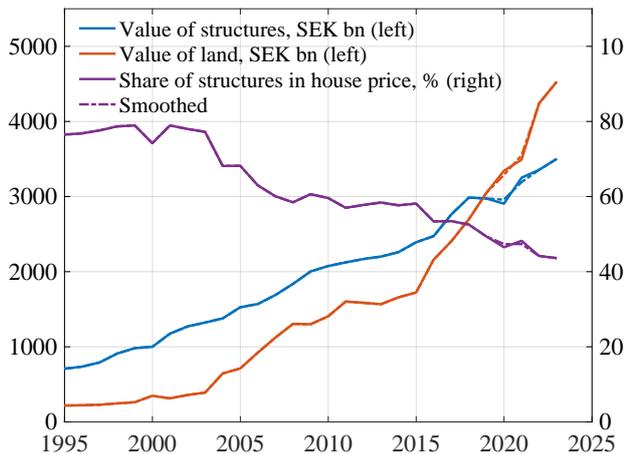
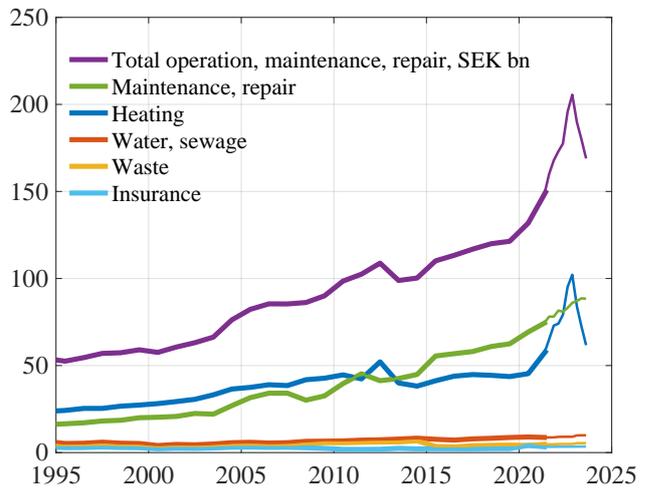
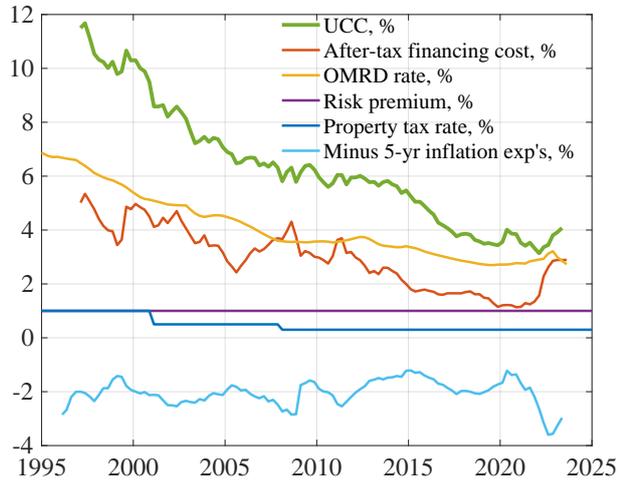


Figure G.12: Operation, maintenance, and repair costs.



Source and note: See appendix A. Figure G.11: The smoothed variant removes a difficult-to-explain down-and-up blip for December 2019 and 2020 but keeps the total value constant. Figure G.12: The thick lines are data. The thin lines are extrapolations for 2021 and 2022. Heating, insurance, and maintenance and repair are extrapolated with the electricity, insurance, and repair goods prices in figure G.21. The costs of water and sewage and of waste collection are linearly extrapolated.

Figure G.13: The UCC and its components. Average 5-year inflation expectations.



Source and note: See notes to figures 1.1 and 3.4. Average 5-year inflation expectations are used instead of expectations of annual inflation 5 years ahead. Own calculations.

Figure G.14: Price-to-income and user-cost-to-income ratios (percentage deviation from historical averages) and the user cost of capital (percent). Avg 5-yr inflation expectations.

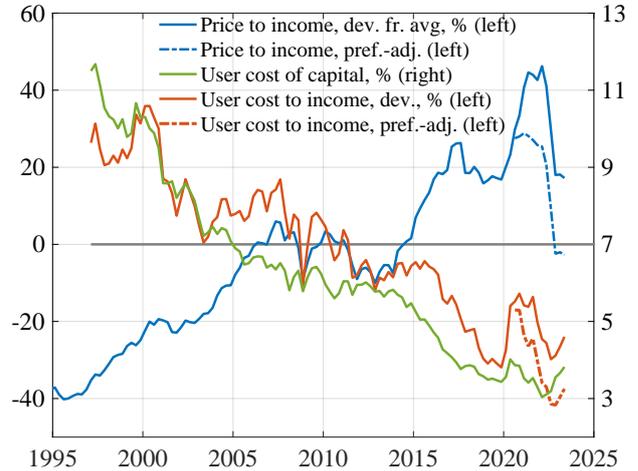
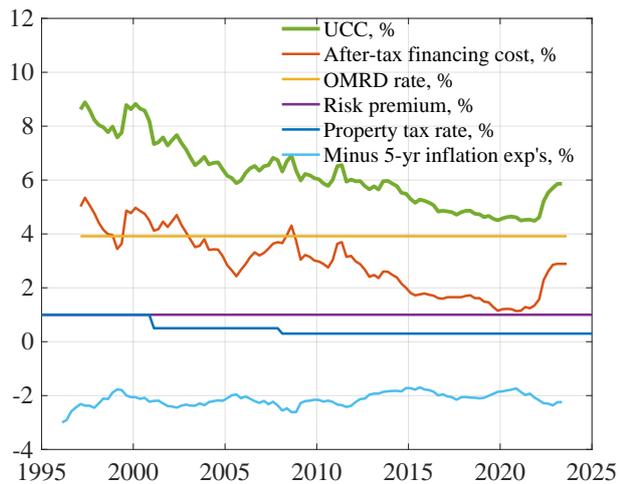


Figure G.15: The UCC and its components. Constant OMRD rate.



Source and note: See notes to figures 1.1 and 3.4. The OMRD rate is assumed to equal its mean during 1997q1–2023q2. Own calculations.

Figure G.16: Price-to-income and user-cost-to-income ratios (percentage deviation from historical averages) and the user cost of capital (percent). Constant OMRD rate.

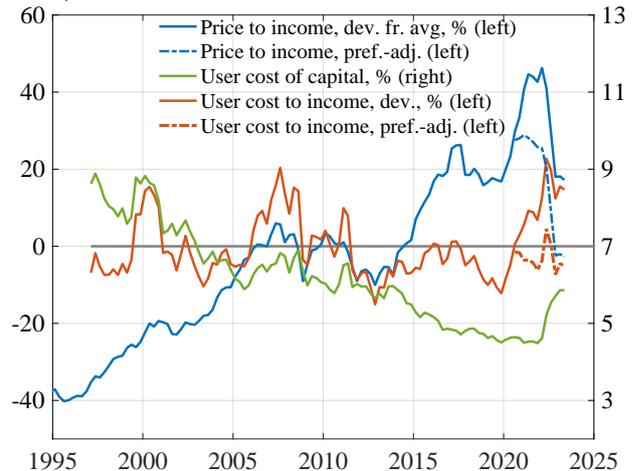
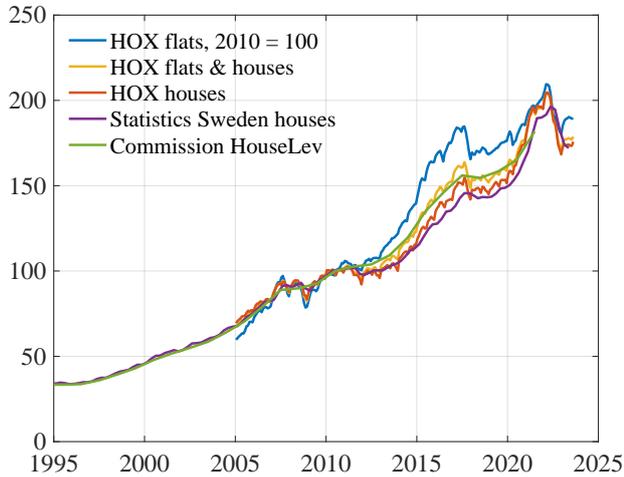


Figure G.17: Housing prices. Index.



Source and note: [Bricongne et al. \(2019\)](#), [Statistics Sweden \(2023h\)](#), and [Valueguard \(2023\)](#). Index = 100 for 2010.

Figure G.18: The price of houses relative to apartments. Index.

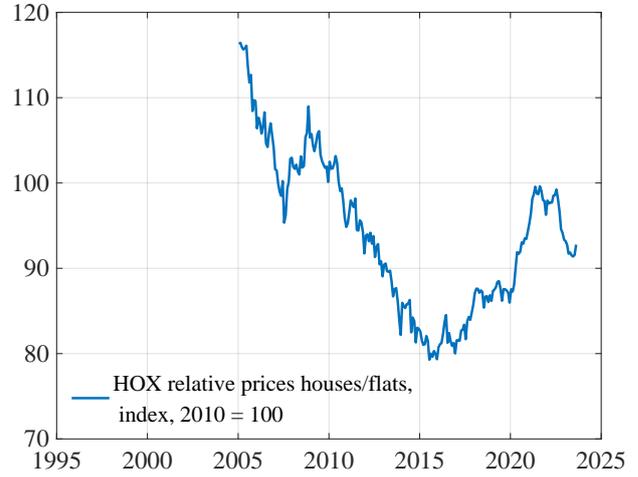
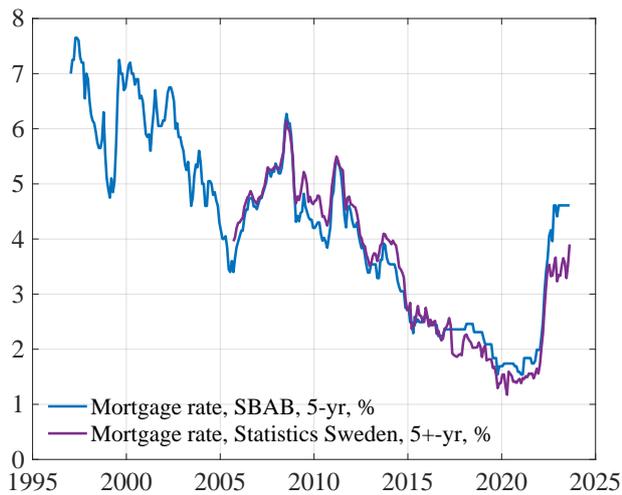


Figure G.19: The SBAB 5-year and the Statistics Sweden 5+-year mortgage rates.



Source and note: [SBAB \(2023\)](#) and [Statistics Sweden \(2023f\)](#). The mortgage rates refer to new and renegotiated loans.

Figure G.20: The SBAB 5-year mortgage rate, the cost of equity, and the resulting financing cost.

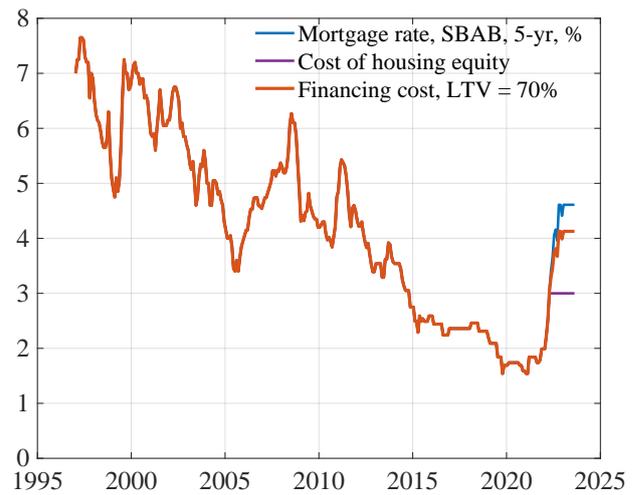


Figure G.21: Electricity prices; repair-goods prices; water, sewage, and waste costs; and insurance fees: Owner-occupied housing. Index.

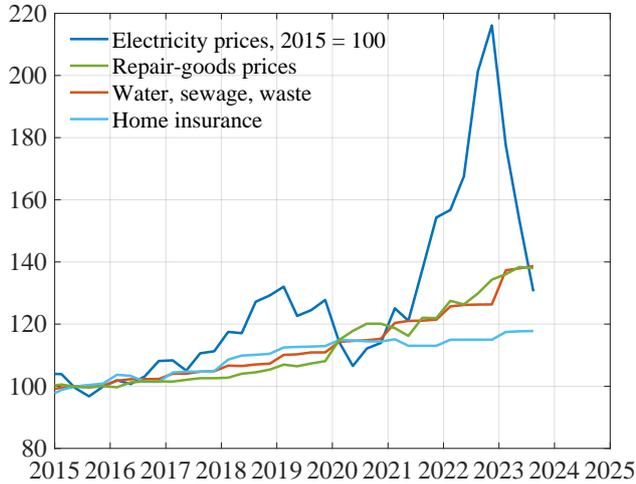
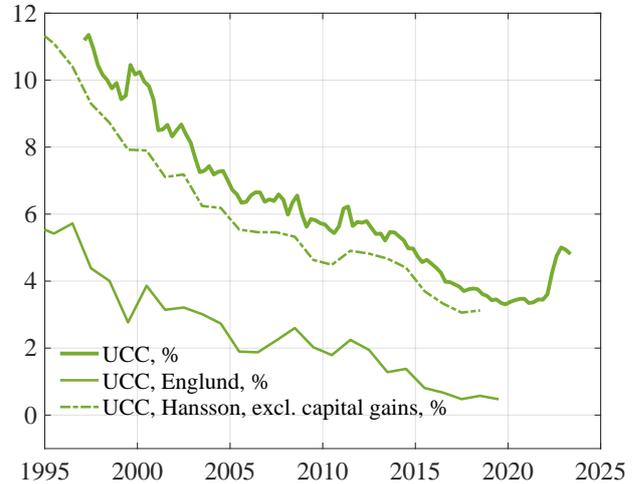


Figure G.22: The user cost of capital of Hansson (2019, figure 7, excl. capital gains) and Englund (2020, diagram 9) .



Source and note: Figure G.21: Statistics Sweden (2023b, 4703 Electricity, 4605 Repair goods, 9801 Home insurance), Statistics Sweden (2023c, 04.4 Owner-occupied housing: Water and dwelling services). Figure G.22: Hansson (2019, figure 7, excl. capital gains) and Englund (2020, diagram 9). The thick green line is the UCC from figure 3.4. Hansson’s UCC is shown excluding expected real after-tax capital gains. It is calculated for a 2% depreciation rate of the value of structures and a zero risk premium. Englund’s UCC is calculated for a zero OMRD rate and risk premium. The calculation of the relevant taxes is more detailed than in this paper. One-year capital gains are equal to firms’ one-year inflation expectations (NIER, 2023b) up to 1997 and 2% thereafter. A 5-year mortgage rate is used from 1997 and 5-year mortgage bonds plus 1 pp is used before.

Figure G.23: Average new mortgage rate, policy rate, and spread.

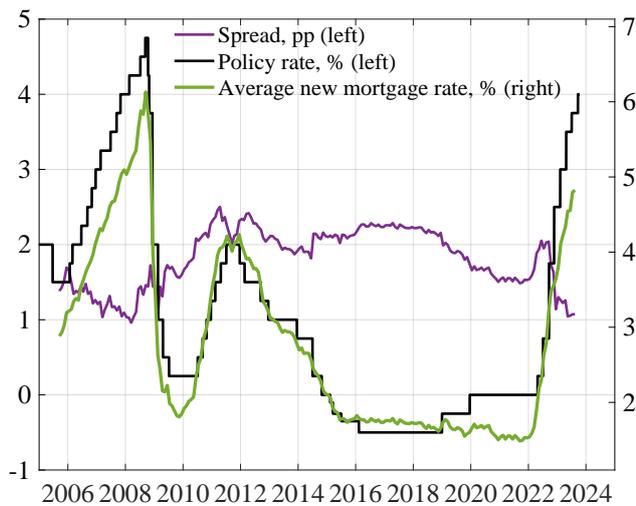
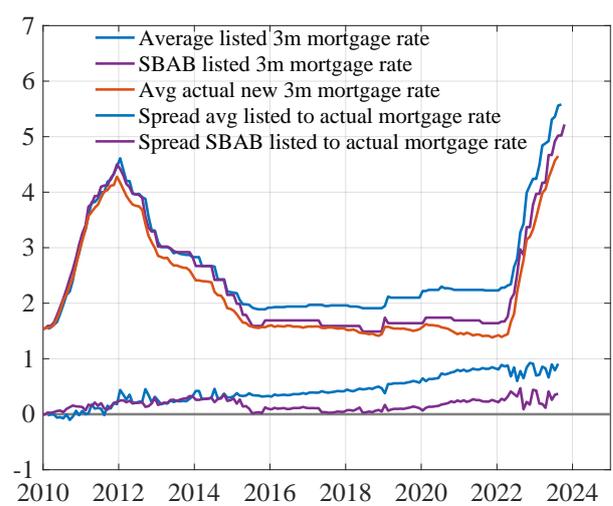


Figure G.24: The average listed, SBAB listed, and average actual 3-month mortgage rates, and the corresponding spreads.



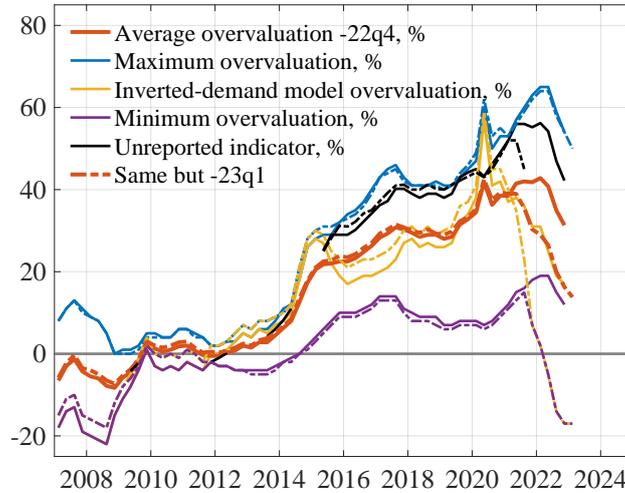
Source and note: Figure G.23: Statistics Sweden (2023f). Figure G.24: NIER (2023a), SBAB (2023), and Statistics Sweden (2023f).

Figure G.25: The ESRB's Scoreboard (ESRB, 2022b, table 1, Scoreboard, part 1).

Country	Indicators						
	Collateral stretch				Lending stretch		
	Residential real estate price index, 36m real growth, average %	Residential price index relative to trend	House price to income ratio (deviation from average, %)	Econometric model (overvaluation, %)	Loans to households for house purchases, 36m real growth, average %	Loans to households for house purchases relative to trend	Household loan spread
AT	5.2	1.14	52.0	33.0	4.2	1.01	1.4
BE	4.7	1.02	24.0	14.0	7.9	1.16	1.7
BG	3.8	1.18	-5.0	-10.0	13.1	1.08	2.7
CY	1.5	0.97	0.0	5.0	-8.2	0.75	2.1
CZ	8.1	1.16	36.0	30.0	5.2	0.99	1.9
DE	7.1	1.20	23.0	19.0	4.6	1.08	1.7
DK	4.8	1.09	27.0	11.0	1.3	0.96	2.4
EE	5.2	1.16	13.0	17.0	5.3	1.12	1.7
ES	2.7	1.03	12.0	12.0	-1.9	0.80	1.4
FI	0.8	0.96	5.0	1.0	1.9	0.94	0.7
FR	3.8	1.00	17.0	-3.0	5.7	1.04	1.1
GR	6.3	1.10	-1.0	-2.0	-10.9	0.61	2.7
HR	8.1	1.21	1.0	-9.0	7.0	1.17	2.5
HU	7.5	1.17	12.0	-1.0	6.9	1.07	3.5
IE	2.3	1.10	-6.0	-20.0	-3.8	0.83	3.1
IS	5.4	1.20	3.7		8.2	1.04	2.3
IT	0.6	0.98	-3.0	-1.0	1.4	0.92	0.9
LI							
LT	7.0	1.26	4.0	14.0	6.7	1.04	2.1
LU	12.3	1.17	68.0	48.0	7.7	1.09	1.4
LV	5.8	1.27	4.0	-18.0	0.3	1.16	2.3
MT	4.1	1.05	26.0	-25.0	8.6	1.08	1.5
NL	6.8	1.15	19.0	14.0	0.5	0.95	1.5
NO	3.8	1.03	28.9		4.6	0.99	1.5
PL	5.8	1.12	5.0	-6.0	2.8	0.89	2.7
PT	8.7	1.27	22.0	6.0	0.7	0.86	0.8
RO	0.6	1.12	-23.0	-34.0	7.5	1.03	3.1
SE	4.0	1.04	66.0	51.0	4.1	1.00	1.3
SI	7.0	1.24	16.0	3.0	4.5	0.94	1.6
SK	10.2	1.23	17.0	13.0	7.6	1.05	0.9
EEA average	5.3	1.1	16.0	6.0	3.6	1.0	1.9
EEA median	5.2	1.1	13.0	5.0	4.6	1.0	1.7
Low	2.5	1.00	4.0	0.0	3.0	1.05	1.0
Medium	5.0	1.04	10.0	6.0	6.0	1.10	1.5
High	7.5	1.08	16.0	12.0	9.0	1.15	2.0

Source: ECB, the national authorities of Iceland and Norway, the Banque centrale du Luxembourg, the Central Bank of Malta. Notes: The latest observation is the second quarter of 2021 for the indicators in the collateral stretch, August 2021 for those in the funding stretch and the first quarter of 2021 for those in the household stretch (with some exceptions). Official data from the National Statistics Office of Malta on disposable income are only available up to the second quarter of 2017 and the quarterly values for the first quarter of 2021 are based on Central Bank of Malta projections. Official data from STATEC on disposable income are only available on an annual basis up to 2020 and quarterly values for 2021 are Banque centrale du Luxembourg projections. The overvaluation figures are estimated by the European Central Bank.

Figure G.26: ECB estimates of residential property overvaluation: Sweden. Latest observation 2022q4 and 2023q1, respectively.



Source and note: Data downloaded from [ECB \(2023\)](#) in June 2023 with latest observation 2022q4 (solid) and in September with latest observation 2023q1 (dash-dotted).

Table G.1: Operation, maintenance, and repair costs for one- and two-dwelling houses, 1993–2021, and values of structures of and land under one- and two-dwelling houses, 1993–2022. SEK mn.

Year	Heating	Water and sewage	Waste collection	Insurance	Maintenance and repair	Structures	Land
1993	22,252	6,295	4,457	3,392	14,740	745,371	203,302
1994	23,637	6,358	4,503	3,427	15,969	708,213	217,784
1995	24,224	5,227	3,703	2,818	16,544	735,587	221,942
1996	25,371	5,372	3,804	2,894	17,111	791,819	228,324
1997	25,390	5,975	4,232	3,220	18,151	910,037	246,576
1998	26,668	5,394	3,820	2,907	18,566	982,077	262,155
1999	27,307	5,212	3,689	2,806	20,028	1,000,017	347,343
2000	28,146	4,051	2,867	2,182	20,312	1,174,945	313,730
2001	29,324	4,685	3,317	2,524	20,778	1,270,733	358,410
2002	30,598	4,475	3,166	2,408	22,469	1,323,026	390,310
2003	33,182	4,926	3,488	2,652	22,071	1,378,078	644,097
2004	36,516	5,687	4,024	3,061	26,969	1,526,517	712,291
2005	37,470	5,907	4,178	3,179	31,572	1,569,493	922,352
2006	38,986	5,495	3,884	2,956	34,117	1,689,467	1,122,720
2007	38,498	5,683	4,016	3,058	34,135	1,837,440	1,305,104
2008	41,853	6,466	5,006	2,785	30,101	2,002,840	1,299,996
2009	42,735	6,577	5,733	2,435	32,571	2,074,961	1,406,283
2010	44,634	6,711	5,659	1,881	39,628	2,124,164	1,602,512
2011	42,341	7,153	5,902	1,834	45,268	2,168,065	1,585,716
2012	52,131	7,358	6,106	1,933	41,305	2,201,094	1,566,710
2013	39,972	7,766	6,103	2,463	42,560	2,259,862	1,658,557
2014	38,178	8,286	6,785	2,145	44,864	2,391,597	1,722,808
2015	41,270	7,632	3,528	2,215	55,497	2,473,288	2,160,025
2016	43,895	7,195	3,225	2,185	56,803	2,760,793	2,403,395
2017	44,819	7,867	3,951	2,156	58,054	2,985,953	2,696,819
2018	44,393	8,218	4,157	2,272	60,935	2,973,678	3,048,997
2019	43,668	8,679	4,281	2,283	62,457	2,904,938	3,343,306
2020	45,347	8,982	4,132	4,103	69,277	3,251,351	3,491,044
2021	58,961	8,664	4,832	3,215	75,140	3,355,987	4,241,439
2022						3,501,628	4,528,353

Source and note: [Statistics Sweden \(2023g\)](#) and [Statistics Sweden \(2023a, AN1112 One- or two-dwelling buildings, AN2111A2 Land underlying one- or two-dwelling buildings\)](#) .

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