Economic Commentary

House prices and interest rate expectations

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Summary

In this Economic Commentary, we examine how changes in households' expectations about future interest rates may affect house prices.[1] Households' willingness to pay for housing depends on their expectations about the future. An important factor is how they expect interest rates to evolve. Over the last year, the Riksbank and many other central banks, after a protracted period of low rates, have started to raise their policy rates in order to counteract high inflation. This affects house prices.

Households' expectations about future mortgage rates cannot be observed directly, but both survey data and financial market data show that interest rate expectations have risen – in the short as well as the long run. We show that if house prices reflect the user cost and households are forward-looking, it is the higher expected interest rates in the long run that have the largest impact on house prices.

We present calculations where house price are determined by the user cost of housing. This is a common way of analysing the relationship between house prices and different factors that affect the cost of homeownership. Our calculations should be seen as illustrative examples, not a forecast. Their purpose is to shed some light on how changes in expectations about interest rates could affect house prices.

Since February 2022, house prices in Sweden have fallen by more than 8 percent. The Riksbank's forecast is that prices will continue to decline in the near term. This is hardly surprising, considering how much households' interest-rate expectations have shifted up in both the short and long run. But house prices are also affected by factors that are not accounted for in our calculations.

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[1] Economic Commentaries are brief analyses of issues that are relevant to the Riksbank. They may be written by individual members of the Executive Board or by staff members at the Riksbank. Staff members' Commentaries are approved by their head of department, while Executive Board members are themselves responsible for the content of the Commentaries they write.

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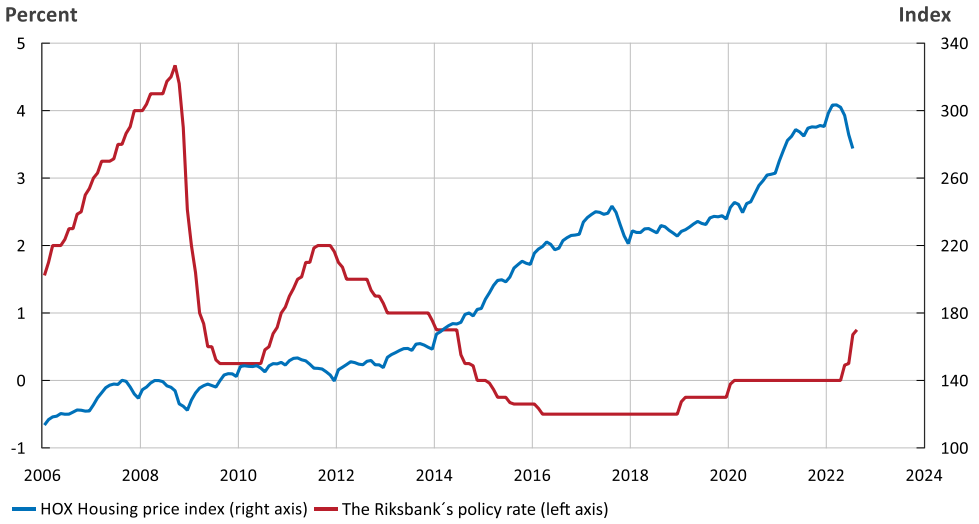
Higher rates and lower house prices

Following the pandemic and the Russian invasion of Ukraine, inflation has risen to historically high levels, causing market interest rates to rise rapidly and central banks, including the Riksbank, to raise policy rates, reduce asset purchases and signal further rate hikes ahead.

Higher rates have in many places been accompanied by falling house prices.[3] Since the supply of new housing adjusts slowly, in the short run house prices are mainly determined by housing demand. Households' willingness to pay for housing depends in turn on their expectations about the future, including how they expect interest rates to evolve. Because a large share of home purchases are financed with mortgages, households' expectations about mortgage rates can play an important role for house prices. In Sweden, house prices have fallen by more than 8 percent since February and the Riksbank forecasts that prices will continue to decline in the near term.[4]

Figure 1. The Riksbank's policy rate and house prices



Note. The HOX housing price index is quality adjusted and measures the underlying price development in the housing market, January 2005=100.

Sources: Sveriges Riksbank and Valueguard.

In this Economic Commentary, we report calculations where the price of a home is determined by the so-called user cost of housing. This is a common way of analysing the relationship between house prices and different factors that affect the cost of homeownership. In this case, we wish to shed some light on how the price is affected by changes in expectations about interest rates in the future. According to this approach, house prices reflect the present discounted value of all future benefits from owning a

[3] Throughout the text, we refer to the prices of owner-occupied housing as house prices, for ease of exposition. In practice, owner-occupied housing consists of both apartments and houses.

[4] The HOXSWE (nationwide) price index, without seasonal adjustment. With seasonal adjustment, HOXSWE declined by about 6 percent during the same period.

home, corresponding to the rent that the owner could charge if letting the property in a competitive rental market, less the expected future costs of homeownership.[5]

Our results should be seen as illustrative examples, not a forecast. One reason for this is that they disregard the fact that higher rates may be related to other changes in the economy that also matter for the evolution of house prices. In addition, the calculations do not account for general equilibrium effects. Over a longer horizon, it is for example likely that the supply of new housing stock adjusts to the change in prices, gradually dampening the initial price effect.[6] A further limitation is that the approach we use says nothing about how housing is valued compared to other assets, or what the determinants of homebuyers' risk appetite are.[7]

House prices reflect expectations about the future

A common way of doing user cost calculations is to assume that the different costs of homeownership can be expressed as a constant fraction of the market value of the home. In this case, the price can be expressed as a function of a housing service that accrues to the owner, an imputed rent *R* that grows at the rate g, as well as the cost of capital in the form of the net of tax financing cost $r(1-\tau)$, a risk premium γ, expenditures on maintenance and utilities m as well as property taxes θ.[8] The equilibrium price can then be written as

$$P = \frac{R}{r(1-\tau) + \gamma + \theta + m - g}$$

By changing the values of the parameters in the above equation, one can calculate the price effect of permanent changes, for example changes in tax rules.[9] The same approach has also been applied to study the effect of higher mortgage rates and of higher utility expenditures due to higher energy prices.[10] User cost calculations can also be used to assess whether a housing market appears to be over-valued.[11]

[5] See Poterba (1984), Himmelberg et al (2005) and Englund (2011). For applications to Swedish conditions, see Englund (2011, 2016), Almenberg and Andersson (2020), Finansinspektionen (2022) and Svensson (2022).

[6] Poterba (1984) combines short-run user cost calculations with long-run calculations where the stock of housing adjusts to changes in the user cost. If homebuyers anticipate this adjustment, prices respond less.

[7] Increased uncertainty can motivate a higher risk premium. This has a negative effect on prices. In theory, this could be accounted for in the model by allowing the risk premium to vary over time. Gelain and Lansing (2014) study house prices in an asset pricing model with time-varying risk aversion.

[8] Some studies for simplicity let mortgages be the only source of financing. Typically, however, purchases are financed with a combination of debt and equity. In our calculations, *r* applies to a combination of debt and equity and the tax rate τ is a combination of the mortgage interest deduction and the tax on capital income. The imputed rent *R* is difficult to assess based on Swedish data, due to rent control. A simplifying assumption is that the imputed rent grows at the same rate as the general price level according to the Riksbank's inflation target of 2 percent. How to arrive at the equation above is explained in the appendix.

[9] See for example Englund (2016) and Almenberg and Andersson (2019).

[10] See Finansinspektionen (2022).

[11] See Fox and Tulip (2014) and Svensson (2022). For an alternative approach, see Dermani et al. (2016).

In the above equation, a higher interest rate leads to a lower price. The lower the initial interest rate, the larger is the effect on the price of a rate hike of a given size expressed in percentage points. How strong this relationship is depends on how important mortgage costs are compared to other costs associated with owning a home.[12] It also depends on the choice of mortgage rate. In our calculations, it is what homebuyers expect mortgage rates to be in the future.

A drawback with the aforementioned equation is that if the interest rate (or other parameters) change, this represents an equal increase across all time horizons. This follows from the simplifying assumption that the interest rate is constant over time.[13] For some purposes, for example to look at the effect of permanent changes, this is sufficient. But when studying changes where developments clearly differ in the short and long run, it is a severe limitation to assume that all changes are permanent.[14] In this case, one can instead let the interest vary over time initially, and only later take on a constant value. In the appendix we show how to set up the user cost equation in such a manner. In the simplest case, the interest takes on one value in the first period and another value from the second period and onward. The expression can be extended to longer horizons as desired. In our calculations, we let the first five years constitute the short run, with a time-varying interest rate, and all years beyond that constitute the long run, with a constant rate. The same approach can be used to study the effect of other temporary changes, for example if the cost of utilities rises as a result of large but more or less temporary increases in energy prices – but this is outside the scope of this economic commentary.

Higher interest rate expectations in both the short and the long run

It is not possible to directly observe households' mortgage-rate expectations, but both survey data and market data indicate that interest rate expectations have risen – both in the short run and the long run. But which interest-rate changes matter the most for house prices? The National Institute of Economic Research (NIER) each month asks a sample of households about their expectations of future mortgage rates. They ask what the respondent expects the adjustable mortgage rate to be in one, two and five years' time. We refer to this time series as household *survey-based* expectations. An advantage with these data is that they expressly aim to measure households' expectations about interest rates.

[12] This also applies to other parts of the calculation. Poterba (1984) for example compares the effect of a transition to higher inflation from different starting points for the inflation rate.

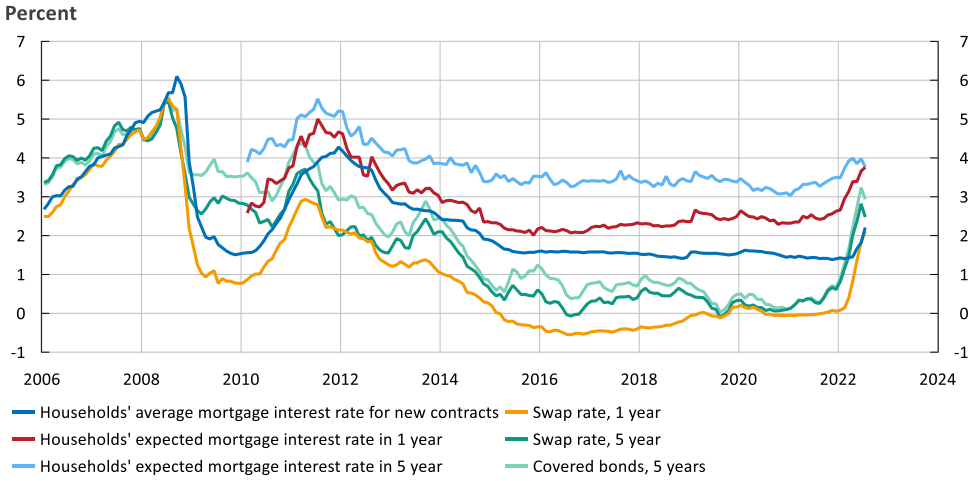
[13] Poterba (1984) is, unlike the simple version described here, a dynamic model. The dynamics describe the transition from the short run, in which the stock of housing is unaffected, to the long run where lower (higher) prices lead to a smaller (greater) housing stock. The main results in Poterba (1984) are with regard to permanent changes in the inflation rate and the mortgage interest deduction, but the author also mentions calculations comparing temporary and permanent changes (see Poterba 1984, p. 746).

[14] An alternative approach is to use the equation above and change the interest rate parameter that is assumed to be equivalent to the change in the interest-rate path that one wishes to examine. Such an approach is sensitive to the choice of interest rate that is assumed to be equivalent.

A drawback with the survey-based measure is that it merely represents survey responses, neither more nor less. There is no "money where your mouth is" and the respondents are not necessarily representative of the households that set prices in the housing market.[15] The average survey response has for a long time been rather high compared to actual mortgage rates.[16] Also, there are systematic differences between different groups of respondents. For example, older respondents, with more experience of high inflation and high interest rates, have expected higher interest rates in the future compared to younger respondents.[17] As a comparison, we use a measure based on market expectations as reflected in the prices of interest-rate swaps at different maturities.[18]

In figure 2, we show how the survey-based mortgage-rate expectations and the swap rates have developed over time, compared to the Riksbank policy rate, the average five-year fixed mortgage rate offered to households, and the average rate on a five-year (mortgage-backed) covered bond. We include the covered bond in the comparison because this is a common way for Swedish banks to fund mortgage lending.

Figure 2. Interest rates and interest rate expectations



Note. The expected mortgage interest rate refers to an adjustable rate mortgage.

Sources: NIER, Macrobond, Refinitiv and Sveriges Riksbank.

[15] Österholm (2017) finds that households overall have had realistic expectations about mortgage rates in the period from 2010 to 2016. In addition, if one estimates a simple regression where the change in house prices depends on the survey-based expectations, the explanatory value is about the same as if using the mortgage rates that households actually face.

[16] In the survey, the respondent is told the current average "listed" mortgage rate (the advertised rate, before discounts), which normally exceeds the actual rate that the borrower and the lender agree on. This could be one reason why the expectations have tended to be higher than actual rates.

[17] See Hjalmarsson and Österholm (2019).

[18] An interest rate swap is a financial instrument that allows two parties to exchange interest payments during a fixed period of time without affecting the composition of their balance sheets, debt profile, or investments. The swap rate reflects expectations about three month STIBOR, which is to say the cost of short term borrowing in the Swedish interbank market at different points of time in the future.

Our two measures of expectations are available at a few different time horizons. For the survey-based measure, we have household mortgage-rate expectations one, two and five years ahead.[19] To obtain values three and four years ahead, we assume that expectations evolve in a linear fashion between two and five years. In addition, we assume that expectations in five years' time also correspond to the expected mortgage rate at all times beyond that.[20] For the market-based expectations, we base this measure on swap rates with maturities of one, two, three, four and five years. As a measure of market expectations in the long run, we use the expected five-year rate in five years' time, which reflects expectations about interest rates between five and ten years ahead.

In the calculations, we use changes during the twelve months from July 2021 to July 2022. The reference point hence precedes the moment where interest-rate expectations began shifting up in a broad manner. Table 1 below reports how the two data series evolved between July 2021 and July 2022.

Table 1. Survey-based expectations about future mortgage rates and market-based interest-rate expectations

Per cent

	Households' expectations about adjustable mortgage rates (survey-based)			Market expectations about short interest rates (based on swap rates)		
Year	July 2021	July 2022	Difference	July 2021	July 2022	Difference
1	1.94	2.99	1.04	–0.03	2.10	2.12
2	2.61	3.96	1.36	0.09	2.76	2.67
3	2.86	4.10	1.23	0.26	2.63	2.37
4	3.07	3.97	0.90	0.43	2.42	1.99
5	3.27	3.84	0.57	0.60	2.49	1.88
> 5	3.37	3.77	0.40	0.97	2.56	1.59

Note. Differences are expressed in percentage points. Short interest rates refers to three-month STIBOR.

Sources: Bloomberg, Macrobond, NIER and own calculations.

In both cases, expectations about future interest rates have clearly shifted higher. Expectations have risen across all time horizons, but more in the short run than in the long run. The change is larger for the market-based measure. One reason for this is that the survey-based expectations were relatively high already at the outset. During a long period of low rates, the survey-based expectations did not go down as much as the market-based expectations. Lately, the distance has shrunk.

[19] The survey-based measure refers to the average value in the NIER survey, adjusted for outliers.

[20] The expectations refer to the end of each twelve-month period, while the calculations refer to the expected average rate over the course of the entire year. For this reason, we use the mid-point between the expectation in year t and the expectation in year t+1 as the average rate in period t+1, and as an initial value we use the average adjustable mortgage rate paid by households at the time of the survey.

Mortgage rates are typically considerably higher than the swap rate which here refers to the market expectation of the three-month STIBOR. To make the market-based interest-rate expectations more comparable to mortgage rates, we make the simplifying assumption in our calculations that mortgage rates exceed the swap rate by 150 basis points at all horizons.[21] In the calculations, we let this constitute market-based expectations of mortgage rates. That is a considerable simplification, since we assume a constant difference, whereas the difference between the swap rate and mortgage rates has varied over time. However, our constant is in line with the historical average in the 2000s.[22] Our other assumptions are standard and are reported in the appendix.

Expectations about the long run matter the most for house prices

The examples that we have reported above illustrate that when expectations about interest rates shift up to the extent that has occurred over the last year, it can bring about a non-negligible decline in house prices. The calculations are sensitive to how interest-rate expectations are measured. House prices fall by 7 percent when we use a survey-based measure, and by 21 percent, or about three times as much, when we instead rely on a market-based measure.

To shed more light on the effect of changes in expectations about the long and short run respectively, we also perform the calculations using only changes in the short run, which is to say up to five years, then only changes in the long run, which is to say five years ahead and beyond. The increase in expectations about interest rates is smaller in the long run than in the short run. But in our calculations, the change in expectations about the long run still has a larger impact on prices. It is somewhat larger if looking at the survey-based expectations, and more than twice as large, if looking at market-based expectations. In other words, even though expectations about interest rates have increased far more in the short run than in the long run, the change in expectations about the long run matters the most for house prices in our calculations.[23]

[21] How Swedish banks fund mortgages, and how this affects rates, is described in Eidestedt et al. (2020).

[22] The historical average is calculated based on the difference between a five-year swap rate and the average rate of new mortgages with an interest-rate fixation period of at least five years during the period from September 2005 to July 2022. The difference between mortgage rates and the swap rate is not directly comparable to the mortgage margin calculated by Finansinspektionen, since the latter is based on banks' overall funding costs, including covered bonds where the interest rate normally exceeds the swap rate. The mortgage margin has over the same period averaged 110 basis points. The exact size of the mark-up is of little importance for our results.

[23] When calculating the total effect of higher interest rates in the short run as well as in the long run, the effect of higher rates in the long run must be adjusted downward in order to allow the discount rate to be higher than the initial rate also in the short run. As a result, the combined effect is somewhat less than the sum of the two cases where rates only increase in the short run or the long run.

Table 2. What is the effect of changes in interest-rate expectations in the short and long run?
Per cent

Measure of interest-rate expectations	Effect of higher expectations in the short run, %	Effect of higher expectations in the long run, %	Combined effect, %
Survey-based	–3.1	–3.9	–6.9
Market-based	–6.7	–15.5	–21.1

Sources: Bloomberg, Macrobond, NIER and own calculations.

The price effects in table 2 refer only to an effect from higher interest rates. In other regards we assume that parameter values are unchanged in the calculations. Other factors also matter for house prices and they may have changed at the same time, which we do not account for in the calculations.

Discussion

A conclusion from our calculations is that the effect of higher interest-rate expectations on house prices to a large extent depends on how much households' revise their expectations about interest rates in the long run. When looking at how house prices are affected by higher interest rates, user-cost calculations can be a useful starting point. This approach has the reasonable property that the valuation of housing is forward-looking, in the sense that expectations about interest rates in the future play a central role, rather than the current level of interest rates. If prices were solely determined by the current adjustable mortgage rate, this would imply that the value of a home is independent of how the cost of owning it is expected to evolve in the future.

But this approach is still a simplification. The calculations reported above are examples with the aim of illustrating how changes in expectations about interest rates can affect house prices, without considering other changes. This is not a forecast for house prices. House prices have fallen by more than 8 percent since their peak in February 2022. The Riksbank forecasts that they will continue to decline in the near future. In the light of our calculations, this is hardly surprising, considering how households' expectations about interest rates have evolved, both in the short and long run. But other factors may have affected house prices at the same time, which we do not account for in the calculations. Energy prices have increased sharply in the short run and there is a risk that they will remain elevated for some time. Moreover, house prices in Sweden rose steeply during 2021, a pattern that has also been observed in other countries. The rise in prices has been interpreted as a shift in preferences where households chose to spend more of their income on housing during the pandemic.[24] If that shift in preferences is reversed, fully or partially, after the pandemic this could also contribute to lower house prices.[25]

[24] See Sveriges Riksbank (2021).

[25] See Finansinspektionen (2022).

An interesting aspect is the large discrepancy between the survey-based and the market-based expectations about future interest rates. As figure 2 shows, both mortgage rates and swap rates declined noticeably from 2011 and onward, while households' survey-based expectations about mortgage rates in the long run did not decline to the same extent. We cannot directly observe households' actual mortgage rate expectations, and both our survey-based measure and our market-based measure have limitations. If household expectations are better captured by the survey-based measure, it could indicate that households to some extent already anticipated higher rates. In this case, the impact of higher rates on house prices could be smaller, all else being equal.

We wish to emphasize, however, that we use the average expectations of households. Different subgroups also differ in their expectations. Underlying data show that older respondents on average expect higher rates in the future, compared to younger respondents. If the expectations of younger homebuyers are more similar to market expectations, and if younger buyers would play a larger role in determining house prices – for example through a higher propensity to move – then market-based expectations might offer a better indication when calculating the impact on house prices. The effect on house prices would then be larger.

Other important factors to consider are household liquidity constraints and their access to credit. If interest rates rise, households may to a larger extent face binding liquidity constraints in the short run. This can lead to a further decline in the demand for housing, when prospective buyers' postpone their home purchases or choose to buy a smaller property. Higher expectations about interest rates could also cause banks to become more restrictive in their provision of credit. Reduced access to credit would in turn lead to lower house prices. On a final note, we wish to underscore that we assume in the calculations that the risk premium demanded by homebuyers is constant. In a time of markedly higher uncertainty about the evolution of prices, interest rates and the state of the economy, it is likely that households, at least in the short run, will demand a higher risk premium when buying a home. These additional factors could lead to a larger price decline than the one we obtain in our calculations. Last, but not least, our results say nothing about how quickly the effect on house prices can be expected to materialize.[26]

[26] Sutton et al. (2017) find that the impact of higher policy rates on house prices occurs with lags in the US and other developed economies.

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APPENDIX – About the calculations

User-cost calculations with a constant interest rate

User-cost calculations can be viewed as a version of a classical formula for stock valuation, according to which the price of an asset, *P*, is determined by the dividend *D*, the growth rate of dividends *g* and a rate *r* that is used to discount future returns:

$$P_0 = E\sum_{t=1}^{\infty}\frac{(1+g_t)^t D_0}{(1+r_t)^t}$$

where g_t and r_t are the periodic dividend growth rate and the discount rate between period 0 and period *t*. With a constant discount rate and growth rate, the equation above becomes a geometric series and be expressed more simply ("the Gordon growth model"):

$$P_0 = \frac{D_1}{r-g}$$

This approach can be applied to housing by replacing the dividend *D* with the value of the housing service that accrues to the owner, an imputed rent *R*, that grows at the rate *g*. The discount rate *r* still refers to the cost of capital, but in a wider sense, since homeownership also entails expenditures for utilities and maintenance as well as taxes.[27] Hence, we augment the expression above to incorporate the net-of-tax financing cost $r(1-\tau)$, a risk premium γ, and other capital costs in the form of expenditures on utilities and maintenance m and property tax θ. With this notation (which is the same as in Englund, 2016), the equilibrium price at time 0 can be written as

$$P_0 = \frac{R_1}{r(1-\tau)+\gamma+\theta+m-g}$$

User-cost calculations with a time-varying interest rate

The equation above only contains one interest rate. However, as mentioned before, this is the result of a simplifying assumption that the interest rate (like the other parameters) is constant over time. But sometimes one is interested in studying interest-rate changes over a particular time horizon. To separate the effects of higher interest rates in the short and long run, one must account for this in the calculations. Changing the interest rate in the equation above implies a parallel shift of the yield curve, such that the short and long end increase by the same amount. In this case, it is suitable to go back a step and instead write the price as a sum of discounted future returns using a time-varying interest rate. An alternative approach is to rely on the equation above

[27] Utilities, maintenance and taxes are assumed to be proportional to the market value of the home.

and make the change in the (constant) interest rate that is assumed to be "equivalent" to the new path for the interest rate. That is an easy way out, but sensitive to the choice of interest rate that is assumed to be equivalent.

We are mainly interested in allowing the interest rate to vary over a short time horizon. One way of dealing with this is to allow the interest rate initially to take on different values, but be constant in the long run. In the simplest case, the interest rate takes on one value in the first period and another value in the second period and beyond. The price in the second period can then be written as

$$P_2 = \frac{R_3}{r(1-\tau)+\gamma+\theta+m-g}$$

which is the same equation as above but applied only to the second period and beyond, and hence needs to be discounted to get the present value at time 0. The value of the house can then be expressed as the sum of a discounted present value with regard to the short run (period 1, the first term on the right hand side) and a discounted present value with regard to the longer run (period 2 and beyond, the second term on the right hand side):

$$P_0 = E\left[\frac{R_1}{(1+\propto_1)}+\frac{R_2+P_2}{(1+\propto_1)(1+\propto_2)}\right] = E\left[\frac{R_1}{(1+\propto_1)}+\frac{R_2+\left(\frac{R_3}{\propto-g}\right)}{(1+\propto_1)(1+\propto_2)}\right]$$

where $\propto = r(1-\tau)+\gamma+m+\theta$, $\propto_1 = (r_1(1-\tau_1)+\gamma_1+m_1+\theta_1)$, $\propto_2 = (r_2(1-\tau_2)+\gamma_2+m_2+\theta_2)$, r_1 is the interest rate during period 1 och r_2 is the interest rate during period 2 (and in the same manner for utilities and maintenance as well as taxes). The expression above can be extended to a longer horizon as desired. In our calculations, we allow the interest rate to take on different values during the first five years, beyond that point it is constant.

Other assumptions

The recurring property tax in our calculations amounts to 0.5 percent of the market value of the home. In reality, this tax is collected in different ways and at different points in time, through a recurring local property tax, stamp duty at the time of purchase and income tax on capital gains when the property is sold. The parameter in our calculations should be viewed as the recurring tax that would be equivalent to the sum of these taxes.[28] Utilities and maintenance amount to 2.5 percent. The purchase of the home is financed by a combination of debt (7/10) and equity (3/10). The weights are broadly in line with the average among new mortgage borrowers in recent years.[29] The opportunity cost of equity is, for simplicity, assumed to be the same as the mortgage interest. The tax rate is set to 20 percent for equity and the mortgage

[28] See Englund (2016).

[29] See Finansinspektionen (2022).

deduction is set to 30 percent, making equity a slightly more expensive source of financing compared to debt, net of taxes. The reason why the tax rate is set to 20 percent for equity is that a large part of household savings in Sweden is in practice taxed at rates below the statutory tax rate of 30 percent for capital income.[30] The risk premium is set to 2 percent, in line with previous studies.

[30] See Almenberg and Andersson (2020).

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