# Households' mortgage-rate expectations – more realistic than at first glance?

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Household expectations of future mortgage rates elicited over the last few years might appear unrealistically low. However, taking explicit account of the high persistence in interest rates, we find that Swedish households' implied long-term expectation of mortgage rates is around 4.7 per cent. This number lines up well with the long-term expectation that can be deduced from the Riksbank's assessment of the repo rate in the long run and the typical spread between the mortgage rate and the repo rate. Our analysis makes use of household mortgage-rate expectations at three different horizons, which enables an explicit modelling of the 'term-structure' of household forecasts.

## 1 Introduction

Expectations of future mortgage rates are arguably an important factor for many households when they decide how much they are willing to pay for owner-occupied housing. Whether (irrationally) low household expectations of future mortgage rates might contribute to general housing price increases is an open question, but many policy makers clearly see it as a real concern in this era of unprecedentedly low interest rates. In Sweden, for instance, housing prices rose by more than 50 per cent between 2010 and 2016, from a level that was already considered 'high' and which was barely dented by the financial crisis.[1] Sveriges Riksbank (2013b, p.9) suggested that 'Low mortgage rate-expectations could lead to a stronger upward trend in both housing prices and debts'. As a large share of mortgages in Sweden – typically well in excess of 50 per cent during the period 2010 to 2016 – have fully adjustable rates, subject to change every three months, the household exposure to interest rate changes is large by international standards,[2] and currently low rates might have an undue effect on house prices if households have unrealistic expectations of continuing low rates.

From a historical perspective, recent Swedish mortgage rates have been extremely low, which may have affected households' long-term mortgage-rate expectations. However, there has been little analysis conducted to establish the validity of the claim that households' long-term mortgage-rate expectations may be unrealistically low.[3] In this paper, we conduct an empirical analysis of household mortgage-rate expectations from the *Economic Tendency Survey* of the National Institute of Economic Research (NIER). This monthly survey – which is generally considered to be Sweden's most important source of data concerning household

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1 See, for example, Sveriges Riksbank (2009, p.56): 'There are signs that house prices are currently slightly above the level that can be considered sustainable in the long term'.

2 The remaining fraction of mortgages have rates that are fixed for horizons between one and ten years. At the end of a fixed-rate period (for example, after five years), a new rate is determined subject to the then prevailing interest-rate levels. Thus, virtually all mortgage takers will be subject to a significant interest-rate exposure at some future date, unless they pay off their debt extremely quickly.

3 The study by Österholm (2017) is a recent exception.

expectations – provides us with monthly observations on average household mortgage-rate expectations from February 2010 until March 2017.

Specifically, for each month, we observe a forecast of the (adjustable) three-month mortgage rate for one, two, and five years into the future. We make explicit use of this 'term-structure' of forecasts to recover the implied long-term mortgage-rate expectation of households. Under an assumption that mortgage rates follow a first order autoregressive (*AR*(1)) process, the elicited survey expectations can be modelled as conditional forecasts obtained from such a process. This enables us to recover estimates of both the long-term (or unconditional) mortgage-rate expectation of Swedish households and the speed with which this long-term forecast should be reached. Our study accordingly contributes to the ongoing debate regarding the potential risks of inflated housing prices as a result of historically low interest rates in many countries.[4] In addition, we contribute to the general literature on expectations and price-formation in housing markets; see, for instance, Case and Shiller (2003); Case, Shiller and Thompson (2012); Lambertini, Mendicino and Punzi (2013); and Gelain and Lansing (2014).

# 2 Data

The NIER's *Economic Tendency Survey* is a large monthly survey in which Swedish households and businesses are asked questions regarding both their own economic situation as well as the overall Swedish economy. In this paper, we use data from the part of the survey that concerns households.[5] In February 2010, three questions regarding the future value of the (adjustable) three-month mortgage rate – which in Sweden is also commonly denoted the 'variable' mortgage rate – were added to the survey. The specific questions that the households are asked are as follows.

**Question 18. Today the variable home loan rate is *x* %. State how high you expect the variable home loan rate to be in:**

(a) 1 year's time

(b) 2 years' time

(c) 5 years' time

The individual survey responses are aggregated by the NIER to create time series of average household responses for each question.[6] These time series thus represent the average household forecasts of the three-month mortgage rate for one year, two years and five years into the future.[7] These forecasts are lined up with the current three-month mortgage rate at the time of each survey – the reference rate – which is stated to the respondents as the questions are read out to them. We use the full available time series, from February 2010 to March 2017, on each of these three questions as well as the reference rate. Data are plotted in Figure 1.

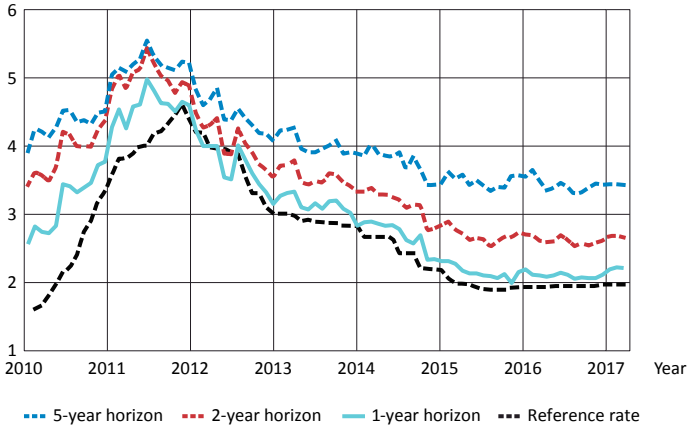
4 See, for example, Sveriges Riksbank (2011), Dermani, Lindé and Walentin (2016), European Commission (2016) and International Monetary Fund [IMF] (2016) for a discussion concerning Sweden.

5 See www.konj.se/english/publications/economic-tendency-survey.html for details.

6 On average, in each survey round, approximately 75, 65, and 55 per cent of the 1500 respondents answer the questions concerning the future mortgage rate at the one-year, two-year, and five-year horizons, respectively.

7 The NIER has a pre-determined formula for classifying outliers in the individual responses and removes such outliers prior to calculating average responses.

**Figure 1. Mortgage-rate expectations and reference rate**
Per cent




Note. Dates correspond to when the expectations were collected and the reference rate stated to the respondents.
Source: National Institute of Economic Research

# 3 Empirical analysis

The econometric analysis is based on the assumption that households view the mortgage rate as an $AR(1)$ process,

$$(1) \qquad i_t-\mu=\rho(i_{t-1}-\mu)+e_t,$$

where $i_t$ is the three-month mortgage rate, $\mu$ is its unconditional mean, and $e_t$ is a disturbance term that is independently distributed (*iid*) across time. Assuming a mean reverting mortgage rate ($-1<\rho<1$), $\mu$ thus represents the long-term forecast, or unconditional expectation, of mortgage rates. The parameter $\rho$ determines the degree of persistence in the process or, put differently, determines how quickly the process reverts to the long-term mean $\mu$. The closer $\rho$ is to zero, the quicker the mean reversion.

The $AR(1)$ model assumption is clearly an approximation to the households' perception of the mortgage rate. Though extremely simple in its formulation, the $AR(1)$ model is generally viewed as a good approximation of the time-series properties of many economic variables, and forecasts from this model are easily understood in intuitive terms. Specifically, as shown in detail below, an $AR(1)$ forecast is easily seen to equal a weighted average between today's value and the long-run mean of the process, where the weight on today's value declines with the forecasting horizon. The $AR(1)$ model is frequently used in empirical macroeconomic work related to forecasting, providing a simple benchmark model that performs well in many settings; see, for example, Pesaran, Smith and Schuermann (2009).[8] Our model choice is also in line with, for instance, Orphanides and Williams' (2004) model for monetary policy analysis, in which the private sector uses an $AR(1)$ model in order to form inflation expectations.

Forecasts from the model are conveniently generated due to its simple, recursive structure. Standing at time $t$, households form conditional expectations $h$ years ahead, which we denote $i^e_{t+h}$. Since the best forecast of all future disturbances ($e_{t+h}$, where $h>0$) is zero, the one-step-ahead forecast is given as

$$i^e_{t+1}=\mu+\rho(i_t-\mu),$$

8 It can also be noted that an $AR(1)$ model performed well relative to judgemental forecasts when survey expectations of Swedish inflation were evaluated by Jonsson and Österholm (2012).

where $i_t$ is the current rate at time $t$ (that is, the reference rate stated to the respondents at each round of the survey). Rearranging, the one-step-ahead forecast can equivalently be expressed as

$$i^e_{t+1}=\mu(1-\rho)+\rho i_t,$$

which is now easily seen to equal a weighted average between today's value ($i_t$) and the unconditional, or long-run, mean ($\mu$). In the one-step-ahead forecast, the weight on today's value is given by $\rho$, such that a greater $\rho$ gives more weight to current conditions and less weight to the long-run mean. The two-step-ahead forecast is given recursively as

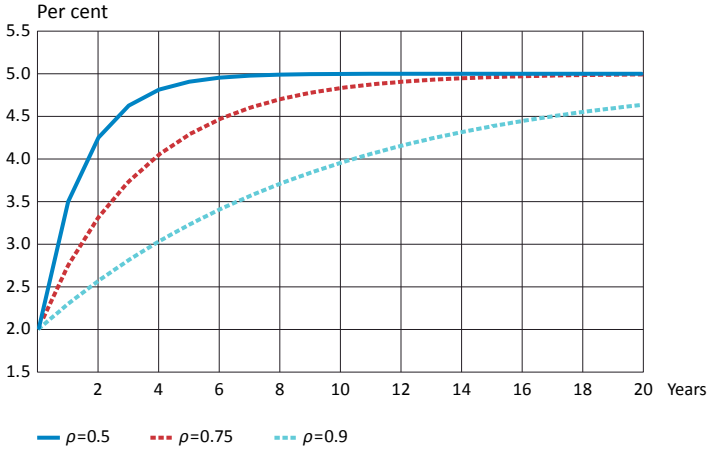
$$i^e_{t+2}=\mu(1-\rho)+\rho i^e_{t+1}=\mu(1-\rho)+\rho[\mu(1-\rho)+\rho i_t]=\mu(1-\rho^2)+\rho^2 i_t,$$

and, in a similar manner, the $h$-step-ahead forecast is given as

$$i^e_{t+h}=\mu(1-\rho^h)+\rho^h i_t. \quad (2)$$

In order to illustrate the properties of this model, Figure 2 plots the forecasts for three different $AR(1)$ models, all with an unconditional mean ($\mu$) equal to 5 per cent, but with the autoregressive parameter $\rho$ taking on values of 0.5, 0.75, and 0.9, respectively. Today's value is set equal to two per cent. With $\rho=0.5$, it then takes six years to reach the unconditional mean (measuring at the first decimal place). Increasing $\rho$ to 0.75 it instead takes 15 years, and finally setting $\rho=0.9$, the unconditional mean has not been reached in the 20 years that we show in the graph. After 20 years, the value is in fact only 4.6 in this case.[9]

**Figure 2. Illustration of forecasts for processes with different persistence**




Note. The persistence (0.5, 0.75 and 0.9) is the autoregressive parameter, $\rho$, of the $AR(1)$ model in Equation (1). The forecasts at different horizons are generated according to Equation (2).
Source: Authors' calculations

9 It takes 39 years to reach the unconditional mean in this case (measuring at the first decimal place). As seen from the general forecast formula in Equation (2), the forecast of any $AR(1)$ model, with $\rho\neq0$, never fully reaches the unconditional mean, since some weight is always placed on today's value. However, from a practical perspective, the forecast eventually gets close enough to the unconditional mean that the two are essentially indistinguishable.

Based on the model specification in Equation (1), we formulate the following three moment conditions, corresponding to the three different forecast horizons in the survey:

$$E[i^e_{t+1} - \mu(1-\rho) - \rho i_t] = 0$$

$$E[i^e_{t+2} - \mu(1-\rho^2) - \rho^2 i_t] = 0$$

$$E[i^e_{t+5} - \mu(1-\rho^5) - \rho^5 i_t] = 0.$$

The model parameters $\mu$ and $\rho$ are estimated through the Generalized Method of Moments (GMM) procedure, using the full set of 86 monthly observations.[10] Results are given in Table 1. As can be seen, the long-term expectation of the mortgage rate is approximately 4.7 per cent. Is this a reasonable value to which the households let their forecasts converge? One way to assess this question is to relate the estimated unconditional expectation to the average of the actual mortgage rate over a longer period. Calculating the average over the period February 1997 to March 2017 – a period chosen due to a combination of data availability and the fact that Sveriges Riksbank's inflation target had been made credible by 1997 – we find that it is 3.8 per cent.[11,12] From this perspective, the estimated unconditional mean is actually on the high side. However, during the last two decades, inflation in Sweden – and in many other countries – has been lower than expected and on average below the target. This is to some extent explained by the fact that resource utilisation on average has been lower than neutral, which is not surprising given that the recent global financial crisis is included in the sample. This low inflation helps explain why the Swedish repo rate during this period in general was kept below what can be considered a steady-state value.[13] A long-run repo rate has been suggested by Sveriges Riksbank (2017) to be in the range of 2.5 to 4 per cent. The spread between the three-month mortgage rate and the repo rate might be approximately 1.5 percentage points, as it typically has varied between 1 and 2 percentage points; see, for example, Sveriges Riksbank (2012) and Turk (2016). Taken together, a reasonable range for the three-month mortgage rate could accordingly be 4 to 5.5 per cent.[14] From this perspective, the estimated unconditional mean seems very reasonable.

**Table 1. Estimation results**

| Parameter | Point estimate | Standard error |
|---|---|---|
| $\mu$ | 4.74 | 0.13 |
| $\rho$ | 0.80 | 0.03 |

Note. The sample is February 2010 to March 2017. $\mu$ is expressed in per cent. $\rho$ is the persistence at an annual basis.

Turning to the estimated autoregressive parameter, $\rho$, Table 1 shows that it is equal to 0.8 (on an annual basis). This value indicates a fairly slow speed of mean reversion – a finding well in line with the empirical literature on nominal interest rates, which typically finds that they are highly persistent; see, for example, Lanne (2000) and Beechey, Hjalmarsson and

10 The first- and second-stage GMM estimates are very similar. Here we simply report the first-stage results, which have the appealing property of giving equal weight to each of the three forecast horizons. The parameter values are obtained through a grid-search, allowing for values of $\rho$ between 0 and 0.999 and values of $\mu$ between 0 and 15.

11 This value was calculated by taking the mean over the adjustable three-month mortgage rates of three of Sweden's largest actors in the mortgage market, namely Nordea, SBAB and Swedbank.

12 In January 1993, it was declared that inflation targeting was the new monetary-policy regime in Sweden. However, due to a lack of credibility for Swedish monetary policy, interest rates in Sweden were fairly high for the first few years after the introduction. The assessment that the Swedish inflation-targeting regime had been thoroughly established by 1997 is shared by, for example, Svensson (2015).

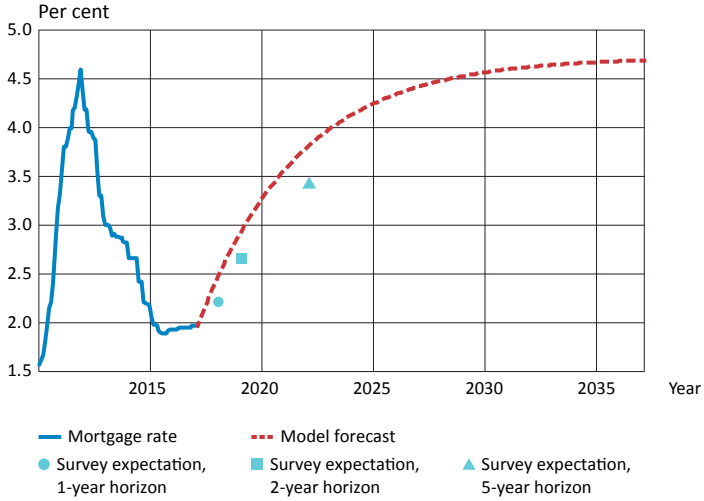
13 For a further discussion of why inflation in Sweden has been low in recent years, see Andersson, Corbo and Löf (2015) and the references therein.

14 It can be noted that until quite recently, the Riksbank assumed that a long-run value for the mortgage rate should be in the interval 5.2 to 6.5 per cent. This was also based on a combination of long-run values for the repo rate and the mortgage spread; see, for example, Sveriges Riksbank (2013a).

Österholm (2009). To get a clearer understanding of the implications of this value for $\rho$, it is instructive to calculate the implied model forecasts for various horizons, starting at the last observed reference rate in our sample, which is equal to about 2 per cent for March 2017. The five-year ahead conditional forecast – based on the *AR*(1) forecasting function and the estimated parameter values – is equal to 3.8 per cent; the ten-year ahead forecast is 4.4 per cent, the fifteen-year ahead forecast is 4.6 per cent and the twenty-year ahead forecast is 4.7 per cent. Thus, under this level of persistence ($\rho$=0.8), it takes about ten to fifteen years before the conditional forecast gets close to the unconditional mean of the process.

Figure 3 graphically illustrates these findings, showing the model-implied forecast over the next 20 years, until March 2037. In the figure, the forecasts of the model are also compared to the survey expectations from the *Economic Tendency Survey* of March 2017, in order to give an illustration of the fit of the model. As is seen, the forecasts from the model at the end of the sample are somewhat higher than the corresponding survey expectations. This result could possibly signal a decrease in the perceived unconditional mean, which might have occurred if households' expectations are eventually affected by the fact that the mortgage rate has been low for a long time. However, some deviations between the model and the actual elicited survey expectations should clearly be expected, and one should certainly be cautious not to over-interpret the fact that the fit of the model is not perfect for a given sample point.

**Figure 3. Forecasts from the estimated model, standing at March 2017**




Note. The survey expectations are from the Economic Tendency Survey of March 2017.
Sources: National Institute of Economic Research and authors' calculations

Overall, we believe that our results indicate that the households' expectations concerning the future mortgage rate appear reasonable. That said, some caveats with our analysis should be noted. In particular, by using aggregated data – that is, average responses across survey respondents – we ignore the inherent dispersion in the forecasts. Since our results suggest that on average households have sensible expectations about future mortgage rates, there must be households who have expectations that are too low. For the individual household, such biases might lead to unfortunate decisions in terms of taking on too much debt or relying overly much on adjustable rate loans that offer less protection against adverse future interest rate movements. The extent of these concerns depends on which parts of the population form forecasts that are too low.

For instance, suppose expectations of future mortgage rates are systematically lower for people who have recently bought a house or an apartment, than for people who rent or have owned their homes for a long time. The former group would generally have new

and relatively large mortgages, whereas the latter group would likely have smaller or no mortgages. In such a case, the average mortgage-rate expectations might look reasonable, but for the group for whom these expectations really matter (the recent home buyers) the expectations might be too low. Such a bias could occur if the group of recent home buyers decided to buy because they have, at least from their perspective, a relatively more optimistic view of the future in the sense of continuing low mortgage rates (and perhaps more rapidly increasing house prices). Alternatively, it could also be the case that less educated and poorer households are less capable of forming realistic forecasts for future mortgage rates. Such concerns are well supported by research on household finance and financial literacy; see, for instance, Campbell (2006). If these households systematically put too much weight on today's low rates in their forecasts, this would clearly be worrying since these households are likely the ones that would be most exposed if rates increase faster and/or more than they expect.

However, while these types of caveats should certainly be kept in mind, it should be stressed that sensible average expectations among households must still be viewed as encouraging, and as positive a result as one could hope for in any study using aggregate data.

# 4 Conclusion

In this paper, we have introduced a novel approach to using survey data to estimate the long-term, or unconditional, expectation of the mortgage rate. The results suggest that Swedish households seem to have realistic expectations of the future mortgage rate. Specifically, the implied long-term expectation appears well in line with reasonable values of the long-run repo rate and the mortgage spread.

Our analysis also points to an important principle: While five years might seem like a long forecasting horizon, one should not necessarily interpret five-year forecasts as proxying for truly long-term (or unconditional) expectations. This is particularly true when data – as in the case of interest rates – are highly persistent.

# References

Andersson, Björn, Vesna Corbo and Mårten Löf (2015), 'Why has inflation been so low?', *Sveriges Riksbank Economic Review*, No. 3, pp. 5–47.

Beechey, Meredith, Erik Hjalmarsson and Pär Österholm (2009), 'Testing the expectations hypothesis when interest rates are near integrated', *Journal of Banking & Finance*, Vol. 33, No. 5, pp. 934–943.

Campbell, John Y. (2006), 'Household finance', *The Journal of Finance*, Vol. 61, No. 4, pp. 1553–1604.

Case, Karl E. and Robert J. Shiller (2003), 'Is there a bubble in the housing market?', *Brookings Papers on Economic Activity*, Vol. 34, No. 2, pp. 299–342.

Case, Karl E., Robert J. Shiller and Anne Thompson (2012), 'What have they been thinking? Homebuyer behavior in hot and cold markets', *Brookings Papers on Economic Activity*, Vol. 43, No. 2, pp. 265–298.

Dermani, Emilio, Jesper Lindé and Karl Walentin (2016), 'Is there an evident housing bubble in Sweden?', *Sveriges Riksbank Economic Review*, No. 2, pp. 7–55.

European Commission (2016), 'Country Report Sweden 2016', Commission staff working document SWD(2016)95, European Commission.

Gelain, Paolo and Kevin J. Lansing (2014), 'House prices, expectations, and time-varying fundamentals', *Journal of Empirical Finance*, Vol. 29 pp. 3–25.

IMF (2016), 'Sweden: 2016 article IV consultation', International Monetary Fund.

Jonsson, Thomas and Pär Österholm (2012), 'The properties of survey-based inflation expectations in Sweden', *Empirical Economics*, Vol. 42, No. 1, pp. 79–94.

Lambertini, Luisa, Caterina Mendicino and Maria T. Punzi (2013), 'Expectation-driven cycles in the housing market: evidence from survey data', *Journal of Financial Stability*, Vol. 9, No. 4, pp. 518–529.

Lanne, Markku (2000), 'Near unit roots, cointegration, and the term structure of interest rates', *Journal of Applied Econometrics*, Vol. 15, No. 5, pp. 513–529.

Orphanides, Athanasios and John Williams (2004), 'Imperfect knowledge, inflation expectations, and monetary policy', in *The Inflation-Targeting Debate*, ed. by Bernanke, Ben S. and Michael Woodford, University of Chicago Press: Chicago.

Österholm, Pär (2017), 'Är hushållens förväntningar rörande bolåneräntan realistiska? [Are households' expectations concerning the mortgage rate realistic?]', *Ekonomisk Debatt [Journal of the Swedish Economic Association]*, Vol. 45, No. 5, pp. 22–32.

Pesaran, Hashem M., Vanessa L. Smith and Til Schuermann (2009), 'Forecasting economic and financial variables with global VARs', *International Journal of Forecasting*, Vol. 25, No. 4, pp. 642–675.

Svensson, Lars E. O. (2015), 'The possible unemployment cost of average inflation below a credible target', *American Economic Journal: Macroeconomics*, Vol. 7, No. 1, pp. 258–296.

Sveriges Riksbank (2009), Monetary Policy Report, October, Sveriges Riksbank.

Sveriges Riksbank (2011), 'The Riksbank's inquiry into the risks in the Swedish housing market', Sveriges Riksbank.

Sveriges Riksbank (2012), Monetary Policy Report, February, Sveriges Riksbank.

Sveriges Riksbank (2013a), Monetary Policy Report, July, Sveriges Riksbank.

Sveriges Riksbank (2013b), Monetary Policy Report, December, Sveriges Riksbank.

Sveriges Riksbank (2017), Monetary Policy Report, February, Sveriges Riksbank.

Turk, Rima A. (2016), 'Negative interest rates: how big a challenge for large Danish and Swedish banks?', Working Paper No. 198, International Monetary Fund.