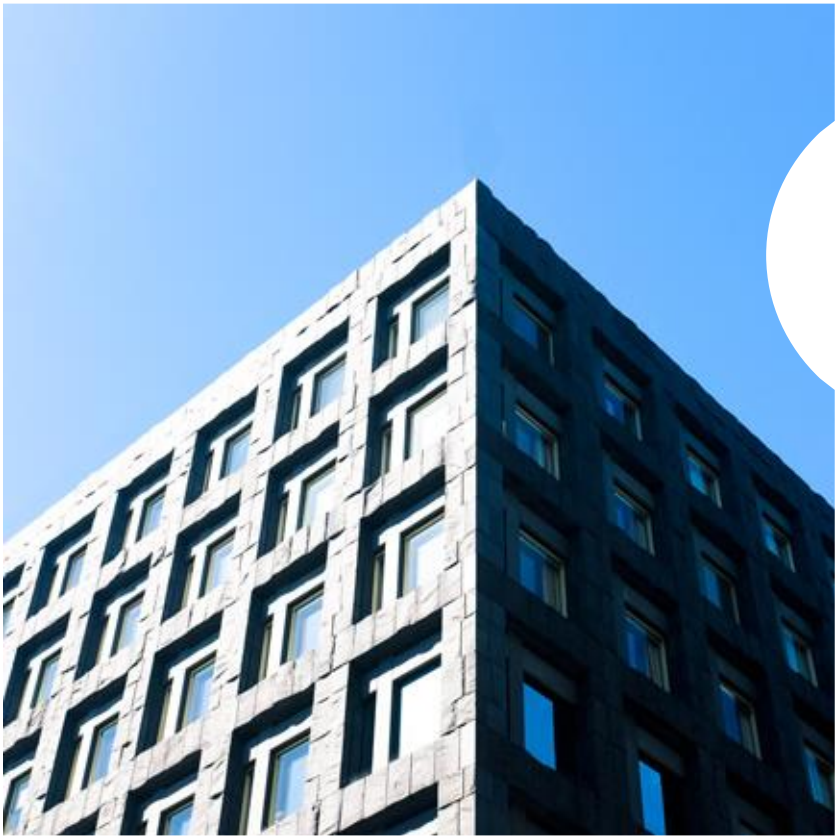

Economic Commentary

How has the impact of the policy rate on consumption changed when the debt-to-income ratio has risen?

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Summary

Household debt has increased faster than income over a long period of time, while the proportion of loans with a short interest-rate fixation period is high. This means, among other things, that households' borrowing costs are more affected than previously by a particular change in interest rates. The Riksbank has previously concluded that the effects of monetary policy on household consumption are therefore greater than before. In this Economic Commentary[1], we use an econometric model to estimate the impact on household consumption when the policy rate changes. We find that it has increased over time as household debt has risen. According to our estimates, the impact may have roughly doubled over the last 15 years as the debt-to-income ratio has increased from 150 to 200 per cent. A compilation of other research studies for Sweden supports the view that there is a relationship between the effects of monetary policy on consumption and the level of the debt-to-income ratio among households.

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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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Introduction

House prices have risen and household debt has increased faster than income over a long period of time, while the proportion of loans with a short interest-rate fixation period is high. This means that monetary policy will have a greater effect on the cash flow of households than before and can thus also have a greater impact on their consumption.[3] In order to assess the appropriate size of rate increases now that inflation has risen and is high, it is important to gain an understanding of how much the sensitivity of consumption to interest rates has changed with the higher indebtedness.[4] In this Commentary, we find that the effect on consumption when the Riksbank changes the policy rate has roughly doubled over the past 15 years as the debt-to-income ratio, i.e. the ratio of household debt to annual disposable income, has increased from around 150 per cent to around 200 per cent today. If the policy rate is raised by one percentage point, consumption will decrease by more than one per cent, or by approximately SEK 30 billion in current prices.

An important reason for the rising debt-to-income ratio is that interest rates have also been on a downward trend for a long time, mainly due to a downward trend in international real rates.[5] Lower interest rates are also usually followed by shorter interest-rate fixation periods on mortgages.[6] Although debt has risen, lower interest rates have also meant that the interest-to-income ratio, i.e. household interest expenditure as a share of income, has fallen. But expectations that rates will rise rapidly again now mean that the interest-to-income ratio is expected to rise steeply in the period ahead.

An important explanation for the increased sensitivity of consumption to interest rates is usually referred to as *the cash flow channel*.[7] When the Riksbank raises the policy rate, households' interest income and interest expenditure increase and thereby affect their disposable income. If it is difficult for indebted households to reduce their savings or obtain new loans, this means that they instead need to reduce their consumption when interest expenditure rises. And if households with interest-bearing assets choose to use their increased interest income for consumption to a lesser extent, consumption will decrease overall. A higher level of debt means that these effects of a change in interest rates on households' cash flows, and thus also consumption, will be greater. Another channel whose importance may have increased over time is the *collateral channel.*[8] A higher interest rate has a negative impact on housing prices, limiting households' ability to borrow with the home as collateral, which in turn can have a negative impact on their consumption.

[3] See Sveriges Riksbank (2017b).

[4] Interest-rate sensitivity describes how much consumption is affected by a certain change in the policy rate.

[5] See, for example, The Riksbank (2017a, 2021).

[6] The correlation between the Riksbank's policy rate and the average fixation period for loans with the home as collateral 2-3 years ahead is 0.7-0.8. Thus, lower interest rates tend to be followed by shorter fixation periods, and conversely, higher rates tend to be followed by longer fixation periods. See also Finansinspektionen (2017).

[7] See Hughson et al. (2016), Gustafsson et al. (2017), The Riksbank (2017b) and Flodén et al. (2021).

[8] See, for example, Finocchiaro et al. (2016) and Walentin (2014).

Studies using microdata for households have shown that indebted households reduce their consumption more when the interest rate rises and that the importance of the cash flow channel has increased over time when debt has increased.[9] In this commentary, we instead use a structural vector autoregressive (SVAR) model and macroeconomic data to examine how the effects of monetary policy on consumption have changed over time. By calculating the effect over different periods of time when the size of the debt-to-income ratio has differed, we can illustrate how the interest-rate sensitivity of consumption has changed when indebtedness has increased. With this approach, we can capture how the overall effects of policy-rate adjustments on consumption have changed over time, but we cannot quantify the importance of the different channels for this change.[10]

The relationship between the sensitivity of consumption to interest rates and the debt-to-income ratio

A common way of estimating the effects of monetary policy on macroeconomic variables is to use a structural vector autoregressive (SVAR) model. This method allows us to estimate how an unexpected and exogenous increase in the policy rate, a monetary policy shock, affects the other variables in the model.[11] We estimate the model for different sub-periods between 1996Q1 and 2019Q4. By doing so, we can examine how the effect of the Riksbank's changes in the policy rate on consumption has changed over time as the debt-to-income ratio has increased.[12] Figure 1 below illustrates the relationship between the effect on consumption of an interest-rate change of one percentage point (y-axis) and the average debt-to-income ratio during the period in which the model is estimated (x-axis). The black circles in the diagram show the different estimates and the line is there to illustrate the relationship more clearly.[13] We can see that the effect of interest rate changes on consumption is

[9] See Cloyne et al. (2020), Flodén et al. (2021) and Gerdrup and Torstensen (2018).

[10] A similar analysis has previously been conducted by Di Casola and Iversen (2019). Calza et al. (2013) also estimate a structural VAR model for a large number of countries and relate the effects of monetary policy on consumption, housing investment and house prices to various indicators of the level of development in the mortgage market. They find that the effects are greater in countries with a higher debt-to-income ratio, a higher loan-to-value ratio, a higher proportion of variable-rate loans and greater opportunities to borrow with the home as collateral.

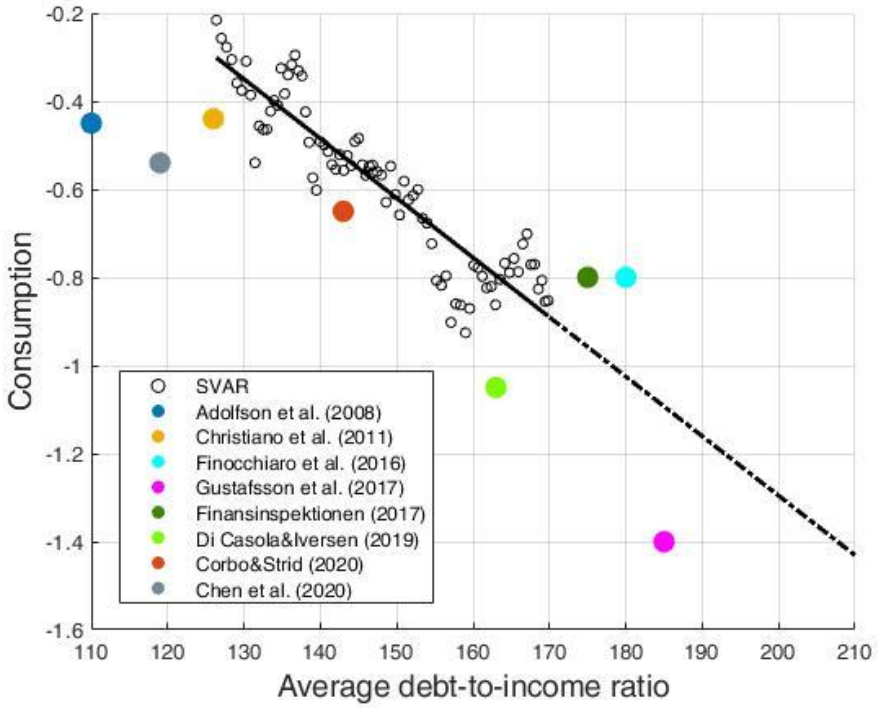
[11] See Appendix for more information on the model and data. The Riksbank's policy rate is mainly driven by resource utilisation and inflation (systematic, or endogenous, monetary policy). However, it is common to estimate the effects of monetary policy on the basis of unexpected changes in interest rates, that is, those that deviate from the normal pattern (exogenous monetary policy, or monetary policy shocks).

[12] A limitation here is that we focus entirely on the effects of monetary policy on consumption. An interesting question is, of course, whether the interest-rate sensitivity for other variables, such as inflation, has also increased, but we do not discuss this issue further here.

[13] We estimate a probability distribution for the consumption effect over time to an unexpected rate increase and report the maximum effect on consumption, that is, the largest value (in absolute terms) for the median response. In the Appendix, the uncertainty in our reported estimates is briefly discussed. The maximum effect will typically come about 1– 2 years after the rate increase. It is common to assume that interest-rate changes do not have permanent effects on consumption (so-called neutrality) and this is also roughly true in our estimates.

greater for periods when the debt-to-income ratio is higher.[14] Although this illustration does not in itself show that the larger consumption effect *is caused* by higher indebtedness, there are strong reasons to believe that it is an important explanation. We discuss this in the introduction, where more information can also be found among the references.

Figure 1. Impact on consumption (in per cent) of an unexpected one percentage point policy-rate increase for different levels of the debt-to-income ratio



Note. The Y-axis shows the maximum (peak) effect on consumption after a one percentage point increase in the policy rate. The X-axis shows the average debt-to-income ratio (household debt as a percentage of disposable income) for each estimation period. The model is estimated for 81 sub-periods between 1996Q1 and 2019Q4. The larger, coloured dots show estimates based on Swedish data in various research articles.

We also compare our estimated consumption effects with the findings in some research articles which have estimated the effect of interest rate changes on consumption in Sweden using data from different time periods. They appear as larger, coloured dots in Figure 1 above. As these estimates have been made in different ways and are uncertain, it is natural that there is a dispersion in the estimated effects. But we can nevertheless see that the overall picture from the studies is that the estimated effects of interest-rate changes on consumption are related to the level of the debt-to-income ratio.

[14] As the debt-to-income ratio has shown a rising trend over time, the average debt-to-income ratio is higher for later periods. The lowest average debt-to-income ratio, 126 per cent, is obtained for the sample period 1996Q1-2009Q4. The highest average debt-to-income ratio, 170 per cent, is obtained for the sample period 2006Q1-2019Q4. For the whole period 1996Q1-2019Q4, the average debt-to-income ratio is 147 per cent.

In the Riksbank's macroeconomic model MAJA, the maximum effect on consumption when the policy rate is unexpectedly raised by one percentage point is equal to −0.65 per cent (see the red dot in Figure 1). This effect is larger than in the Riksbank's previous models of the same type, Ramses 1 and 2, which were estimated for periods when the debt-to-income ratio was lower on average. You can see them illustrated by the dark blue and yellow dot in Figure 1.[15] These estimates are also well in line with our SVAR estimates.

Finocchiaro et al. (2016) estimate the effects of monetary policy on consumption using a macroeconomic model in which a proportion of households need to take on debt to be able to buy a home. The debt-to-income ratio is calibrated to 180 per cent and the maximum effect on consumption when the interest rate is raised by one percentage point is -0.8 per cent. We can see this result in the light blue dot in Figure 1. We can also see that it is roughly in line with the line in Figure 1.[16] Di Casola and Iversen (2019) and Chen et al. (2020) use similar models to examine the impact of indebtedness on the effects of monetary policy and their estimates are illustrated by the light green and the grey dot in Figure 1.[17]

Gustafsson et al. (2017) show that the direct effect of a one-percentage-point higher interest rate on disposable income, i.e. the effect of higher interest income and interest expenditure, is about -1.0 per cent but with much larger effects for highly indebted households.[18] In order to calculate the maximum cash flow effect on consumption, they assume that households will save all their increased interest income, while the increased interest expenditure means that they reduce their consumption to the corresponding extent. The consumption effect is then −1.4 percent and is illustrated by the pink dot in Figure 1. We can see that this is a greater effect than the line in the graph would indicate.[19] Finansinspektionen (2017) makes a similar calculation

[15] MAJA (Corbo and Strid 2020), Ramses 1 (Adolfson et al. (2008) and Ramses 2 (Christiano et al. 2011) are general equilibrium models without explicit modelling of the housing sector and household debt. For these models, the average debt-to-income ratio over the period in which each model is estimated is used.

[16] They also calculate the effects on consumption when the debt-to-income ratio is assumed to be 90 and 210 per cent, and find that these effects are -0.4 per cent and -1.8 per cent respectively. The values for the debt ratio are chosen to correspond to the situation in the mid-1990s (90 per cent), in 2016 when the article was written (180 per cent) and in 2026 where the value 210 per cent is a projection 10 years ahead made in 2016 based on the historical evolution of the debt-to-income ratio. Thus, in this model, the relationship between the consumption effect and the debt-to-income ratio is non-linear.

[17] Finocchiaro et al. (2016), Di Casola and Iversen (2019) and Chen et al. (2020) use general equilibrium models with a housing sector and indebted households. For these models, the calibrated steady-state debt-to-income ratio is specified and calculated as in Finocchiaro et al. (2016).

[18] The Riksbank (2018) makes an updated calculation in which the effect on disposable income is slightly lower, -0.9 per cent.

[19] Gerdrup and Torstensen (2018) estimate how the effects of monetary policy on consumption via the cash flow channel have changed in Norway between 2004 and 2015, when the debt-to-income ratio rose from around 150 to 210 per cent. According to their calculations, which use microdata for all Norwegian households, the effect on consumption of an unexpected one percentage point rate increase rose by 0.10– 0.15 percentage points over this period. This change in the consumption effect is much smaller than the one we present in Figure 1.

where consumption is assumed to decrease by the same amount as interest expenditure increases. We see this result in the dark green dot.[20]

The debt-to-income ratio has increased over time, and currently it is around 200 per cent. It is higher than the average debt-to-income ratio in our samples, which varies between 126 and 170 per cent. Based on the relationship in the figure, the effect of a one percent higher interest rate on consumption would now be -1.3 per cent, which is about double the effect when the debt-to-income ratio was around 150 per cent about 15 years ago. Household consumption in the past year has amounted to around SEK 2,500 billion. The effect of a rate increase on real consumption is then approximately SEK 30 billion, with the interest-rate sensitivity we estimate for a debt-to-income ratio of 200 per cent and expressed in current prices.[21] However, the uncertainty in our calculations is considerable, partly because the consumption effect is estimated for a debt-to-income ratio that is significantly higher than the average debt-to-income ratios in our samples.

Conclusions

Housing prices and household debt have been rising sharply in several countries, including Sweden, and for a long time. Recently, inflation has risen globally and central banks are tightening monetary policy. In order to assess the currently appropriate size of rate increases, it is important to understand how the sensitivity of consumption to interest rates has changed with the higher indebtedness. We find that when the Riksbank changes the policy rate, the effect on consumption has roughly doubled in the last 15 years as the debt-to-income ratio has increased from about 150 per cent to about 200 per cent today. This suggests that smaller policy rate increases than before are needed to have a certain tightening effect on the economy.

[20] The fact that the consumption effects are still different between Gustafsson et al. (2017) and Finansinspektionen (2017) are mainly due to the fact that they are based on different measures of household debt. The former study is based on households' total financial debt, while the latter study uses mortgages with a remaining interest-rate fixation period of up to 1 year.

[21] To put the estimated effect on consumption into perspective, the effect on households' interest expenditure when the interest rate is increased by one percentage point is about SEK 40 billion and the effect on their real debt according to our estimates, is that it decreases by roughly SEK 110 billion. Households' total financial debt is around SEK 5,400 billion at mid-year 2022. We assume that the interest rates faced by households change in the same way as the policy rate and we assume 30 per cent tax relief on interest expenditure. In our SVAR estimates, the maximum effect of a one percentage point rate increase on real debt has varied around 2 per cent over time but without a clear connection to the debt-to-income ratio.

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APPENDIX – Model and data

A common way of estimating the effects of an unexpected increase in the policy rate on macroeconomic variables is to use a structural (i.e. identified) vector autoregressive model. Our model uses four lags and quarterly data for the following ten variables: trade-weighted (KIX-weighted) measures of GDP, CPI inflation and the international policy rate, and CPIF inflation, consumption, GDP, real household debt, real housing prices, the policy rate and the real exchange rate for Sweden.[22] The units of the variables and how they have been transformed are described below. Note that consumption, GDP, debt and house prices occur in level, which in our estimates implies that monetary policy does not affect these variables in the long run. The monetary policy shock is identified recursively (Cholesky) so that the policy rate is allowed to affect the exchange rate, but no other variables, in the same quarter. It is assumed to have no impact on the international variables, which is a typical assumption for a small economy like Sweden. For all estimates used here, and for all variables, a monetary policy shock has the expected qualitative effect. Thus, a monetary policy shock that raises the policy rate will cause consumption, GDP, inflation, house prices and debt to fall and the exchange rate to strengthen.

We estimate the model using Bayesian methods for different sub-periods in the period 1996Q1 to 2019Q4.[23] We choose to exclude data for the period after 2019Q4 due to the coronavirus pandemic. We first let the end period vary from 2009Q4 to 2019Q4 (expanding period).[24] We then let the start period vary from 1996Q1 to 2006Q1 (shrinking period). In this way, we obtain estimates of the effects of monetary policy for several different sub-periods when both the average indebtedness and the interest-rate fixation period have varied. The shortest period used is therefore 14 years of data, or 56 observations.

The effects presented in Figure 1 are uncertain and the uncertainty can be described, for example, by probability intervals around the point estimates presented. Based on such probabilities, we can answer the following two questions:

- What is the probability that a rise in interest rates will have negative effects on consumption?
- What is the probability that these effects have increased over time?

Regarding the first question, we estimate that the probability is greater than 75 per cent in all our estimates, greater than 90 per cent in 75 per cent of our estimates and greater than 95 per cent in 37 per cent of our estimates. The probability is typically

[22] A similar model was used by Laséen and Strid (2013) to study the effects of monetary policy on debt. If we use one or two lags instead of four, we obtain similar results.

[23] Bayesian methods use not only information from the data but also the knowledge of the user or other sources about a population or a particular parameter. When these are combined, the estimates can in many cases be improved, especially when, as in this case, large models with relatively few observations are estimated.

[24] We are aware of the potential problems that estimating SVAR models during periods when the interest rate is close to a lower bound may involve, see e.g. Mavroeidis (2021).

higher for estimates based on later time periods when the debt-to-income ratio is higher and when the median effects on consumption are estimated to be higher.

The second question is more difficult to answer in a straightforward way because our estimates are based on overlapping time periods. Nevertheless, to provide a rough idea, we compare the two estimates for which the average debt-to-income ratio in the random sample is the lowest and the highest, 126 and 170 per cent respectively, when the median effects on consumption are estimated at -0.22 and -0.85 per cent. Using a normal distribution approximation, the probability that the consumption effect is larger in the case where the debt-to-income ratio is higher than in the case where it is lower is around 95 per cent.[25]

The variables in the model and how they have been transformed are described below:

- **KIX-weighted GDP**: the logarithm of KIX-weighted (trade-weighted) GDP, fixed price, seasonally adjusted
- **KIX-weighted CPI:** Percent quarterly change, seasonally adjusted
- **KIX-weighted policy rate:** per cent
- **Real household debt**: the logarithm of households' total financial debt deflated by the CPIF
- **Real housing prices**: the logarithm of the property price index (fastighetsprisindex) deflated by the CPIF
- **CPIF**: percentage quarterly change, seasonally adjusted
- **Consumption**: the logarithm of household consumption, fixed price, seasonally adjusted
- **GDP**: the logarithm of GDP, fixed price, seasonally adjusted
- **Policy rate**: The Riksbank's policy rate, per cent
- **Real exchange rate**: the logarithm of the KIX-weighted real exchange rate.

[25] We calculate this as the probability that the difference between two independent stochastic variables distributed according to N(-0.85; 0.3) and N(-0.22; 0.23) is less than zero, where the notation indicates the mean and standard deviation of a normally distributed variable. Assuming independence means that we are probably underestimating the probability.

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