Staff memo

How are household cashflows and consumption affected by higher interest rates?

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Summary

The Riksbank's interest rate path indicates that the repo rate will rise in the coming years. The higher interest rate will affect household disposable income and lead to a redistribution from borrowers to savers. This can give rise to a negative aggregate effect on consumption due both to interest income rising less than interest expenditure and to household consumption reacting more to an increase in interest expenditure than to an increase in interest income.

To estimate the significance of such a "cashflow channel", we calculate in this staff memo how household disposable income is affected by an increase in the interest rate of 1 percentage point. The calculation shows that, all other factors being equal, disposable household income decreases by about 1 per cent.

The higher expenditure caused by the rate rise affects different groups of households in different ways. For borrowers, income is subdued by an average of just under 2 per cent and for households with the highest debt-to-income ratios (over 600 per cent), income falls by 6 per cent.

How household consumption is affected when disposable income falls depends on the behaviour of individual households. If highly indebted households have a higher marginal propensity to consume (MPC) than households with a low level of debt, household consumption is affected more than if the MPC is the same for all households.

How are household cashflows and consumption affected by higher interest rates?

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Swedish household debt has increased rapidly over a long period of time, while the average interest-rate fixation period for households has decreased. They are therefore more exposed to rising interest rates than before. A contributory factor to the increased indebtedness is the low interest rate, which can primarily be explained by a global trend of falling interest rates over a long period of time. An increasing number of central banks are expected to normalise their monetary policies in the years ahead even if policies in many countries are expected to remain very expansionary. The Riksbank is among those central banks that have signalled a gradual increase in the policy rate.

This staff memo aims to highlight how rising interest rates would affect household disposable income and discusses the possible consequences for household consumption. It also presents how households' interest expenditure and interest income are affected by a higher interest rate. The ultimate effect on household consumption depends on how different households react to the change in income.

By way of introduction, we provide a brief background and a review of what research has to say about the theoretical relation between interest rates and consumption. Thereafter, we present how household disposable income changes when the repo rate rises by 1 percentage point. Finally, we discuss how the change might affect consumption if we make various assumptions about how different groups of households react to the change in income.
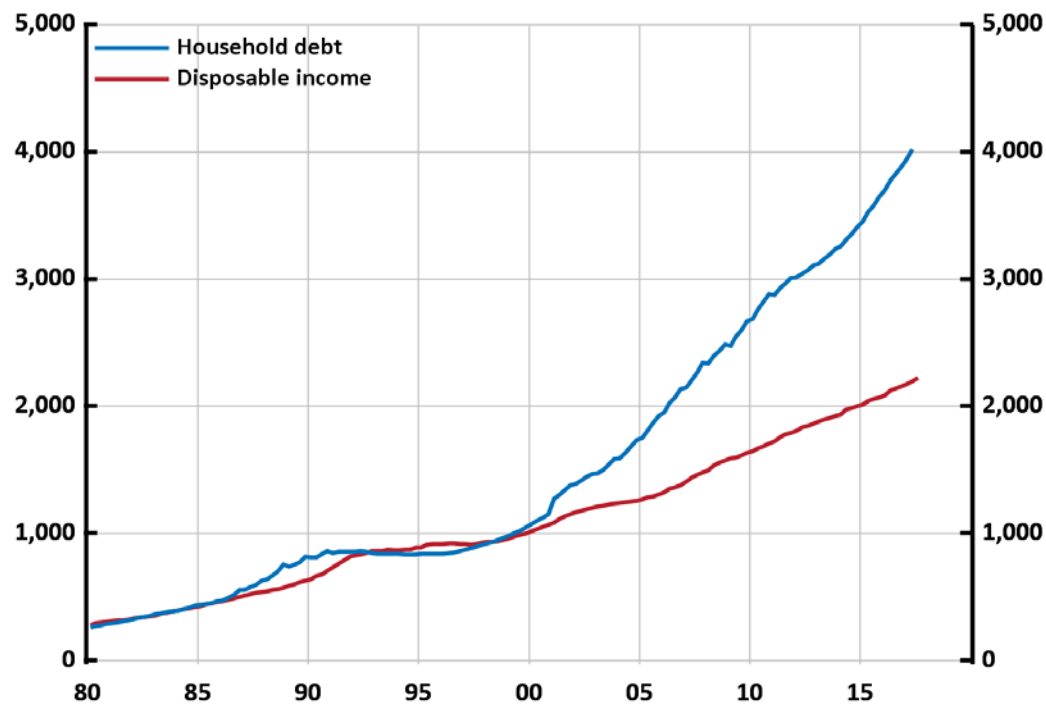
However, the calculations only take into account the direct effects of interest rate adjustments on household disposable income. In the calculations, we therefore disregard a number of channels (including other income, confidence and price adjustments to household assets), through which the interest rate can affect household consumption.

Household debt has risen and the interest-rate fixation period has become shorter

Household debt has increased rapidly over the last 20 years (see Figure 1). In mid-2017, household debt comprised about 180 per cent of disposable income, which means that indebtedness has basically doubled since the mid-1990s.

Figure 1. Household debt and disposable income
SEK billion

Sources: Statistics Sweden and the Riksbank

A contributory factor to the rising indebtedness is the global decline in real interest rates. Since the end of the 1990s, real interest rates have fallen in both Sweden and countries like the United States (see Figure 2). The decline in global real interest rates can be explained both by structural factors that have increased the willingness to save and reduced the willingness to invest, including demographical factors, more skewed income distribution and slower technological development, and by cyclical factors linked to the financial crisis and the euro crisis (see Sveriges Riksbank, 2017a).

Figure 2. Real interest rates in Sweden and the United States
Per cent

Note. 10-year yield on real government bonds in Sweden and the United States. Swedish real interest rates are zero coupon yields interpolated from bond prices using the Nelson-Siegel method.

Sources: US Federal Reserve and the Riksbank

Other factors that explain the increasingly high indebtedness include greater household wealth, more home ownership and a rapidly growing population (see Finansinspektionen et al. 2015).

The proportion of loans with shorter interest-rate fixation periods has also increased in Sweden since the mid-1990s. In mid-2017, loans for housing purposes with an interest-rate fixation period of less than 1 year comprised about 70 per cent of the outstanding loan stock, compared with 40 per cent in 2004 (see Figure 3).[2] About 80 per cent of new loan agreements and renegotiated agreements for housing purposes have an interest-rate fixation period of less than 1 year.

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[2]For possible reasons behind households' choice of interest-rate fixation period, see Holmberg et al. (2015).

Figure 3. Share of outstanding loans for housing purposes with a fixed-rate period of up to 1 year and a fixed interest rate
Per cent of outstanding loans

Share of loans with a fixed rate period up to 1 year ■ Share of loans with a fixed interest rate

Sources: Statistics Sweden and the Riksbank

The increased indebtedness and ever-shorter interest-rate fixation periods for mortgages have sparked a discussion on whether household consumption has become more sensitive to interest rates. The Riksbank has previously discussed different aspects of households' interest-rate sensitivity; see, for instance, Johansson et al. (2011), Sveriges Riksbank (2014a), Holmberg et al. (2015) and Sveriges Riksbank (2017b).

How does monetary policy affect household consumption in theory?

The traditional channel: The real interest rate affects the trade-off between consumption today and in the future

A common element in macroeconomic models is that the real interest rate affects households' choice between consuming today and consuming in the future. Monetary policy affects the real interest rate and thereby consumption during a limited period as prices are slow-moving. Households are assumed to maximise the utility of consumption over many periods. The "Euler equation" describes optimal household consumption in two periods:

$$U'(C_t) = \beta(1 + r)U'(C_{t+1}).$$

The equation says that the marginal utility of consuming in a period, $U'(C_t)$, compared with the marginal utility of consuming in the next period, $U'(C_{t+1})$, depends on the relationship between the real interest rate and the preference of households to consume today, measured by the "discount

factor", β.[3] If we assume a logarithmic utility function, $U(C) = \ln(C)$, so that the marginal utility can be expressed as $U'(C) = 1/C$, we derive the following simple relationship between household consumption today and in the future:

$$\frac{C_{t+1}}{C_t} = \beta(1 + r).$$

If $\beta = 1/(1 + r)$, so that the discount factor is exactly equal to the real interest rate, the household will then want to consume the same amount in both periods. A higher real interest rate means that the household consumes relatively more in the next period and less in the current period. The higher real interest rate hence gives rise to a substitution effect in consumption.[4]

According to classic consumption theory ("permanent income hypothesis"), the level of consumption in a given period is determined by the total expected future household income, discounted with the real interest rate, i.e. the *permanent* income.[5] A (temporary) change in *current* income therefore has a very limited effect on permanent income and hence also on consumption.[6] In other words, households can cope with reduced income today by borrowing and thereby even out consumption as they wish.

Household balance sheets and indebtedness can influence the effects of monetary policy on consumption

The permanent income hypothesis, and similar consumption theories like the life-cycle hypothesis, predicts a weak correlation between a household's current income and consumption. Empirical studies have often found that this correlation is relatively strong. One explanation for this may be that certain households have limited access to credit and cannot take loans to consume when their income is low.[7] Even if the households with limited access to credit are forward-looking and rational, their consumption can therefore have a strong correlation with their current income.[8]

A question that has emerged both in Sweden and internationally, and that has once again become topical after the financial crisis, is whether the impact of monetary policy is affected by household

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[3]The derivation of the Euler equation which describes the relation between marginal utility in different periods based on a maximisation of the household's utility function over all periods and an intertemporal budget constraint, which says that the present value of consumption in all periods must be equal to the present value of all income. We disregard uncertainty. It is normally assumed that households have a preference for consuming today, so that $\beta < 1$.

[4] As regards how the level of consumption today is affected by an elevated real interest rate, macroeconomic theory refers not only to the substitution effect but also an income effect and a wealth effect. The income effect shows that the present value of all future consumption decreases, which enables an increased level of consumption for a given wealth. The wealth effect shows that the present value of future income, wealth, decreases, which instead tends to subdue the level of consumption. For the logarithmic utility function, the income and substitution effects cancel each other out. The intuition for this is as follows: The present value at the time t of consumption in $t + 1$ is $C_{t+1}/(1 + r)$. According to the Euler equation above, we have that $C_{t+1} = C_t \beta(1 + r)$. This means that the present value at the time t of consumption in $t + 1$ will be $C_t \beta(1 + r)/(1 + r) = C_t \beta$, which is not affected by the interest rate. An effect of this is that the share of wealth devoted to consumption today is independent of the interest rate. For a detailed description of these effects, see, for instance, Cromb and Fernandez-Corugedo (2004).

[5] We then combine the Euler equation with the intertemporal budget constraint; see footnote 3. Note that a higher real interest rate dampens the permanent income; see the description of the wealth effect in footnote 4.

[6] A classic example is that a lottery prize of SEK 1,000 would have a very limited effect on permanent income and consumption, while a salary rise of SEK 1,000 per month would have a considerable effect on permanent income and hence a greater effect on consumption. Academic literature normally differentiates between expected and unexpected changes in income. According to the permanent income hypothesis, a change in income that is known in advance should not affect consumption when it occurs, but when it becomes known.

[7] Campbell and Mankiw (1989, 1991) are early examples of studies that try to explain the correlation in aggregate data between changes in income and household consumption by positing that some households have a high propensity to consume, due to credit constraints for example, and the remaining households are "permanent income households". The reaction to fiscal policy measures can also vary between different types of household; see, for instance, Mankiw (2000), Johnson et al. (2006) and Parker et al. (2013).

[8] In addition to credit constraints, there are other feasible reasons why household consumption has a strong correlation with current income. One such reason is the need for households for precautionary saving. According to Carroll (2001), this need can work as a self-imposed credit constraint, and give rise to similar correlations between consumption and income as actual credit constraints. Kaplan et al. (2014) show that transaction costs for utilising illiquid assets can lead to wealthy households with little access to liquid funds also demonstrating "hand-to-mouth" consumption, i.e. having a high propensity to consume with regard to their current income. Explanations based on behavioural economics, such as a lack of self-control and the use of rules of thumb, can also give rise to a strong correlation between household consumption and current income. See, for instance, Shefrin and Thaler (1988).

balance sheets and indebtedness. A common feature of the findings of this research is that borrowers and savers behave differently and have different marginal propensities to consume, for example because borrowers have limited access to credit.[9]

Some of the research uses general equilibrium models with borrowers and savers, and the housing market is modelled explicitly. Savers basically behave as "permanent income households" and have a low propensity to consume. Borrowers, on the other hand, use their home as loan collateral, and have limited access to credit due to a "mortgage cap".[10] Among other things, monetary policy affects housing prices, which in turn affect how much more credit borrowing households can secure, which in turn affects how much they can consume. This channel from monetary policy is usually called the "collateral channel". The effect on consumption, both in aggregated terms and for individual borrowers, is greater the more in debt households are.[11]

The cashflow channel: An interest rate rise transfers income between borrowers and savers

A channel that has also been highlighted in academic research is the "cashflow channel". The idea behind it is that a rate change leads to a change in households' borrowing costs. For a household with a loan, the cost of the loan can be expressed as

$$-r \times D,$$

Where r is the real interest rate and D is the size of the loan. The higher the loan, the more the borrowing costs rise when the interest rate is increased. If more households have variable-rate mortgages, it means that a change in the policy rate affects the average mortgage rate, and thereby also interest expenditure, with a shorter time lag. The disposable income Y^D for the household with a loan can in simple terms be expressed as

$$Y^D = Y - r \times D,$$

Where Y is the wage income after tax. In this way, the household's disposable income falls when the interest rate is increased. An obvious theoretical objection to this reasoning is, however, that the interest expenditure should be equal to the interest income in other households.[12] For these, the interest income from savings can be expressed as
$$+r \times D$$

Similarly, the disposable income Y^D for the saving household can be expressed as

$$Y^D = Y + r \times D.$$

An interest rate rise therefore means more disposable income for savers and less for borrowers. In this way, income from borrowers is redistributed to savers when the interest rate is increased. If the marginal propensity to consume (MPC) among borrowers and savers is the same, i.e. they adjust their consumption to the same extent after the change in their disposable income, this redistribution should not have any aggregate effect on household consumption.

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[9] For a general discussion on how borrowers and savers can be affected in different ways by monetary policy, see, for instance, Auclert (2017) and Sufi (2015).
[10] See, for instance, Iacoviello (2004, 2005), Walentin (2014) and Finocchiaro et al. (2015).
[11] For a new empirical study based on American data, see Alandagady (2017). See also Mian and Sufi (2011) and Mian et al. (2013).
[12] "Borrowers and savers" can in practice be the same household, which, for example, has both interest-bearing savings and a mortgage at the same time, which means that both the income from interest savings and mortgage expenses can increase as a result of rising interest rates in the economy.

If, on the other hand, the MPC differs between borrowers and savers, a redistribution of income among households may affect aggregate consumption.

According to classic consumption theory, the household can cope with a temporary change in its disposable income by borrowing or saving and thereby maintain stable consumption growth.[13] But a household that has already taken on a maximum amount of debt, lacks liquid savings and therefore has limited access to credit cannot take on additional loans to maintain its consumption. In this case, an increased interest rate leads to a reduction in disposable income entirely proportionate to reduced consumption.

Higher indebtedness might mean that the effect is greater on consumption when the interest rate is increased for two reasons. Firstly, the effect on disposable income will be larger; "the cashflow" will be more affected. Secondly, there are several studies indicating that highly indebted households react more to changes in income than less indebted households. An explanation for this might be that highly indebted households have, or run the risk of having, limited access to credit.[14] In Sweden, a relatively large proportion of new mortgage holders have mortgaged their homes as much as Finansinspektionen's (FI's) mortgage cap allows, i.e. 85 per cent of the value of the home (see Finansinspektionen, 2017). This can be seen as an indication that at least some groups of mortgage holders encounter or risk encountering some form of credit constraint.[15]

Empirical studies suggest that the cashflow effect is significant

Several new research papers specifically study the cashflow channel in the event of interest rate adjustments, and mainly focus on the question of whether highly indebted households with a higher proportion of variable-rate mortgages adjust their consumption more than other households.

Using Swedish microdata for the years 2000–2017, Flodén et al., (2016) study how consumption among various households is affected when the repo rate changes.[16] Consumption cannot be directly observed and measured but is estimated with the aid of household assets and income. They find that consumption is affected significantly more among households that are highly indebted and have a greater proportion of variable-rate mortgages. To a large extent, the effect on consumption is also concentrated within these groups. The authors interpret the findings as support for a cashflow channel.

Cloyne et al. (2016) perform a similar study based on British and American data. As fixed mortgages are considerably more common in the United States than in the United Kingdom, they can compare how consumption is affected by interest rate adjustments in both countries. Overall, the difference between the countries in the consumption effect is small, which the authors interpret as differences in interest-rate fixation periods not playing such a major role in the effect of monetary policy on consumption. However, households with mortgages adjust their consumption more than other households in the event of interest rate adjustments, their marginal propensity to consume (MPC) is greater, in part because they have limited access to liquid savings and hence find it more difficult to cope with fluctuations in interest payments.

Di Maggio et al. study a special type of mortgage hybrid, in which the interest rate is fixed for the first 5 years and then automatically reset to a variable rate. The authors study loans issued in 2005–2007 which were reset to variable rates 5 years later. This meant that they were substantially affected by the very expansionary monetary policy in the United States in conjunction with the financial crisis. Borrowers in the study saw their borrowing costs halved in connection with the interest rate adjustment. The reduced interest expenditure was used both to increase consumption of cars (which

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[13] A change in the real interest rate would affect consumption growth in line with the Euler equation described above.

[14] See, for instance, Baker (2017) for a new study based on American data.

[15] 21 per cent of new mortgage holders in FI's 2017 mortgage survey had a loan-to-value ratio of 85 per cent. These households are then dependent on expensive unsecured loans if they want to take out new loans. Furthermore, many households have a loan-to-value ratio of 75–85 per cent and therefore also run the risk of having limited access to credit, especially if housing prices were to fall.

[16] The reason why data from this period is used is that there is data available on household assets, which enables estimates to be made of consumption among households.

is the available measure of consumption) and to increase mortgage repayments. Households with a low income or high loan-to-value ratio used much more of the reduced interest expenditure to increase their consumption and, to a lesser extent, to repaying their loans and had therefore a higher MPC with regard to their cashflow. In an attempt to estimate the effect on total consumption, the authors find that about 80 per cent of the reduced interest expenditure was used for increased consumption.

La Clava et al. (2016) use microdata for the years 2002–2014 from Australia to study the relationship between consumption expenditure on durable goods and household balance sheets for a sample of households. The data makes it possible to study the effects of interest rate adjustments on both interest income and interest expenditure. They divide the households into "borrowers", whom they define more or less as households whose mortgage is greater than their interest-bearing assets, and "savers", whom they define more or less as households whose interest-bearing assets are greater than their mortgage. They find that the interest expenditure for borrowers far exceeds the interest income for savers, which means that interest rate adjustments give rise to a total cashflow effect on disposable household income. Among their findings, they also point out that borrowers adjust their consumption considerably more than savers for a given cashflow; their MPC with regard to the cashflow is hence greater than that of savers. Furthermore, they find that households that are more likely to have limited access to credit change their consumption more than other households.[17] In addition, they find that the effect on consumption among borrowers is concentrated among households with variable-rate mortgages. The estimated overall effect means that if the interest rate is lowered by 1 percentage point, consumption of durable goods via the cashflow channel will increase by about 1.5 per cent.

Direct effects of the interest rate on household disposable income

There are studies that have found that higher indebtedness and a higher proportion of mortgages with short interest-rate fixation periods contribute to making the cashflow channel more important. Both these factors also suggest that the cashflow channel has increased in significance in Sweden.

Interest expenditure and interest income are included in the National Accounts definition of disposable household income, which can approximately be expressed as
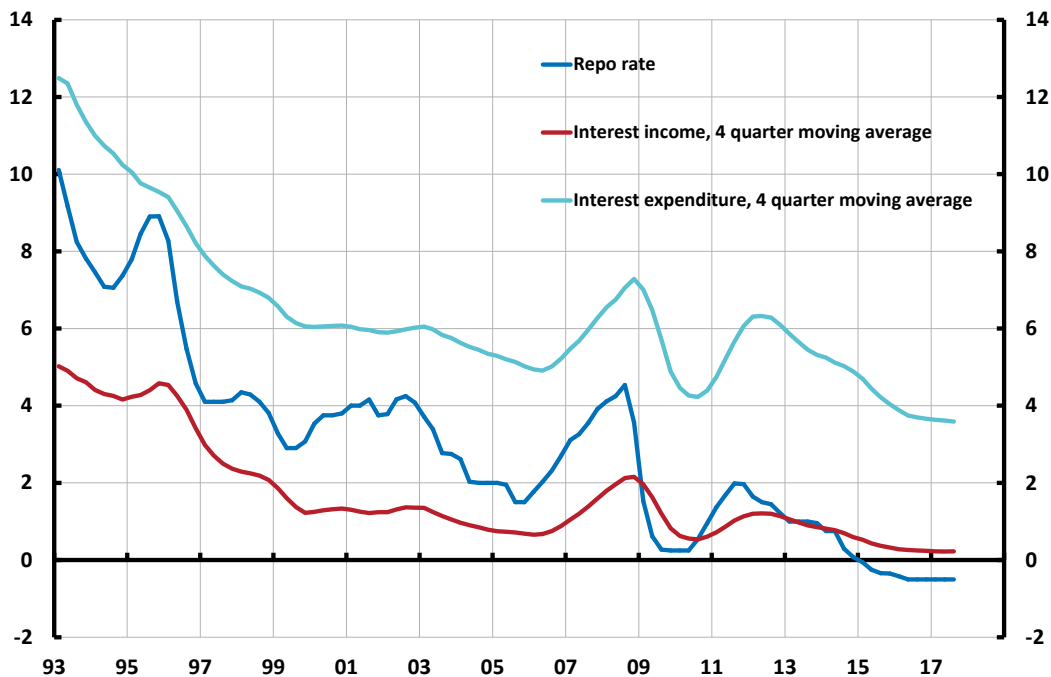
*Disposable income ≈ wages + transfer payments **+ interest income** + other capital income **– interest expenditure** – taxes*

A higher interest rate affects household disposable income directly in the form of an increase in both interest expenditure and interest income. Historically, interest income and interest expenditure have unsurprisingly covaried with changes in the repo rate, but households' interest expenditure has generally exceeded their interest income (see Figure 4).

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[17] These households are referred to as *hand-to-mouth households*, to signify that they have a high propensity to consume. But as the criterion is based on liquid assets in relation to income, these households can be perceived as (more likely) to have limited access to credit.

Figure 4. The repo rate and households' interest expenditure and interest income
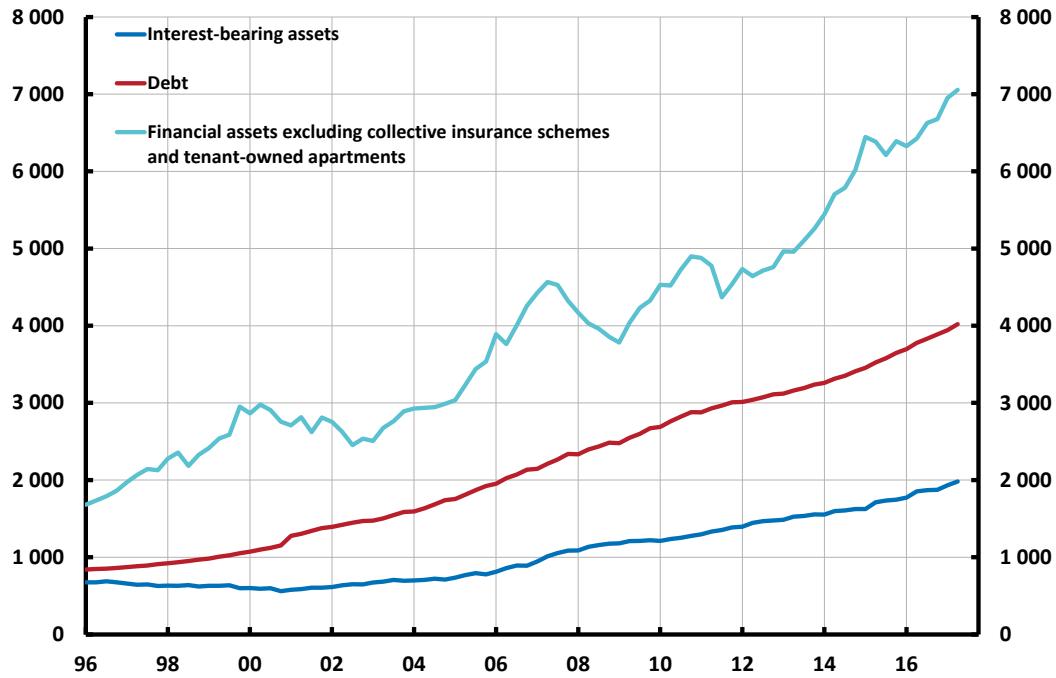Percent and percentage of disposable income

Note. Interest income and interest expenditure are calculated before taxes and not FISIM-adjusted.

Sources: Statistics Sweden and the Riksbank

The fact that interest expenditure is greater than interest income is in part due to lending rates being higher than deposit rates and in part to households' debt being larger than their interest-bearing assets.[18] In mid-2017, households' debt was just over twice the value of their interest-bearing assets, calculated as the sum of households' deposits in bank accounts and National Debt Office Savings Accounts and bond holdings (see Figure 5). Debt has also risen more rapidly than interest-bearing assets in the last 20 years, which has increased the impact of the interest rate on household disposable income. It is important to point out, however, that households, in addition to these interest-bearing assets, also have other financial assets, such as equities and funds, and real assets such as property and land. Overall, this means that the household sector, as a whole, has significant net wealth.

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[18] Household savings comprise not only interest-bearing assets but also fund and equity savings, etc. For a description of the Swedish mortgage market, see Sveriges Riksbank (2014b).

Figure 5. Households' financial assets, deposits and debt
SEK billions

Sources: Statistics Sweden and the Riksbank

In the following section, we calculate how a higher interest rate affects household disposable income based on its <u>direct</u> effects on interest income and expenditure. This involves us disregarding effects on other household income, such as wages, equity dividends or other capital income that normally fluctuate over the course of the business cycle. We also disregard the indirect effects of interest rate adjustments on the economy. This is of course a rough simplification of how interest rate adjustments affect household disposable income.

As interest-bearing assets are less than the debt, a repo rate rise, even if it implies the same changes in deposit and lending rates, will subdue household disposable income, assuming all other factors are equal. To calculate how households' interest income and interest expenditure are affected by a higher interest rate, we use as a basis the Financial Accounts' measures of total household debt and interest-bearing assets (see Figure 5). Our calculations can be illustrated as:

$$\Delta Y^d = -\Delta r^D \times (1 - t) \times \overline{D} + \Delta r^S (1 - t) \times \overline{S}.$$

The change in disposable income (ΔY^d) is negatively affected by a higher lending rate ($-\Delta r^D$) adjusted for tax relief ($1 - t$) and the current level of the loans ($\overline{D}$). The change in disposable income is positively affected by a higher lending rate (Δr^S) adjusted for capital income tax ($1 - t$) and the current level of the interest-bearing assets ($\overline{S}$). Expressed as a share of disposable income, this will be:

$$\frac{\Delta Y^d}{Y^d} = -\frac{\Delta r^D \times (1 - t) \times \overline{D}}{Y^d} + \frac{\Delta r^S \times (1 - t) \times \overline{S}}{Y^d}$$

The debt in the second quarter of 2017, i.e. about SEK 4,000 billion ($\overline{D}$ in the equation), multiplied by 1 percentage point (Δr^D in the equation above). All loans are thus assumed to be subject to the new interest rate and no account is taken of the fact that about 30 per cent of the loan stock comprises

loans with an interest rate fixation period of over 1 year.[19] Tax relief on interest payments of 30 per cent is assumed to be unchanged and utilised by all ($1 - t = 0.7$).

This is a simplification that disregards the fact that some household debt comprises student loans. Although the interest on student loans is based on the interest rate on government loans, it is not tax-deductible. At the same time, however, the calculations also disregard the fact that there may be loans whose interest rate can increase more rapidly than the mortgage rate and the fact that not everyone receives the full amount of tax relief on interest expenditure.[20]

In the second quarter of 2017, households' interest-bearing assets amounted to about SEK 2,200 billion ($\overline{S}$ in the equation above). Deposit rates are assumed not to increase as much as the lending rate, but by about 0.3 percentage points (Δr^s in the equation above).[21] This is because household deposit rates have not followed the repo rate down below zero (see Figure 6). Household deposit rates are therefore assumed not to rise as long as the repo rate is negative or close to zero. The simplified assumption that all income is taxed at 30 per cent ($1 - t = 0.7$) is also made for interest income.

All in all, these assumptions mean that a 1 percentage point higher interest rate will cause interest expenditure to rise by just under SEK 30 billion and interest income to increase by just under SEK 4 billion. This is equal to 1.3 and 0.2 per cent respectively of household disposable income, which is expected to amount to just over SEK 2,200 billion in 2017. In net terms, household disposable income will thereby decrease by 1.1 per cent (see table 1).[22] The findings can be summarised as follows:

$$\frac{\Delta Y^d}{Y^d} = -1{,}3\% + 0{,}2\% = -1{,}1\%$$

The negative net effect is due both to the deposit rate increasing more slowly than the lending rate and household deposits being less than household debt.

Table 1. Change in household disposable income as a result of a 1 percentage point higher interest rate
Per cent

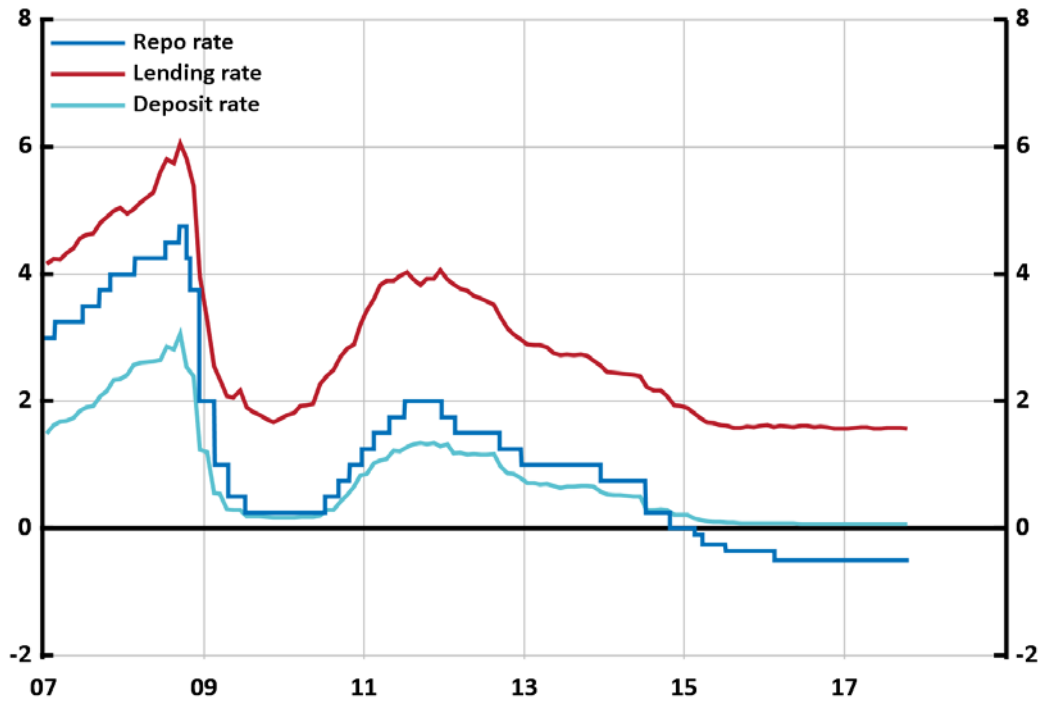|	Percentage of disposable household income
Net effect	−1.1
Effect of rising interest expenditure	−1.3

Source: The Riksbank

[19] The calculation also implicitly assumes that households do not change their fixation periods as a result of the higher interest rate. If households choose a fixed rate for a larger share of their loans, this would lead to a slightly slower future impact on interest expenditure from interest rate adjustments but, normally, a slightly higher immediate rate. In the calculation, therefore, the higher lending rate could also be interpreted as a minor increase in the actual lending rate and some shift towards a larger share of fixed-rate loans.
[20] Households may deduct 30 per cent of their interest expenditure up to SEK 100,000 and 21 per cent of any interest expenditure above that. Currently, about 2 per cent of the borrowers in the microdata have loans exceeding SEK 5 million, which is the approximate limit for maximum relief. About 8 per cent have mortgages of SEK 3–5 million, which means that they might also be affected by the relief limit when the interest rate rises.
[21] The difference between lending rates and the repo rate is, on the other hand, assumed to be constant, irrespective of fixation period.
[22] The National Institute of Economic Research (2017) uses a similar method, but derives slightly weaker effects, which can be explained by the fact that deposit rates are assumed to rise at the same pace as lending rates.

Figure 6. Repo rate and deposit and lending rates for households
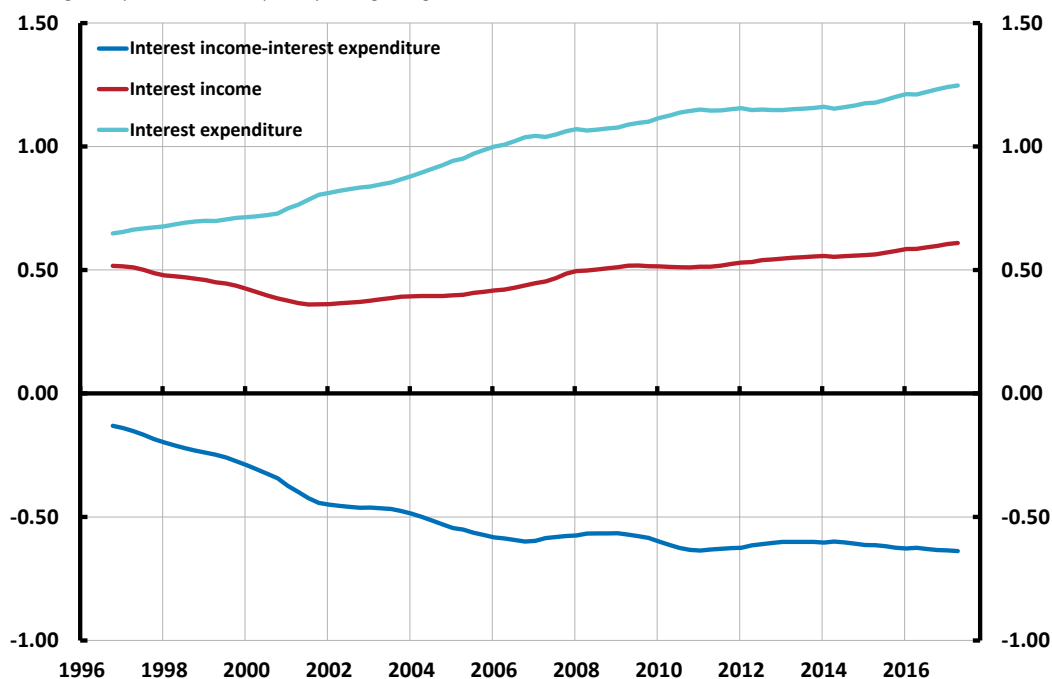Per cent

Note. MFIs' average deposit and lending rates for companies and households.

Sources: Statistics Sweden and the Riksbank

Households' interest-rate sensitivity has increased

By using the Financial Accounts' measures of total household debt and interest-bearing assets, a historical series can be calculated for the interest rate's effect on household disposable income. Under the assumption that deposit and lending rates both rise by 1 percentage point, the direct net effect on household disposable income of a higher interest rate has increased significantly over the last 20 years (see Figure 7).[23] This can primarily be explained by the fact that the share of household disposable income that goes to interest expenditure has increased as a result of higher indebtedness among households.

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[23] The last observation in Figure 7 is therefore not consistent with the findings shown in Table 1 where the deposit rate is assumed to increase less than the lending rate.

Figure 7. Interest expenditure and interest income as a result of a 1 percentage point higher interest rate
Percentage of disposable income, 4-quarterly moving average

Note. The figure assumes that both deposit rates and lending rates rise by 1 percentage point.
Sources: Statistics Sweden and the Riksbank

Microdata suggests significant heterogeneity among households

Using macrodata has certain advantages, but also some disadvantages. The calculation based on aggregate data from the Financial Accounts can be complemented with a calculation based on microdata on household loans. To gain a better picture of the risks linked to increasingly indebted households, the Riksbank has been gathering credit data on all borrowers from the eight largest banks in Sweden since 2013. In addition to mortgages, the debt measure also covers credit card loans and consumer loans, but not student loans. The debt covers about 99 per cent of household mortgages, but a small proportion of other loans, and amounted in 2017 to about SEK 3,000 billion. The microdata covers about 50 per cent of the adult population. A household is defined as individuals who share loans and have the same address.[24]

The advantage of using microdata is that we can study how interest expenditure changes for various households. However, it is not possible to take into account how a higher lending rate affects households' interest income as the statistical material does not contain data on individual households' interest-bearing assets. The calculation therefore only captures the dampening effect that rising interest expenditure has on household disposable income.

The aggregate effects conceal a significant difference in how exposed various households are to higher interest rates. The Riksbank has recently calculated and published how much interest expenditure would rise in SEK calculated for various household groups if the interest rate rose by 1 percentage point.[25] For households that are mainly affected by the interest rate adjustment, i.e. borrowers, the increase in interest expenditure is equal to about 2 per cent of their disposable income.[26] For the 10 per cent who have the largest debt in relation to their income, with a debt-to-income ratio of over 600 per cent, disposable income decreases by 6 per cent (see Table 2).

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[24] For a detailed description of the microdata, see Blom et al. (2017).
[25] See Sveriges Riksbank (2017b).
[26] Disposable income is approximated with income after tax and is based on data from the Swedish Tax Agency. It is therefore slightly different from how disposable income is calculated in the National Accounts.

Table 2. Change in household disposable income for various households as a result of a 1 percentage point higher interest rate
Per cent

	Percentage of disposable household income
Borrowers	−1.9
Debt-to-income ratio>600	−6.1

Note. Based on microdata. Disposable income is approximated with income after tax for the mortgage holders group and households with a debt-to-income ratio of >600 per cent. It is based on data from the Swedish Tax Agency and differs from the National Accounts calculation of disposable income used in the aggregate level calculations.

Source: The Riksbank

How does the cashflow channel affect household consumption?

The calculations for how a higher interest rate affects household disposable income, combined with a few highly stylised assumptions, can give us an idea of what the effect on disposable income would be for aggregate consumption. The lack of microdata on households' assets and consumption expenditure makes it more difficult to assess how individual households' consumption may change. Consequently, to relate our calculated effects on disposable income to effects on household consumption, we need to make different assumptions that relate to the theoretical description of households' consumption decisions.

In the analysis of aggregate data, household disposable income decreases by 1.1 per cent. Using the permanent income hypothesis, the marginal propensity to consume (MPC) with regard to this change in income should be zero, assuming that permanent income is only impacted to a limited extent.

According to the discussion in the theoretical section, the cashflow channel can give rise to aggregate effects on consumption, even if aggregate disposable income is not affected. This is because savers and borrowers have different MPCs, for example because households with loans find it more difficult to raise more loans. In this case, a higher interest rate implies a negative aggregate effect on consumption, as it leads to a transfer of income from households with relatively high MPCs to households with relatively low MPCs.

To be able to discuss, from a cashflow perspective, the *maximum* effect on consumption of the change in aggregate disposable income, we make the simplified assumptions that all households with loans have an MPC of 1 (for example, due to credit constraints) and that interest incomes accrue to households with an MPC of approximately zero.[27] This means that it is only the increase in households' interest expenditure that affects aggregate consumption.

The rise in the interest rate thereby means that households with loans reduce their consumption to the same extent that interest expenditure increases and thus leave their saving unchanged (MPC equals one). Interest income accrues to households that do not adjust their consumption (MPC equals zero). All in all, consumption will slow down by 1.4 per cent (see Table 3).[28] If we instead assume that both borrowers and savers have an MPC of 0.5, which is well in line with empirical estimates, the effects will be smaller, amounting to 0.6 per cent of households' total consumption according to the National Accounts.[29] [30]

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[27] A fresh study by the Bank of England (2017) shows that households, on average, increase their consumption by 10 per cent when there is an increase of interest income, but reduce their consumption by 50 per cent when there is an increase of interest expenditure. Bunn et al. (2017) also show that households in general have a significantly higher MPC with regards to unexpected negative changes in income, compared with unexpected positive changes in income.

[28] The effect on consumption is greater than the effect on disposable income because consumption makes up about 90 per cent of household disposable income.

[29] A review of previous studies in Carroll et al. (2017) indicates that the aggregate MPC usually lies in the interval 0.2-0.6.

[30] Interest expenditure increases are weighted together with the debt-to-income decile's share of household disposable income.

Table 3. Aggregate effects on consumption due to 1% percentage point higher interest rate

Per cent

Effect on household disposable income (per cent)	Propensity to consume, borrowers	Propensity to consume, savers	Effect on household consumption (per cent)
−1.1 (−1.3 + 0.2)	0	0	0
−1.1 (−1.3 + 0.2)	0.5	0.5	-0.6
−1.1 (−1.3 + 0.2)	1	0	-1.4

Note. The figures in parentheses in the left-hand column show the contributions of increased interest expenditure and interest income, respectively. Total household consumption is on a lower level than disposable household income, meaning that the same change, counted in SEK, makes up a larger proportion of consumption than it does of disposable income.

Sources: Statistics Sweden and the Riksbank

The significance of the cashflow channel if the marginal propensity to consume differs from household to household

As we discussed earlier, there is some empirical support for the theory that highly indebted households react more to changes in income than less indebted households do. One reason for this might be that more highly indebted households run a greater risk of being credit constrained.

According to the reasoning in the previous section, the maximum effect can also be illustrated with the help of microdata material, as in this case only the change in interest expenditure is significant for the effect on household consumption. However, as the microdata material only covers about 75 per cent of the measure of debt used in the Financial Accounts, the effect will be smaller, about 1 per cent of household consumption according to the National Accounts.

In order to shed light on the role differences in the propensity to consume among indebted households play for the aggregate consumption effect, we can use the microdata material to make a few stylised sensitivity calculations. In our first example, households are assumed to reduce their consumption by an average of half of the increase in interest expenditure.[31] This means that the MPC is 0.5 for all households with loans (see Figure 8). This also thus implies that households, on average, also reduce their saving by half of the increase in interest expenditure (see Figure 9). In this case, the effect would be 0.5 per cent of household consumption according to the National Accounts.[32]

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[31] This corresponds with the findings of the study from the Bank of England (2017).
[32] The cashflow effect will be less as the debt in the microdata comprises about 75 per cent of the total debt according to the Financial Accounts.

Figure 8. Marginal propensity to consume (MPC)
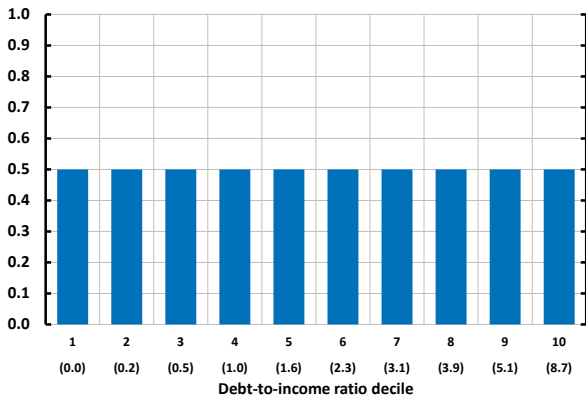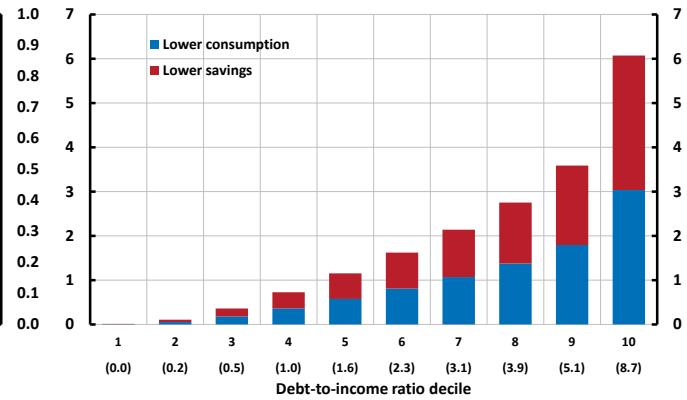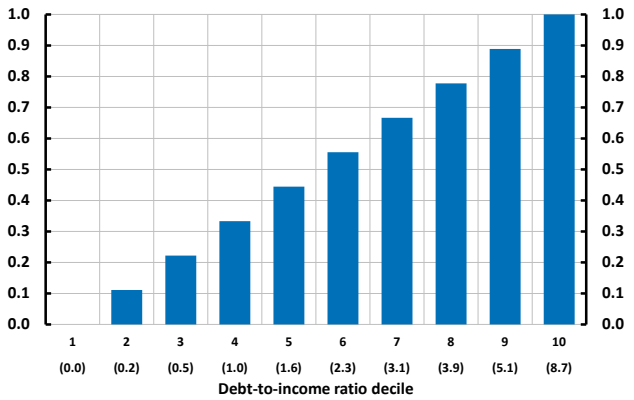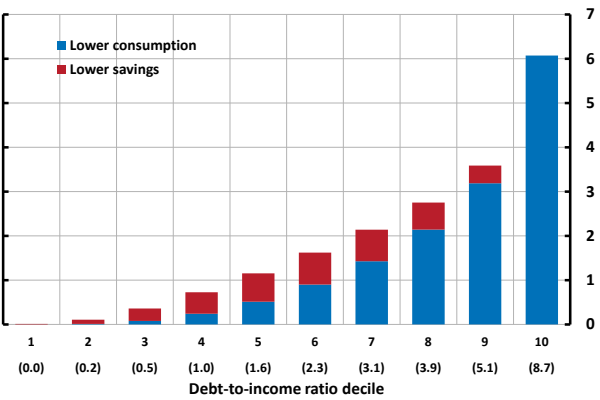Proportion of change in income

Figure 9. Interest expenditure increase as a result of a 1 p.p. higher interest rate
Per cent of income after tax

Note. Increase in interest expenditure refers to the average in each decile. The average debt-to-income ratio is given in brackets.

Source: The Riksbank

If we continue to assume that the average MPC is 0.5, but that it is unevenly distributed among households with different debt-to-income ratios, the aggregate consumption effect may be greater or smaller.

An assumption that ties in with the literature is that highly indebted households run a greater risk of having limited access to credit and will therefore adjust their consumption more if their income decreases. In that case, households with low debt-to-income ratios would reduce their saving to a greater extent while households with high debt-to-income ratios would reduce their consumption to a greater extent when interest expenditure rises. The mechanism is illustrated by assuming that the MPC increases gradually from zero for the least indebted to 1 for the highest indebted (see Figure 10). This means, for example, that the tenth of households with the highest debt-to-income ratios reduce their consumption by 6 per cent, which is equal to the increased interest expenditure. At the same time, the tenth of households with the lowest debt-to-income ratios do not reduce their consumption at all (see Figure 11). When these consumption decisions are combined, the overall effect on consumption will be 0.8 per cent. The fact that the effect is close to the maximum effect is due to the combination of the highest indebted households having a high propensity to consume and being responsible for much of the variation in cashflow. The effect is subdued by the fact that average income is lower than the average in the highest debt-to-income ratio decile.

Figure 10. Marginal propensity to consume (MPC)
Proportion of change in income

Debt-to-income ratio decile

Figure 11. Interest expenditure increase as a result of a 1 p.p. higher interest rate
Per cent of income after tax

Debt-to-income ratio decile

Note. Increase in interest expenditure refers to the average in each decile. The average debt-to-income ratio is given in brackets.

Source: The Riksbank

As a comparison, we can also hypothetically assume the opposite, i.e. that the least indebted have a MPC of 1 and the highest indebted an MPC of zero (see Figure 12). In that case, the least indebted would reduce their consumption and the highest indebted would reduce their saving when interest expenditure increase (see Figure 13). The overall effect will then be significantly less and the aggregate consumption effect amounts to 0.2 per cent. The lesser effect is due to the assumption that the highest indebted, who are responsible for much of the variation in cashflow, will only reduce their consumption very slightly.

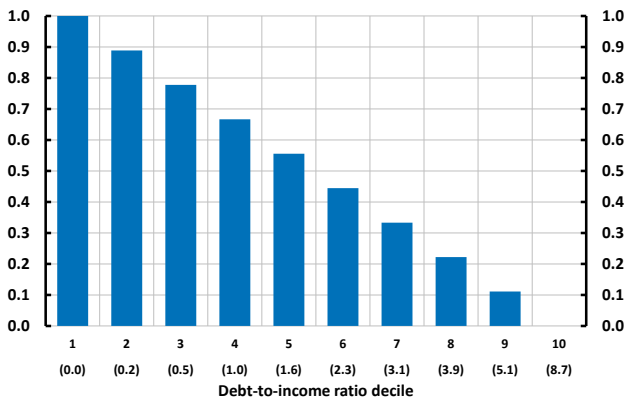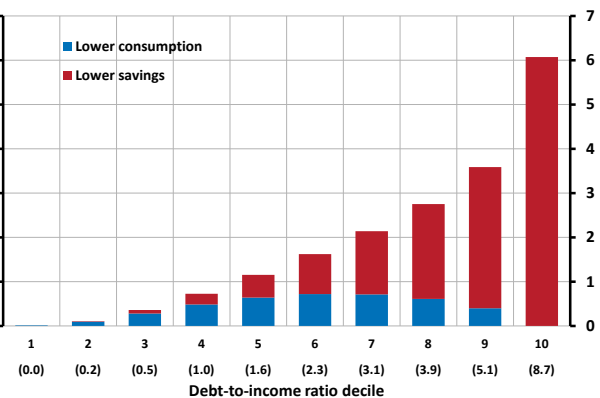**Figure 12. Marginal propensity to consume (MPC)**
Proportion of change in income

Debt-to-income ratio decile

Figure 13. Interest expenditure increase as a result of a 1 p.p. higher interest rate
Per cent Share of income after tax

Debt-to-income ratio decile

Note. Increase in interest expenditure refers to the average in each decile. The average debt-to-income ratio is given in brackets.

Source: The Riksbank

Concluding discussion

In this staff memo, we have shown calculations of how household disposable income is affected by an increase in the repo rate, all other factors being equal. If the repo rate rises by 1 percentage point, the direct effect on households' interest expenditure and interest income mean that their disposable income will decrease by about 1 per cent overall. However, these aggregate figures conceal a significant variation. The highest indebted households would, for example, see their income decline by about 6 per cent.
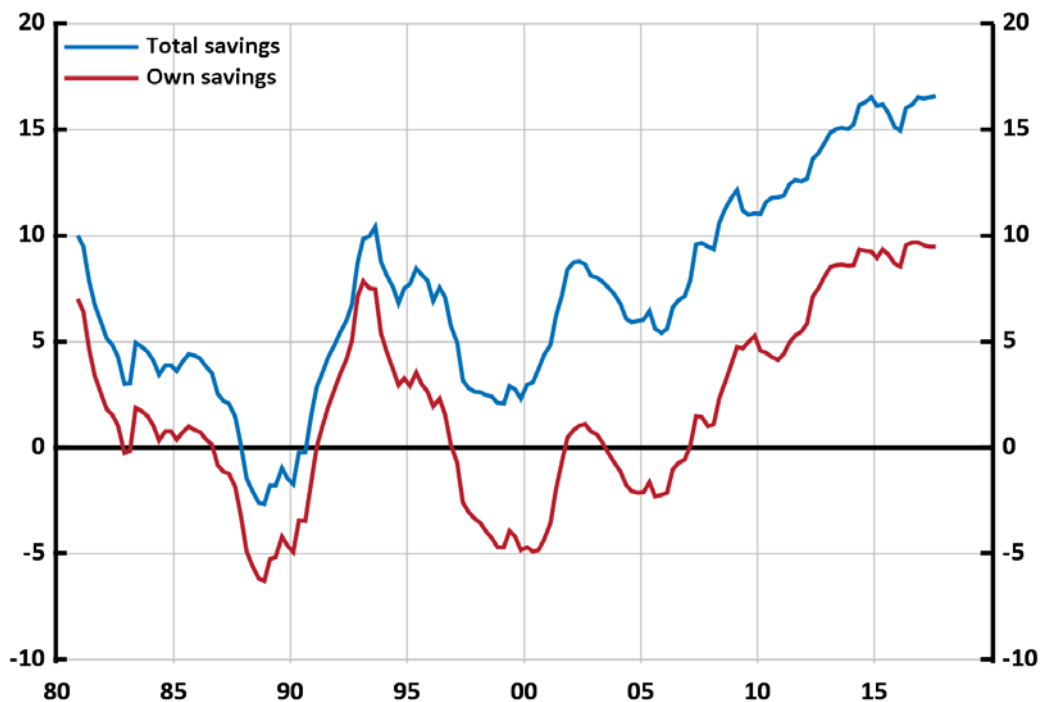
To what extent households would reduce their consumption if their interest expenditure increases is an open question. As the interest expenditure calculations are of a "all-else-equal" nature, they do not take into account indirect effects on household behaviour via, for example, effects on confidence among households and companies, changes in households interest rate expectations, price adjustments on the housing market, and so on.

At the same time, households are saving a historically high proportion of their income (see Figure 14) Therefore, the household sector as a whole has margins that can be used to continue to consume when interest rates rise. This presupposes, however, that saving is fairly evenly distributed among households. Earlier studies show that this is not the case. A new study by the IMF, based on data up to 2012, shows that 80 per cent of the saving is done by the quarter of households with the highest income and that the 50 per cent of households with the lowest income do not save at all (see IMF, 2017).

It is difficult to know exactly why saving by Swedish households is so high even though there are several feasible explanations. One reason might be that, in the wake of the financial crisis, households have become more uncertain about their future income growth. This could give rise to "precautionary saving", even though this can only explain the recent high levels of saving to a lesser extent. Other possible explanations are the age composition of the population, which leads to high pension saving, and changes to social security systems. The high level of saving could also be sign of households expecting rising interest rates in the period ahead. If households are forward-looking, they would increase their saving today if they expect their disposable income to increase more slowly in the future. In that case, some of the effects of future rate rises on consumption would have already occurred.

Highlighting how various households react to interest rate adjustments could help to increase our understanding of the monetary policy transmission mechanism. The analysis would be made significantly easier if there was microdata on household assets and not just household debt.

Figure 14. Household saving
Share of disposable income, 4 quarters moving average

Note. Own savings are the difference between consumption and disposable income.

Source: Statistics Sweden

References

Alandagady, A. (2017), "Housing Wealth and Consumption: Evidence from Geographically Linked Microdata", American Economic Review, pp. 3415-46.

Auclert, A. (2017), "Monetary Policy and the Redistribution Channel." National Bureau of Economic Research Working Paper 23451

Bank of England (2017), "The sensitivity of households and companies to changes in interest rates", article in Inflation Report, November.

Baker, S.R. (2017), "Debt and the Response to Household Income Shocks", under publication, Journal of Political Economy.

Blom K. and van Santen, P. (2017), "Household indebtedness in Sweden – update for 2017", Economic Commentaries No. 6, Sveriges Riksbank.

Bunn, P., Le Roux, J., Reinold, K. and Surico, P. (2017), "The consumption response to positive and negative income shocks", Journal of Monetary Economics.

Campbell, J. Y. and Mankiw, N. G. (1989), "Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence." NBER Macroeconomics Annual 4, pp. 185–216.

Campbell, J. Y. and Mankiw, N. G. (1991), "The response of consumption to income", European Economic Review, pp. 723-767.

Carroll, C.D. (2001), "A Theory of the Consumption Function, With and Without Liquidity Constraints", Journal of Economic Perspectives 15(3), pp. 23-46.

Carroll, C.D., Slacalek, J., Tokuoka, K., White, M.N. (2017), "The distribution of wealth and the marginal propensity to consume", Quantitative Economics 8(3), pp. 977-1020.

Cloyne, J., Ferreira, C. and Surico, P. (2016), "Monetary Policy When Households Have Debt: New Evidence on the Transmission Mechanism", Bank of England Staff Working Paper No. 589.

Cromb, R. and Fernandez-Corugedo, E. (2004), "Long-term interest rates, wealth and consumption". Bank of England working paper No. 243.

Di Maggio, M. Kermani, A. Keys, B.J., Piskorski, T. Ramcharan, R. Seru, A. and Yao, V. (2017), "Interest Rate Pass-Through: Mortgage Rates, Household Consumption, and Voluntary Deleveraging", American Economic Review, pp. 3550–3588

Finansinspektionen, Swedish National Debt Office and Sveriges Riksbank (2015), "The driving forces behind household indebtedness", memorandum to the Financial Stability Council.

Finansinspektionen (2017), "The Swedish mortgage market".

Finocchiaro, D., Jonsson, M., Nilsson, C. and I. Strid, (2016), "Socioeconomic effects of reducing household indebtedness", Economic Review 2016:2.

Flodén M., Kilström, M., Sigurdsson, J. and Vestman, R. (2017) "Household Debt and Monetary Policy: Revealing the Cash Flow Channel", Working paper 342, Sveriges Riksbank.

Holmberg, U., Janzén, H., Oscarius, L,. van Santen, P. och Spector, E. (2015), "An analysis of the interest-rate fixation period for Swedish mortgages", Economic Commentaries, no. 7.

Iacoviello, M. (2004), "Consumption, House Prices and Collateral Constraints: a Structural Econometric Analysis", Journal of Housing Economics 13, pp. 305-321.

Iacoviello, M. (2005), "House Prices, borrowing constraints and monetary policy in the business cycle", American Economic Review 95, pp. 739.764.

Johnson, D.S., Parker, J. A., and Souleles, N. S. (2006), "Household Expenditure and the Income Tax Rebates of 2001," American Economic Review, pp. 1589-1610

Kaplan, G., Violante, G.L., and Weidner, J. (2014) "The Wealthy Hand-to-Mouth", Brookings Papers on Economic Activity 48(1), pp. 77-153.

IMF (2017), "Sweden selected issues".

Johansson J., Lagerwall, B. and Lundvall, H. (2011), "Larger share of variable mortgages – how does this affect the impact of monetary policy?", The Riksbank's inquiry into risks on the Swedish housing market.

National Institute of Economic Research (2017), Konjunkturläget October 2017, pp. 27.

La Clava, G., Hughson, H. and Kaplan, G. (2016), "The Household Cash Flow Channel of Monetary Policy", Reserve Bank of Australia Research Discussion Paper 2016-12.

Mankiw, N, G. (2000), "The Savers-Spenders Theory of Fiscal Policy" American Economic Review, pp. 120-125.

Mian, A. and Sufi, A. (2011). "House Prices, Home Equity-Based Borrowing, and the US Household Leverage Crisis." American Economic Review 58, pp. 2132-56.

Mian, Atif, Rao, K. and Sufi, A. (2013), "Household Balance Sheets, Consumption and the Economic Slump." Quarterly Journal of Economics 118, pp. 1687-1726.

Parker, J.A., Nicholas S., Johnson, D.S. och McClelland, R. (2013), "Consumer Spending and the Economic Stimulus Payments of 2008." American Economic Review 58, pp. 2530-53.

Sveriges Riksbank (2014a), "Households' sensitivity to interest rates", article in Monetary Policy Report, October.

Sveriges Riksbank (2014b), "From A to Z: the Swedish mortgage market and its role in the financial system", Riksbank Studies, April 2014

Sveriges Riksbank (2017a), "The long-term repo rate", article in Monetary Policy Report, February.

Sveriges Riksbank (2017b), "Household indebtedness and interest rate sensitivity", article in Financial Stability Report 2017:2.

Shefrin, H. M., and Thaler, R.H. (1988), "The Behavioral Life-Cycle Hypothesis"
Economic Inquiry 26 (October), pp. 609–643.

Sufi, M. "Out of Many, One? Household Debt, Redistribution and Monetary Policy during the
Economic Slump", Andrew Crockett Memorial Lecture, June 2015, BIS.

Walentin, K. (2014), "Housing collateral and the monetary transmission mechanism", Scandinavian
Journal of Economics pp. 635-668.