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**Research Report**

## The Effect of Higher Interest Rates on Household Disposable Income and Consumption - a Static Analysis of the Cash-Flow Channel

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# STAFF MEMO

The effect of higher interest rates on household disposable income and consumption - a static analysis of the cash-flow channel

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TORSTENSEN



NORGES BANK

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THE EFFECT OF HIGHER  
INTEREST RATES ON  
HOUSEHOLD DISPOSABLE  
INCOME AND CONSUMPTION  
- A STATIC ANALYSIS OF  
THE CASH-FLOW CHANNEL

# The effect of higher interest rates on household disposable income and consumption - a static analysis of the cash-flow channel

Karsten Gerdrup and Kjersti Næss Torstensen\*

## Abstract

*Household debt in Norway has risen substantially over the past 15-20 years relative to both disposable income and bank deposits. An increase in interest rates will therefore reduce disposable income for Norwegian households more than previously. Changes in interest rates can have a direct impact on household consumption via changes in disposable income - an effect generally referred to as the cash-flow channel. In this article, we use tax data from Statistics Norway for all Norwegian households in the period between 2004 and 2015 to shed light on how the cash-flow channel has developed over time. In line with developments in net household debt, we find that the cash-flow effect has become stronger in recent years, but that the increase is somewhat smaller than the total increase in net interest expenses in isolation would imply, owing to increased buffers in the form of liquid assets.*

## 1 Introduction

Household debt in Norway has risen substantially over the past 15-20 years relative to both disposable income and bank deposits. An increase in interest rates will therefore reduce household disposable income more than previously. In 2004, a one percentage point increase in deposit and lending rates would have reduced household disposable income by 0.6 percent. Today, household income would be reduced by about 1 percent.

The direct effect on total household spending of a change in disposable income is generally referred to as the *cash-flow channel*. If households as a whole hold equal amounts of interest-earning assets as interest-earning debt and all have the same marginal propensity to consume (MPC)<sup>1</sup>, changes in interest rates will not affect total consumption via the cash-flow channel. However, the channel will contribute to a decline in consumption in the event of an interest rate increase if there is net interest-earning debt (hereafter referred to as “net debt”)<sup>2</sup> in the household sector or if households with net debt have a higher MPC than households with net bank deposits.

Even though the effect of a rise in interest rates on household disposable income can be substantial, households will be able to smooth consumption over time, limiting the direct impact on consumption. In a theoretical case where households are rational, forward-looking, have

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<sup>1</sup>Marginal propensity to consume (MPC) measures the change in consumption that occurs with a change in income.

<sup>2</sup>In this article, net debt means debt less bank deposits.

full access to information and to a credit market without imperfections, households will adjust their consumption optimally over time based on their lifetime income. The income effect of a rise in interest rates will be spread over the remainder of the life cycle, limiting the effect on current consumption, whether income rises or falls. Households with little or no liquid assets and limited opportunities to increase their borrowing, on the other hand, will not be able to smooth consumption optimally over time. These households are likely to reduce consumption considerably when income is reduced and increase consumption considerably when income rises.<sup>3</sup>

Empirical studies support the notion that household finances are important for the cash-flow channel. Flodén et al. (2017) find that highly indebted Swedish households reduce consumption more than other households when interest rates rise.<sup>4</sup> Kim and Lim (2017) show that changes in interest rates have a stronger impact in countries where the share of fixed-rate loans is low and debt ratios are high. In a study of Norwegian households' consumption response to lottery winnings, Fagereng et al. (2016) find that the response is larger for households with limited bank deposits.<sup>5</sup> In a similar study of US households, Baker (2018) finds that liquid assets have a considerable impact on the consumption response to changes in income. Even households with high levels of wealth can face constraints if their assets are illiquid. This may be due to costs involved in freeing up capital that is tied up in for example housing (see Kaplan et al. (2014)). Cava et al. (2016) estimate the cash-flow channel for Australian households and find that households with less than half a month's income in liquid assets increase their consumption more than other households when interest rates are reduced. Overall, Cava et al. find that a one percentage point increase in interest rates will reduce household consumption by between 0.1 and 0.2 percent via the cash-flow channel.

In this article, we use tax data obtained from Statistics Norway for all Norwegian households in the period between 2004 and 2015 to shed light on how the cash-flow channel has developed over time. After analysing certain features of the financial situation of households, we calculate the cash-flow channel using some simple assumptions regarding different groups' MPCs based on their holdings of liquid assets.

The results can be summarised as follows: Total net debt as a share of disposable income and the share of households with high net debt ratios have both increased over time, suggesting a stronger cash-flow effect. On the other hand, households have used some of their income to build up their stock of liquid assets, which may suggest that households will respond to a lesser extent to changes in income, and pulls in the opposite direction. Overall, our analyses suggest that total consumption could fall by just under 0.4 percent as a result of the direct effect on disposable income of a one percentage point rise in interest rates. In line with developments in net household debt, we find that the cash-flow effect has become stronger in recent years, but that the increase is somewhat smaller than the total increase in net interest expenses in isolation would imply owing to increased buffers in the form of liquid assets. The results are uncertain as our assumptions regarding the MPCs of different groups of households are highly uncertain.

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<sup>3</sup>Uncertainty about future income and expenses can lead to similar behaviour (see e.g. Carroll and Kimball (1996)).

<sup>4</sup>Based on regional US household data, Mian et al. (2013) find that the propensity to reduce consumption in the event of an unexpected decline in housing wealth is greater when debt ratios are high. Misra and Surico (2014) analyse the consumption response of US households to tax rebates and find that the increase in consumption is higher for heavily indebted households. Dynan (2012), Andersen et al. (2016) and Bunn and Rostom (2014) are other examples of empirical studies that find a positive correlation between debt and consumption response.

<sup>5</sup>The response of households in the lowest deposit quartile is almost twice as strong as that of those in the highest deposit quartile.

## 2 Data and method

We use tax data for all Norwegian households obtained from Statistics Norway to shed light on developments in debt and bank deposits and the impact of higher interest rates on disposable income and consumption.<sup>6</sup>

The stock of debt and deposits are measured on 31 December each year, and income is total annual after-tax income. Disposable income is defined as after-tax income less interest expenses. The analyses include all households where the main income earner is aged between 20 and 90. As it is difficult to distinguish between personal and business assets for those who are self-employed, households in which at least one person has income from self-employment that exceeds labour income are therefore omitted from the analysis. Total debt comprises loans from private individuals, foreign banks, Norwegian banks and credit institutions and government lending institutions.

The analyses show the effect of a one percentage point unexpected increase in lending and deposit rates on annual household disposable income. The effect has been calculated based solely on household loan debt and bank deposits. An interest rate increase is assumed to have an immediate impact on income since the share of fixed-rate loans is small.<sup>7</sup> In 2017 Q4, the share of fixed-rate residential mortgages with a term of one year or more was 5.9 percent. The calculated effect takes account of tax deductions for interest payments and taxation of interest income.

The analysis is static and does not take account of economic effects of the interest rate increase on for example employment, labour income and the value of assets. Nor does the analysis take into account the reason for the increase.

## 3 Household debt has risen faster than disposable income

Household debt in Norway has risen substantially since the mid-1990s relative to both disposable income and bank deposits (Chart 1), partly reflecting high housing investment (real saving), which for many households is debt-financed. Aggregate national accounts figures show that the household saving ratio averaged around 2 percent in the period 1995-2017, contributing to higher household wealth.

Household wealth includes many different types of financial assets, such as bank deposits, securities and insurance claims, with varying degrees of liquidity and sensitivity to interest rate changes. To analyse the direct impact of an interest rate increase on disposable income, we limit our analysis to bank deposits since they are both interest-earning and primarily liquid.<sup>8</sup> For 60 percent of households, bank deposits account for over 90 percent of their financial wealth, and this share has been stable over time.

When a large share of household wealth is tied up in housing, which is partly debt-financed, an increase in interest rates will have a greater impact on disposable income as measured in this

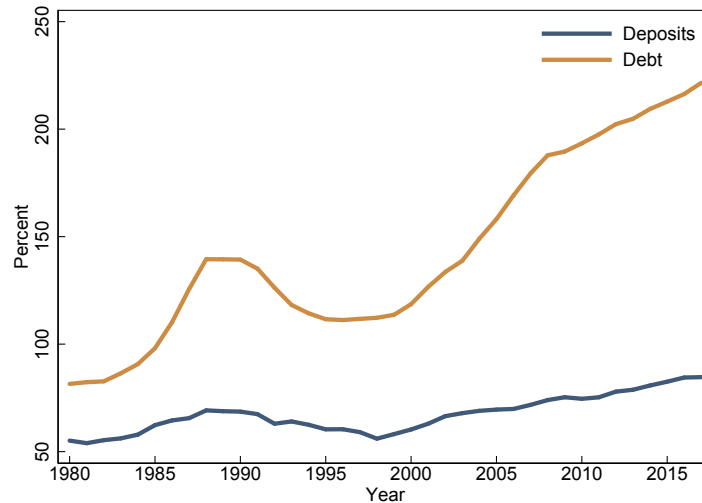
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<sup>6</sup>The stock of debt and deposits, and total income are reported by a third party to the tax authorities. The stock of debt and deposits summed from micro data is very similar to aggregated statistics for the same variables. When summed from micro data, disposable income is somewhat lower compared with aggregated statistics, but developments over time are very similar.

<sup>7</sup>For households with variable-rate and annuity loans, principal payments will normally fall when interest rates increase. This will dampen the effect of a change in interest rates on income disposable for consumption, but has not been taken into account in this analysis.

<sup>8</sup>Due to data limitations, bonds cannot be included, even though they are interest-earning and in many cases liquid. In the analysis period, bonds accounted for less than 1 percent of household financial assets.

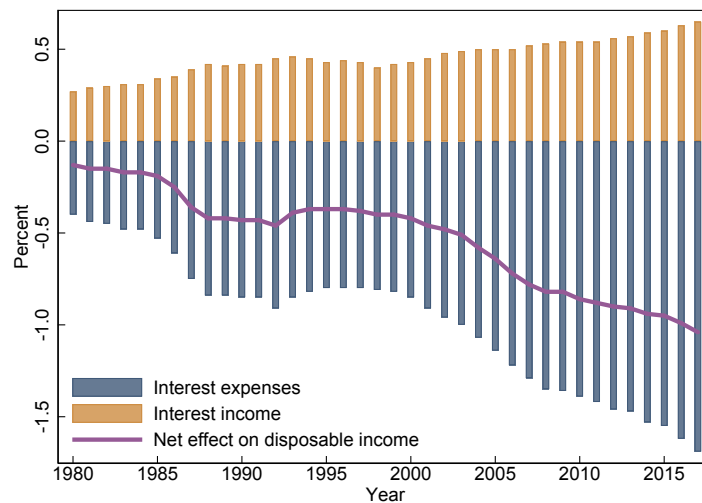
Chart 1: Debt and deposits as percentages of disposable income<sup>1)</sup>



<sup>1)</sup>Disposable income excluding dividend income.  
Sources: Statistics Norway and Norges Bank

article. Chart 2 shows a time series for the estimated effect of a 1 percentage point increase in deposit and lending rates on aggregate disposable household income. In 2004, such an increase would have reduced household disposable income by 0.6 percent. Today, household income would be reduced by about 1 percent.

Chart 2: Effect of a one percentage point increase in interest rates on disposable income<sup>1)</sup>



<sup>1)</sup>Disposable income excluding dividend income. Change in interest income and interest expenses as percentages of disposable income.  
Sources: Statistics Norway and Norges Bank

#### 4 How does the impact of higher interest rates on household income differ across households?

As shown above, household net debt as a share of disposable income has increased. This indicates that the cash-flow channel is stronger today than previously. But changes in the distribution of

debt, liquid assets and income will also influence the cash-flow effect if different households have different marginal propensities to consume. The following section presents an analysis of the distribution of debt, deposits and income in 2015 and how this has changed over time, and the estimated impact of higher interest rates on disposable income for the different household groups.

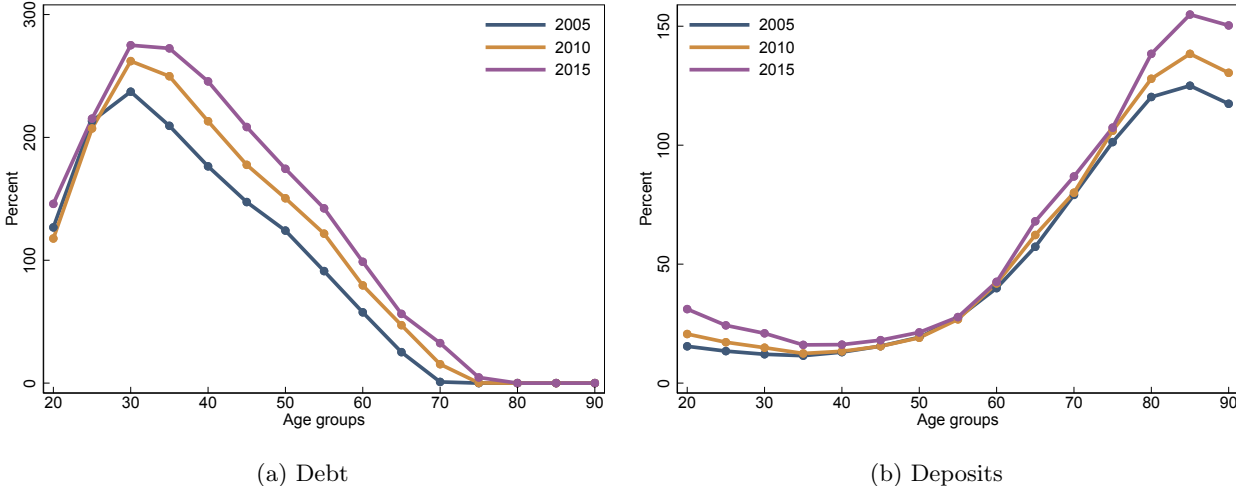
### 4.1 The distribution of debt and deposits has a clear life cycle profile

Younger and middle-aged households have the highest debt-to-income ratios and the lowest deposit-to-income ratios (Chart 3). This is in line with a life cycle pattern in which a household gradually trades up in the housing market, then pays off the debt and saves for retirement and to leave any inheritance. Bank deposits account for a relatively small share of disposable income throughout the life cycle until households reach their 60s. Thus, households’ financial buffers in the form of bank deposits to cover unexpected expenses are low through much of their lives. Bank deposits as a share of disposable income are higher in older age groups.

Debt relative to income increased in all age groups, except those over 80 years of age, between 2005 and 2015. In percentage points, the increase was highest for the households aged 35-39 (63 pp), 40-44 (69 pp) and 45-49 (61 pp). The percentage increase, however, was highest for those aged over 60; debt as a share of disposable income rose by more than 70 percent in the 60-64 age group and more than doubled in the 65-69 and 70-74 age groups.

Households have also increased their liquid assets over time. All age groups increased their bank deposits as a share of disposable income between 2005 and 2015, with the strongest rise in the youngest and oldest age groups.

Chart 3: Debt and deposits as a percentage of disposable income, by age group<sup>1)</sup>



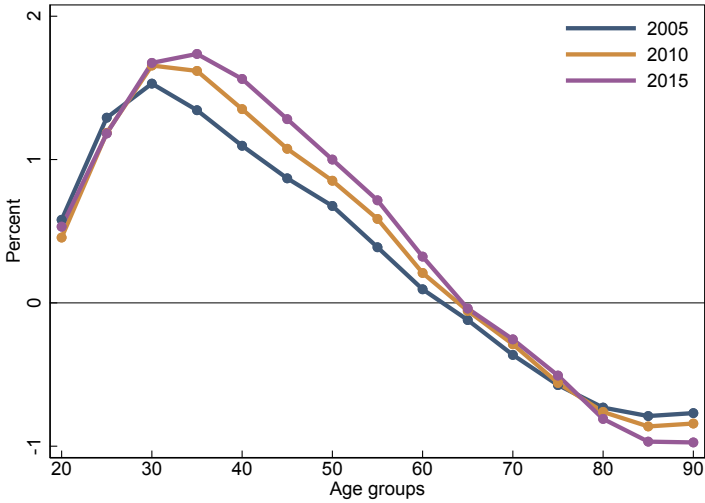
<sup>1)</sup>Median per age group.  
Sources: Statistics Norway and Norges Bank

In line with the distribution of debt and deposits, the effect of higher interest rates has a clear life cycle profile. Chart 4 shows the change in net interest expenses in the event of a one percentage point rise in deposit and borrowing rates, as a percentage of disposable income. Net interest income rises for households with a main income earner aged over 65, while net interest expenses rise for households with a main income earner aged below 65. As a share of disposable income, net interest expenses rise more in 2015 than in 2005 for the 30-74 age groups. For



households aged 75 and above, the increase in net interest income is larger in 2015 compared with 2005. There are small changes in the 20-29 age groups.

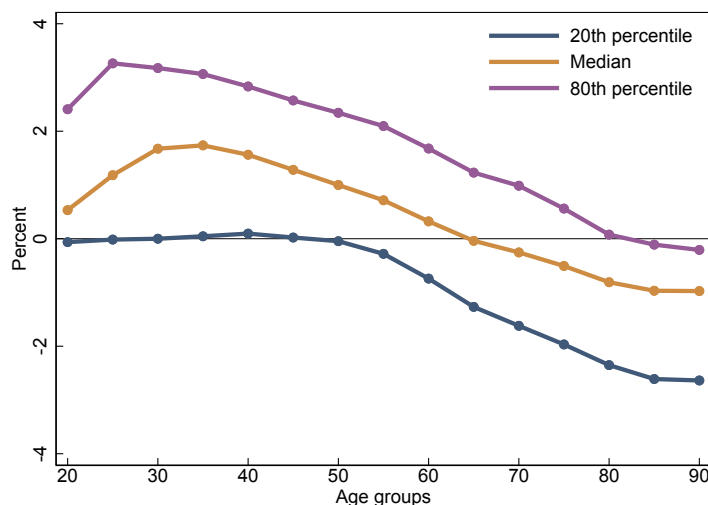
Chart 4: Change in net interest expenses as a percentage of disposable income following a one percentage point rise in interest rates, by age groups<sup>1)</sup>



<sup>1)</sup>Median per age group.  
Sources: Statistics Norway and Norges Bank

Even though the effect on disposable income of a rise in interest rates has a life cycle profile, there are wide differences within age groups. To analyse this, we rank households within each age group according to the change in net interest expenses as a percentage of disposable income. Chart 5 shows the change in net interest expenses as a percentage of disposable income for the 20th percentile, the median and the 80th percentile of each age group. For most age groups, net interest expenses increase, as a share of disposable income, by more than twice as much as for the 20 percent of households with the largest rise in interest expenses (purple line) compared with the median household. For the 20-54 age groups, 20 percent of households experience little or no changes in net interest expenses (blue line).

Chart 5: Change in net interest expenses as a percentage of disposable income following a one percentage point rise in interest rates, by age and percentiles for the change in net interest expenses as a percentage of disposable income.<sup>1)</sup> 2015



<sup>1)</sup>Percentiles per age group.

Sources: Statistics Norway and Norges Bank

Even though the life cycle perspective is important in understanding household behaviour, empirical literature shows that the consumption response to changes in disposable income is more closely related to households' financial position than age itself. In the following, we will therefore group households according to their debt and liquid assets.

## 4.2 More highly leveraged households, but fewer households with low levels of liquid assets

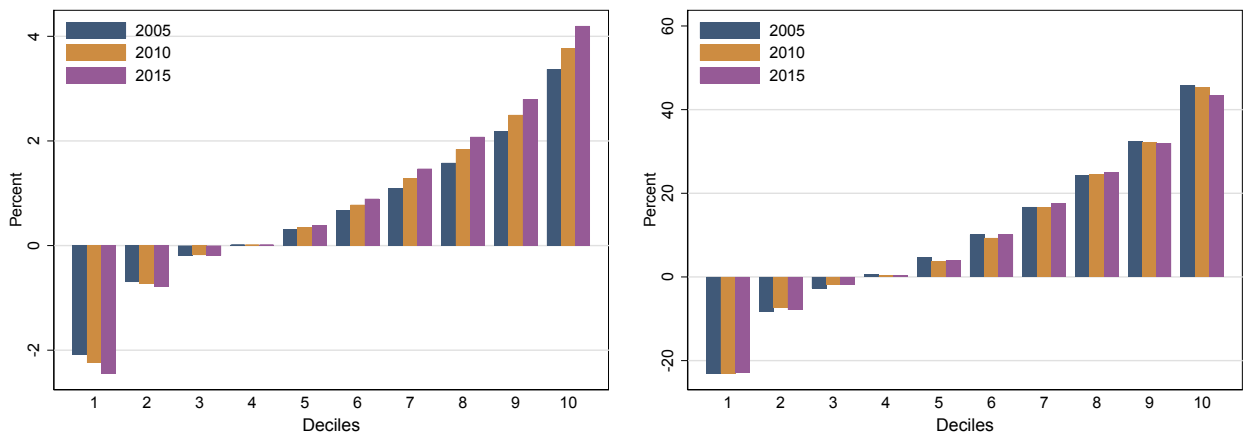
For many households, a one percentage point increase in interest rates amounts to a substantial share of after-tax income. Chart 6(a) shows the change in annual net interest expenses as a percentage of after-tax income when households are divided into ten equal groups by net debt as a share of after-tax income for each of the years 2005, 2010 and 2015. With a division into deciles, the level of net debt in each decile will typically differ in the different years.<sup>9</sup> As shown in the chart, for seven out of ten households, interest expenses rise more than interest income following an interest rate increase in 2015. The effects have increased over time in line with faster growth in household net debt than in income. For the median household, the change in interest expenses corresponds to 0.4 percent of after-tax income in 2015, while for three out of ten households, the increase in interest expenses corresponds to more than 2 percent of after-tax income. In other words, a rise in the median household's income of 0.4 percent would fully cover the increase in interest expenses. Net interest income rises for three out of ten households. For the group of households with the highest net deposits, the interest rate increase corresponds to a rise in after-tax income of 2.5 percent in 2015. For all groups with net debt, the change in net interest expenses as a percentage of after-tax income following a rise in interest rates has increased over time. In 2005, a one percentage point increase in interest rates amounted to more than 2 percent of after-tax income for 18 percent of households, while this share had increased

<sup>9</sup>The share of households with a high level of net debt as a percentage of after-tax income has increased over time (see discussion in Appendix A).

to 26 percent in 2015.

Net debt has grown at a similar pace across large groups of households, as in Chart 6(b), which shows that each decile's share of the total increase in net interest expenses following a rise in interest rates has been about the same over time.<sup>10</sup> The ten percent of households with highest net debt as a percentage of after-tax income account for close to 45 percent of the increase in interest expenses following a rise in interest rates in each of the three years.

Chart 6: Median change in net interest expenses and share of increase in net interest expenses following a one percentage point rise in interest rates, by deciles for net debt as a percentage of after-tax income



(a) Median change in net interest expenses as a percentage of after-tax income

(b) Share of increase in net interest expenses<sup>1)</sup>

<sup>1)</sup>Shares sum to 100. The first three deciles have a negative share as they hold net deposits, and their net interest income increases when interest rate rise.

Sources: Statistics Norway and Norges Bank

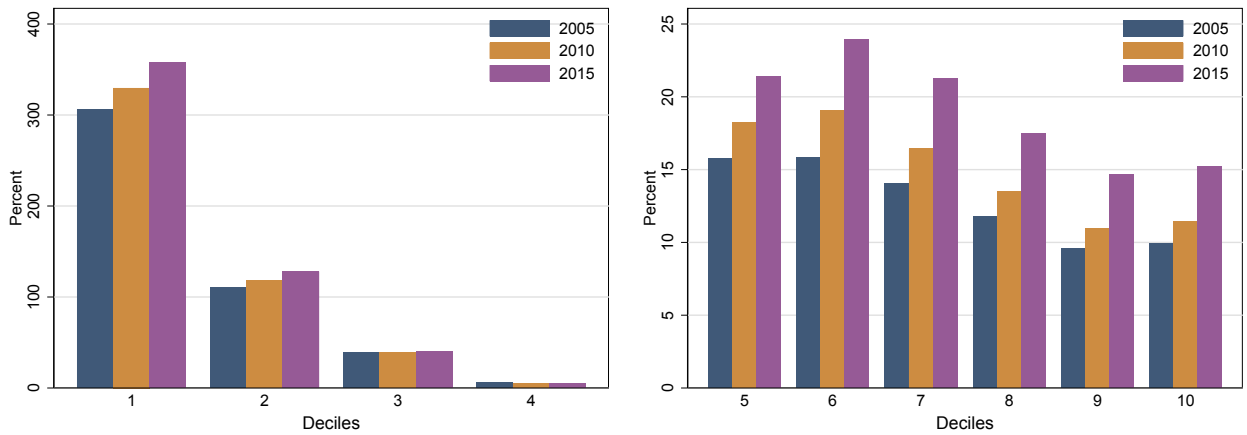
While many households have increased their net debt, they have also built up their stock of liquid assets (Chart 7). In 2005, the households with most net debt relative to income had bank deposits equivalent to 1.4 times monthly income (median). In 2015 this household group had bank deposits equivalent to 2.1 times monthly income. In the period between 2005 and 2015, there was an increase in deposits as a share of after-tax income for all deciles, which gave households more scope to smooth fluctuations in disposable income.<sup>11</sup>

A one percentage point increase in deposit and lending rates will nevertheless constitute a substantial portion of bank deposits for households with a high level of net debt. For the group with the highest level of net debt as a share of after-tax income in 2015, the increase in annual interest expenses constitutes 32 percent of bank deposits (Chart 8). However, compared with 2005, the increase in interest expenses constitutes a smaller share of bank deposits in 2015 for all groups with net debt (as measured by the median).

<sup>10</sup>As these shares have been stable over time, the distribution of net debt as a share of income has not become more skewed over time, even though it has shifted to the right. For a more detailed description of the change in the distribution of debt and income as a share of after-tax income, see Appendix A.

<sup>11</sup>Increased bank deposits do not necessarily imply greater scope to smooth consumption if they are only the result of a change in the composition of household portfolios. However, the increase in bank deposits over the period has not been driven by changes in portfolio composition; bank deposits as a share of financial wealth have remained fairly stable for virtually all deciles between 2005 and 2015.

Chart 7: Deposits as a percentage of after-tax income. By decile<sup>1)</sup> for net debt as a share of after-tax income



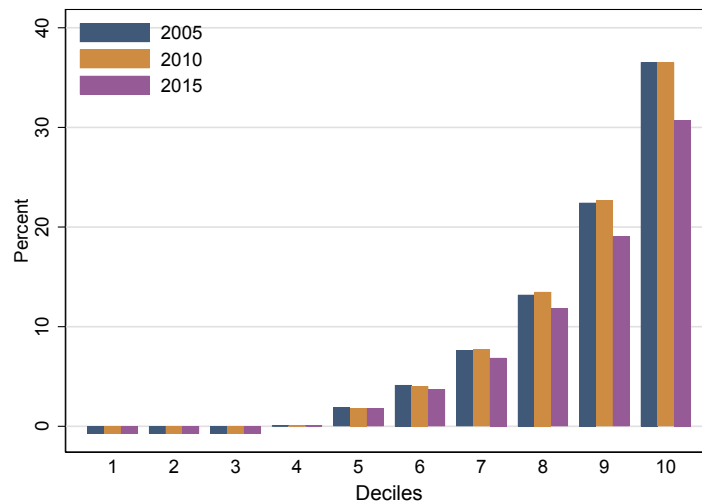
(a) Decile 1-4

(b) Decile 5-10

<sup>1)</sup>Median share per decile.

Sources: Statistics Norway and Norges Bank

Chart 8: Change in net interest expenses as a percentage of bank deposits following a 1 percentage point interest rate increase. By decile<sup>1)</sup> for net debt as a share of after-tax income



<sup>1)</sup>Median change per decile.

Sources: Statistics Norway and Norges Bank

## 5 Possible direct effects on consumption

Overall, the effect of a rise in interest rates on disposable household income has increased, but increased saving in liquid assets may limit the impact on consumption. To calculate the overall cash-flow effect of higher interest rates, we must determine the MPC of the different households. The cash-flow effect at time  $t$  of a one percentage point increase in interest rates can be calculated in the following manner:

$$cash-flow\ effect_t = \sum_{i=1}^N MPC_{i,t} \times \Delta net\ interest\ expense_{i,t}, \quad (1)$$

where  $MPC$  is the marginal propensity to consume for group  $i$  and  $\Delta net\ interest\ expense$  is the change in net interest expenses following the interest rate increase. If households with a high MPC were to increase (reduce) their share of total net interest expenses, it would suggest that the change in the cash-flow effect is stronger (weaker) than what would be implied by the total increase in net interest expenses in isolation.

Quantifying the MPC of the different groups is challenging. In this article, we use households' stock of liquid assets, measured here as bank deposits, to distinguish between household groups. Liquid wealth is the observable household feature emphasised by the literature as correlating with the MPC when other balance sheet items are also taken into account.<sup>12</sup>

When grouping households based on liquid assets, a decision must be made as to whether to do so according to the absolute level of liquid assets or according to the level relative to the rest of the population. If we base groupings on the absolute level, we allow for changes in the share of households in the different groups over time. If instead we base groupings on for example quartiles for each year, the share of households in each group will remain constant over time, and this will affect the calculated consumption response. From the empirical studies we are aware of that estimate the effect of liquid assets on MPCs, we cannot distinguish between the effect of absolute and relative levels of liquid assets.<sup>13</sup> We will therefore calculate the consumption response under different assumptions.

To calculate the consumption response to interest rate changes, we use estimated MPCs from Fagereng et al. (2016), where households are grouped by deposit quartiles. Since this study is based on data for Norwegian households, we consider these estimates to be most relevant for this analysis.<sup>14</sup> Fagereng et al. find that the MPC is 0.44, 0.42, 0.34 and 0.22 respectively for deposit quartiles 1-4. On the basis of these estimates we calculate the cash-flow effect in four different ways:

**Method 1:** Assumes the same MPC for all households, which is set equal to the average MPC in the sample (0.35). This is a useful comparative basis for the other methods since the only change over time is in net interest expenses.

**Method 2:** Divides households into quartiles for each year by deposits. All households in each quartile are assigned the same MPC, but this will vary across quartiles, as mentioned above. The share of households in each group will be constant over time at 25 percent.<sup>15</sup>

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<sup>12</sup>See, for example Fagereng et al. (2016) and Baker (2018). Fagereng et al. includes a broad selection of balance sheet items, including debt, and find that only liquid assets have a significant effect on households' MPC in response to lottery winnings. Without controlling for household access to credit and liquid assets, Baker finds a generally strong positive correlation between household debt ratios and the consumption response to changes in income. However, when he controls for access to credit and liquid assets, he does not find any correlation between debt ratios and the consumption response. Among Norwegian households, there is a strong negative correlation between debt ratios and liquid assets as a share of income. Households with a high debt-to-income ratio often have limited liquid assets relative to income, which can explain why studies limited to the household debt situation find a correlation between household debt and the MPC.

<sup>13</sup>As most empirical analyses cover a limited number of years, it is difficult to conclude whether it is a household's level of liquid assets, or the level relative to the rest of the population, that influences the estimated MPC.

<sup>14</sup>For most households, an interest rate increase means a decline in disposable income. MPC estimates are calculated on the basis of positive income changes. Baker (2018) finds that the response to negative income changes is greater than for positive income changes, which is in line with theoretical models that include lending and liquidity constraints. Estimates in Fagereng et al. are nevertheless somewhat stronger than Baker's estimates for positive income shocks, but lower than the estimates for negative income shocks.

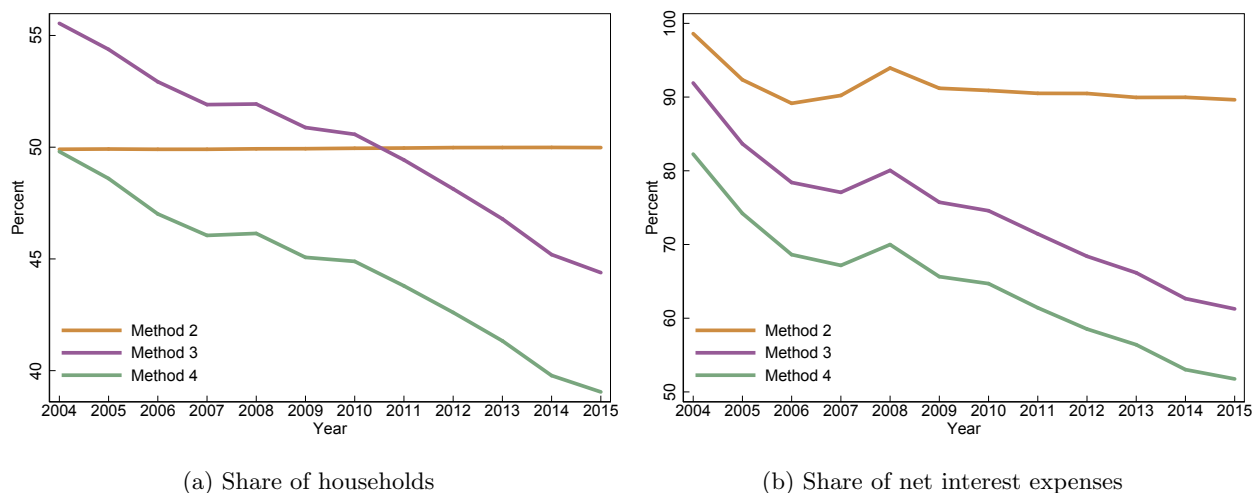
<sup>15</sup>This method yields about the same cash-flow effect as if it were based on the distribution of bank deposits as a share of after-tax income in 2004 and if households were divided according to the 2004 quartiles. This yields approximately the same result since the distribution of bank deposits as a share of after-tax income broadly correlates with the distribution of bank deposits each year, and the distribution of bank deposits as a share of after-tax income has been fairly stable over time.

**Method 3:** Divides households into deposit quartiles for the time period as a whole.<sup>16</sup> The share of households in the different quartiles can then vary from one year to the next.

**Method 4:** Starts with the distribution of bank deposits in 2004, at 2015 prices, and finds the levels of bank deposits held by the 25th, 50th and 75th percentiles, respectively.<sup>17</sup> We then distribute the households according to these levels for the years between 2004 and 2015. This method is based on the notion that it is the level of households' deposits that is important in the estimation and not households' relative position in the distribution. Again, the share of households in the different quartiles can vary from one year to the next.

Chart 9(a) shows the share of households in the two groups with the highest MPC (of 0.44 and 0.42, respectively) for the different methods.<sup>18</sup> As explained above, these households account for half of the households in all the years using method 2, where quartiles are based on annual income. For both method 3 and 4, the share of households with the highest MPC in the two groups declines over time. The share of net interest expenses held by the two groups with the highest MPC is shown in Chart 9(b).

Chart 9: Share of households and net interest expenses in the two groups with the highest MPC (0.44 and 0.42), using different methods<sup>1)</sup>



<sup>1)</sup>Method 2 divides the households into quartiles by bank deposits for each year. Method 3 divides the households into quartiles by bank deposits for the entire period, and method 4 divides the households into 4 groups based on bank deposits in the 25th, 50th and 75th percentiles, respectively, in 2004.

Sources: Statistics Norway and Norges Bank

The overall cash-flow effect of a one percentage point increase in interest rates for the different household groups is shown in Chart 10. The same MPC for all households suggests that the cash-flow effect has increased by 60 percent, from 0.22 percent of total consumption in 2004 to 0.35 percent in 2015 (method 1). This method suggests that the percentage increase in the cash-flow effect is the same as the increase in interest expenses. The percentage increase in the cash-flow effect is approximately the same if households are divided according to deposit quartiles each year (method 2). The cash-flow effect is however stronger using this method as a larger share of total net debt is held by households with a high MPC. The cash-flow effect was

<sup>16</sup>Deposits in the calculations are deflated by CPI for more accurate comparisons across years.

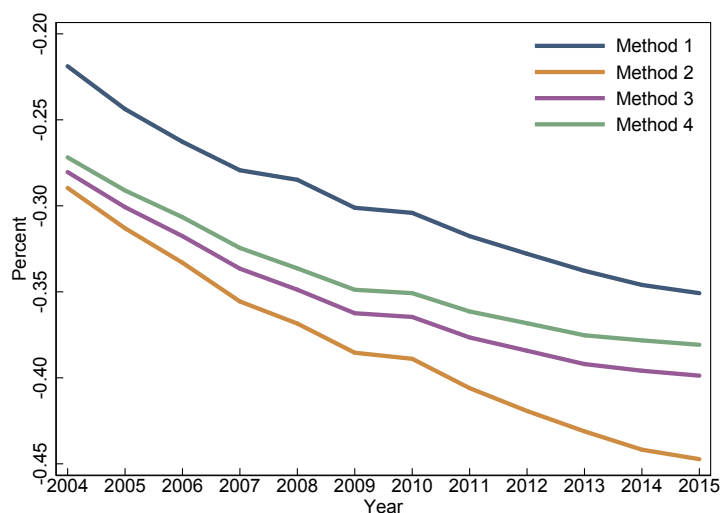
<sup>17</sup>Results in Fagereng et al. (2016) are based on the years 1994 to 2006. We use the earliest overlapping year as our basis.

<sup>18</sup>For an overview of the shares in each group, see Appendix B.

just under 0.4 percent in 2015 using methods 3 and 4. The increase in the cash-flow effect is smaller using methods 3 and 4 than methods 1 and 2 as the share of interest expenses held by households with a high MPC declines over time.

Based on the calculations in Section 4.2, households have better liquidity today compared with previously. This is not taken into account in method 1, and only to a limited extent in method 2 as only the relative distribution of deposits within a year that matters. Methods 3 and 4 take this into account as the share of net interest expenses held by households with a high MPC has fallen. We therefore have more confidence in the results for the cash-flow effect obtained using methods 3 and 4. This suggests that the effect of a change in interest rates on aggregated consumption via the cash-flow channel is smaller than the increase in interest expenses in isolation would imply.

Chart 10: Change in aggregate consumption following a one percentage point rise in interest rates, for different assumptions regarding household MPC<sup>1)</sup>



<sup>1)</sup> Method 1 assumes the same MPC for all households. Method 2 divides households in each year into quartiles by bank deposits. Method 3 divides households into quartiles by bank deposits for the entire period, and method 4 divides households into four groups based on bank deposits in the 25th, 50th and 75th percentiles, respectively, in 2004.

Sources: Statistics Norway and Norges Bank

## 6 Summary

Household debt in Norway has risen substantially over the past 15-20 years, relative to both disposable income and bank deposits. An increase in interest rates will therefore reduce disposable income for Norwegian households more than previously. Changes in interest rates can influence household consumption directly via changes in disposable income - an effect generally referred to as the cash-flow channel. In this article, we have explored how higher interest rates will affect disposable income for different households, depending on age and financial situation, and we have performed some simple calculations of the cash-flow effect. As the share of households with high debt ratios has risen over time, the proportion of income needed to cover a rise in interest rates continues to increase for an ever higher share of the population: in 2005 a one percentage rise in interest rates constituted more than two percent of after-tax income for 18 percent of households, while this share had risen to 26 percent in 2016. On the other hand, households

have put aside some of their funds to build up their liquid assets. This may suggest that fewer households have a high MPC, which will weaken the cash-flow channel. Overall, our analyses suggest that the cash-flow channel has become stronger in recent years, but that the increase is somewhat smaller than the total increase in net interest expenses in isolation would imply owing to increased buffers in the form of liquid assets.

In this article, our analysis has been limited to the effect of a change in interest rates on household consumption via the cash-flow channel. The total impact on consumption of a change in interest rates is influenced, however, by several factors in addition to the effect on households' current income. For both net borrowers and net savers, higher interest rates will increase the cost of consumption now relative to the future (the substitution channel), suggesting that consumption will decrease. Thus, for net borrowers the cash-flow and the substitution channel both pull in the direction of lower consumption. For net savers, the two effects pull in different directions. Higher interest rates will also affect household consumption via changes in employment, wages and asset prices. The duration of an interest rate increase also plays a role. If households expect persistently higher interest rates, it can reasonably be assumed that the effect will be stronger than if households expect the interest rate increase to be transient.



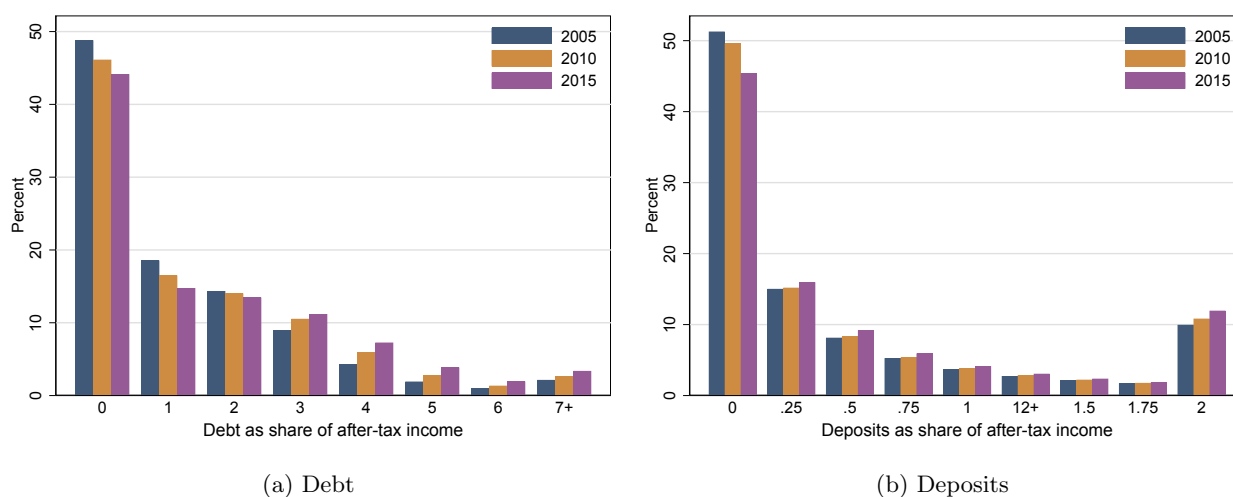
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## A More on the distribution of debt and deposits

The share of households with net debt remained stable at 66 percent between 2005 and 2015, but in parallel with the increase in aggregated debt ratios, the distribution of debt as a share of after-tax income has shifted to the right (Chart A.1(a)). The share of households holding debt equivalent to less than one year's after-tax income fell from 49 percent in 2005 to 44 percent in 2015. The share of households with debt of between one and five years' after-tax income remained stable at 46 percent, while the share with more than five years' after-tax income in debt increased from five percent in 2005 to over nine percent in 2015. At the same time, as households have increased their bank deposits as a share of income, the distribution of households by deposits as a share of after-tax income has also shifted to the right (Chart A.1(b)). The share of households with less than a quarter of a year's after-tax income in bank deposits fell from 51 percent in 2005 to 45 percent in 2015.

Chart A.1: Households distributed by debt and deposits as a share of after-tax income

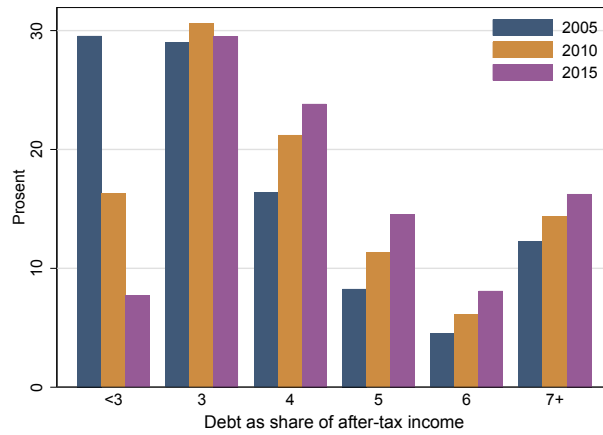


Sources: Statistics Norway and Norges Bank

An increasing share of aggregate net debt, and thereby an increasing share of the total increase in interest expenses following a rise in interest rates, is held by households with high debt ratios (Chart A.2). In 2005, households with a debt ratio of more than three would have borne 70 percent of the increase in interest expenses if interest rates had been raised. In 2015, this share was 92 percent. Households with a debt ratio of more than five would have borne 25 percent of the increase in interest expenses if interest rates had risen in 2005, while the figure for same group would have been 39 percent in 2015.

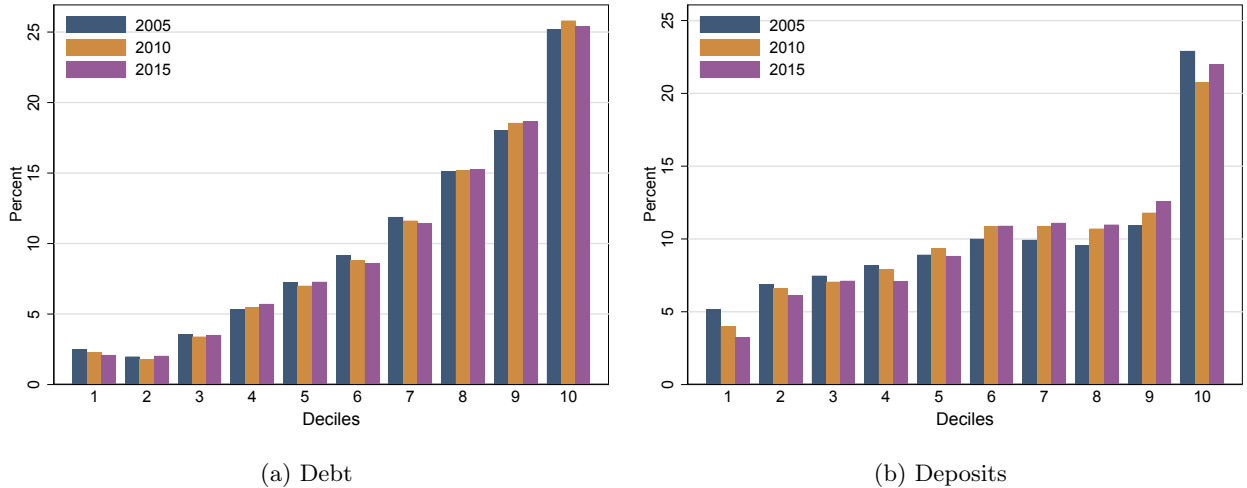
Even though the distribution of deposits and debt as a share of after-tax income has shifted to the right, the distribution of debt and deposits across households has not become more skewed. In Chart A.3, households are divided into ten equal groups by after-tax income. Chart A.3(a) shows the share of total debt held by each decile. This share has remained stable over time. Chart A.3(b) shows the share of total deposits held by each decile. This share has also remained fairly stable for most deciles, with the exception of deciles containing the lowest income households.

Chart A.2: Increase in total net interest expenses following a rise in interest rates, by debt as a share of after-tax income



Sources: Statistics Norway and Norges Bank

Chart A.3: Total debt and deposits by deciles for after-tax income



(a) Debt

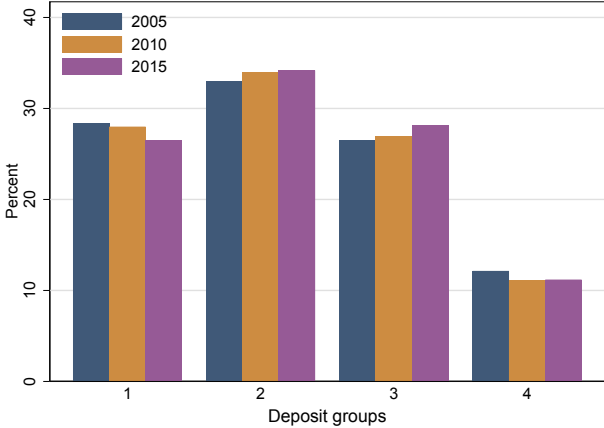
(b) Deposits

Sources: Statistics Norway and Norges Bank

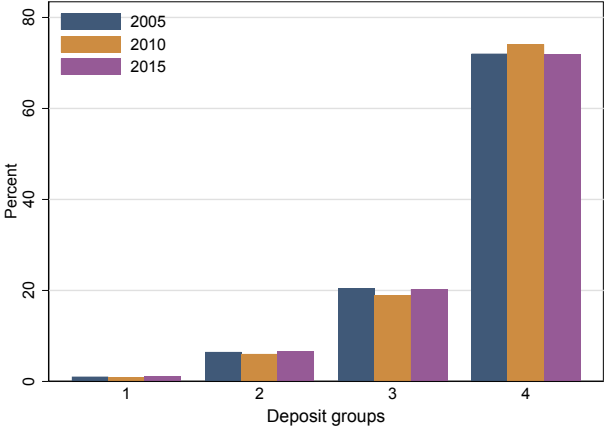
## B More on interest income and expenses for the different groups

In Section 5, we use four different methods to group households into deposit quartiles. The share of interest income, interest expenses and households that can be assigned to the different groups, using methods 2-4, is shown in Chart B.1-B.3.

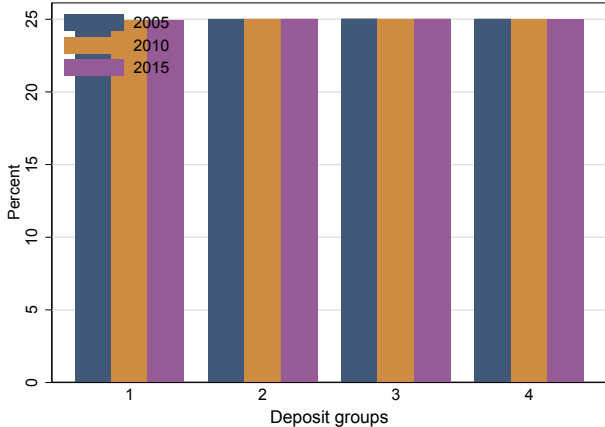
Chart B.1: Share of interest income, interest expenses and households in the different groups. Method 2<sup>1)</sup>



(a) Share of interest expenses



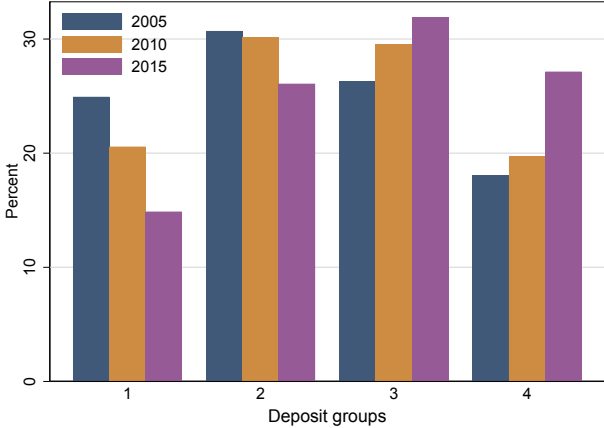
(b) Share of interest income



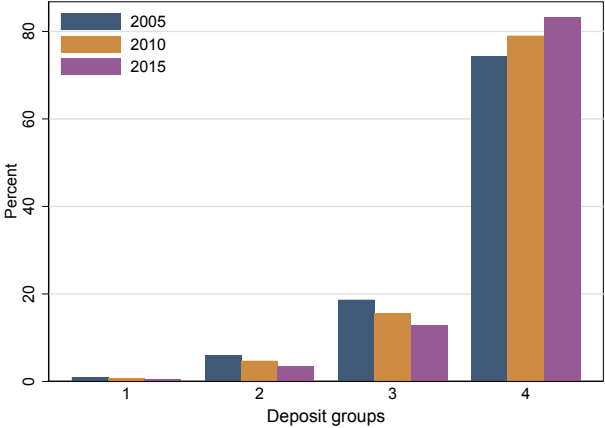
(c) Share of households

<sup>1)</sup>Method 2 divides households in each year into quartiles by bank deposits. Sources: Statistics Norway and Norges Bank

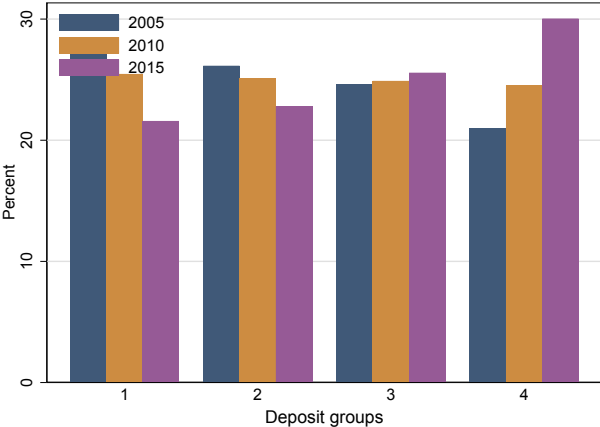
Chart B.2: Share of interest income, interest expenses and households in the different groups. Method 3<sup>1)</sup>



(a) Share of interest expenses



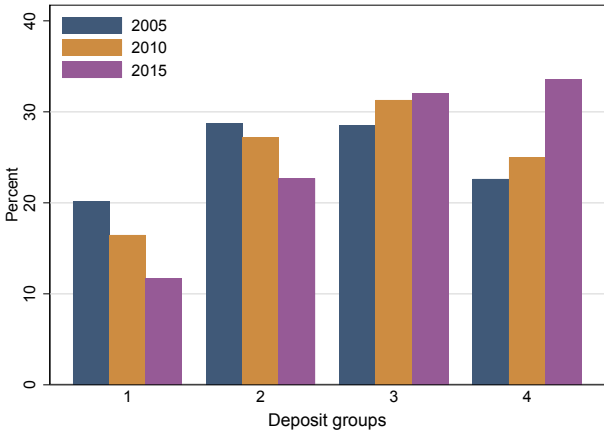
(b) Share of interest income



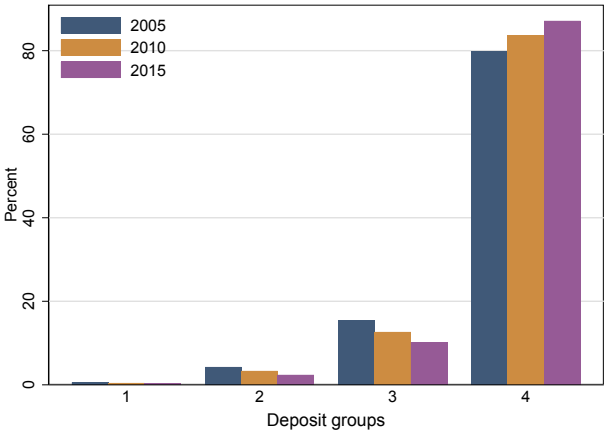
(c) Share of households

<sup>1)</sup>Method 3 divides households into quartiles by bank deposits for the entire period. Sources: Statistics Norway and Norges Bank

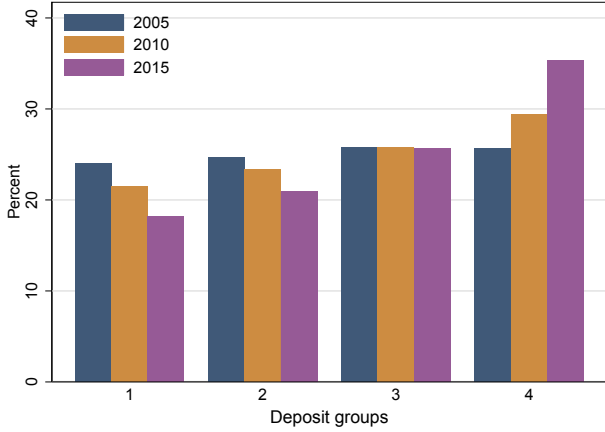
Chart B.3: Share of interest income, interest expenses and households in the different groups. Method 4<sup>1)</sup>



(a) Share of interest expenses



(b) Share of interest income



(c) Share of households

<sup>1)</sup>Method 4 divides households into four groups based on bank deposits held by the 25th, 50th and 75th percentiles, respectively, in 2004.

Sources: Statistics Norway and Norges Bank