

ECONOMIC COMMENTARIES

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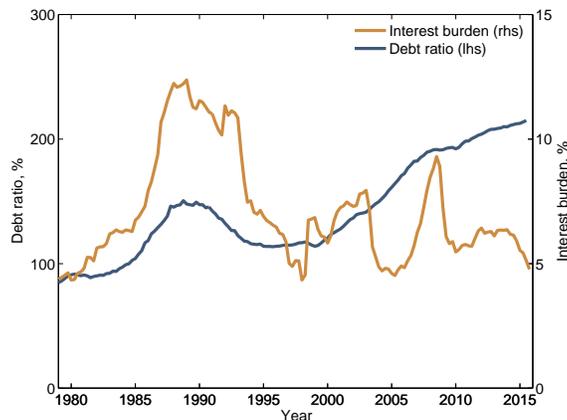
NORGES BANK

From a “critical interest burden” to a “vulnerable debt ratio”

Kjersti Næss Torstensen*

The debt ratio, measured as total household debt relative to disposable income, has risen markedly over the past 30 years (Chart 1). Changes in structural factors such as relaxation of credit standards and financial innovation have contributed to this rise. Such factors make it difficult to compare debt ratio levels over time. By utilising historical information on interest burdens, this commentary seeks to shed light on the extent to which the current debt ratio represents a source of vulnerability for the Norwegian economy. The analyses are based on a simple, static stress test of the household interest burden.

Chart 1: Household debt ratio and interest burden.¹⁾ 1979 Q1 - 2015 Q4



¹⁾For definitions on the debt ratio and interest burden see footnote 1.
Sources: Statistics Norway and Norges Bank

The vulnerability associated with the current debt level may be elucidated, under some simple assumptions, by utilising the close relationship between the debt ratio and the interest burden (see Emanuelsson, Melander og Molin (2015)).¹ If the household debt ratio (\widehat{DR}_t) is calculated as total debt as a share of after-tax income excluding tax-deductible interest, the interest burden (IB_t) and debt ratio are related in the following manner

$$\widehat{DR}_t = \frac{b_t}{y_t} = \frac{1}{(1 - \tau_t)i_t} IB_t, \quad (1)$$

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¹In this commentary, the debt ratio is defined as loan debt of households and non-profit organisations as a percentage of disposable income over the past four quarters. The interest burden is defined as interest expenses after tax as a percentage of disposable income plus interest expenses after tax, hereinafter referred to as after-tax income excluding tax-deductible interest. Disposable income is adjusted for estimated reinvested dividend income for 2003 - 2005 and redemptions/reduction of equity capital for 2006 Q1 - 2012 Q3.

where i_t is the interest on loans to households, b_t is total debt, τ_t is the tax rate on interest expenses and y_t is after-tax income excluding tax-deductible interest. Norges Bank ordinarily defines the debt ratio as total debt relative to disposable income (DR_t), and we seek to quantify a vulnerable level for this measure.² In the calculation of a vulnerable debt level, it is assumed that the ratio between DR_t and \widetilde{DR}_t is constant and equal to 1.065, which is the average relative difference over the past five years.³

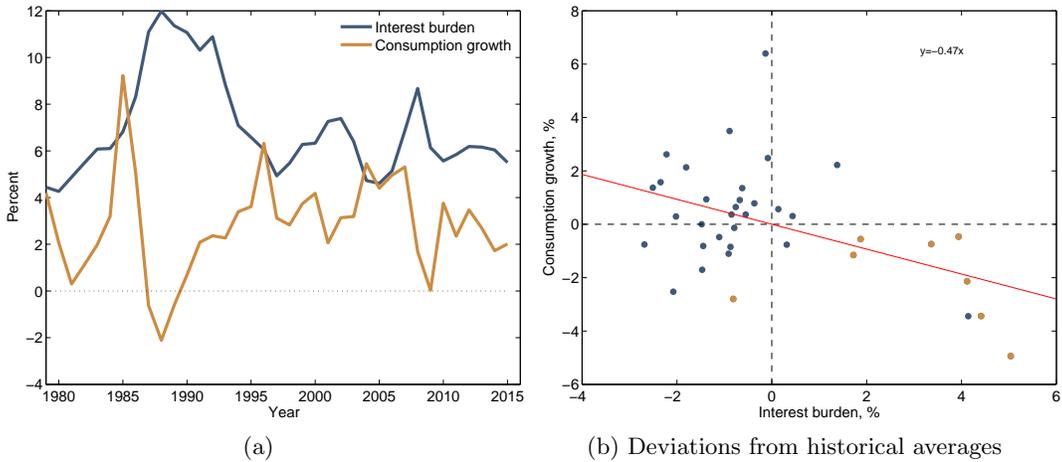
The calculation of a vulnerable debt ratio depends on two important factors: (i) a “critical level” of the interest burden (κ), which is a level of the interest burden that entails a considerable macroeconomic risk, and (ii) a “stressed interest rate” (\tilde{i}), which is the lending rate that can occur in a crisis scenario. By quantifying κ and \tilde{i} , a vulnerable debt ratio (\widetilde{DR}) can be calculated in this manner:

$$\widetilde{DR} = 1.065 * \widetilde{DR} = 1.065 * \frac{1}{(1 - \tau)\tilde{i}}\kappa. \quad (2)$$

“Critical level” of the interest burden

A “critical level” of the interest burden should reflect a level where there is a risk of a steep fall in household demand from macroeconomic shocks, and/or a marked risk of a financial crisis. It is difficult to quantify such a critical level. We analyse this in two steps: first we look at the historical correlation between the interest burden and household consumption growth and real house price inflation. Then we use the historical distribution of the interest burden to calculate a critical level.

Chart 2: Interest burden and consumption growth.^{1),2)} 1979 - 2015



¹⁾Consumption growth measured in volume.

²⁾The yellow circles in chart (b) mark observations during the banking crisis (1988-93) and the financial crisis (2008-09).

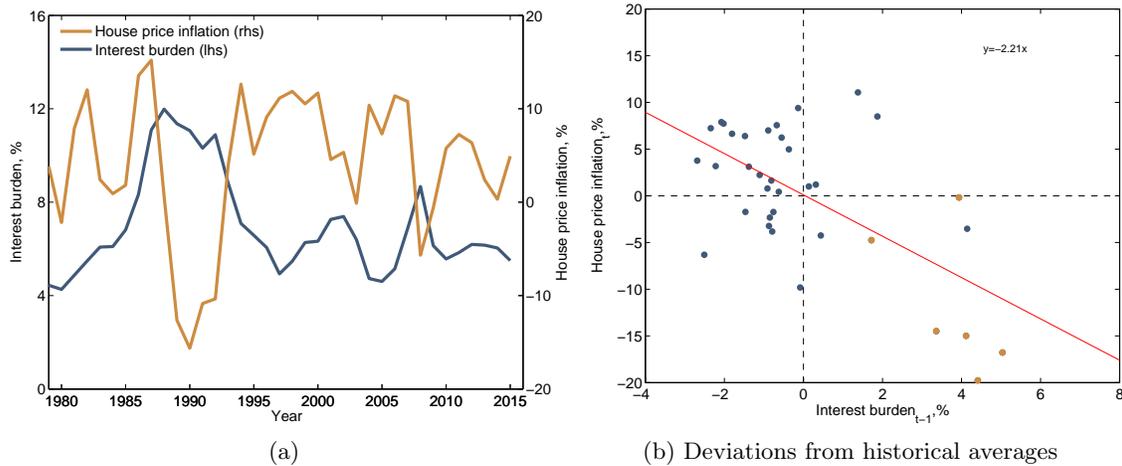
Sources: Statistics Norway and Norges Bank

²The difference between the two definitions of the debt ratio is the income term. A higher debt entails higher interest expenses and thus lower disposable income, while after-tax income excluding tax-deductible interest is unaffected. Thus, higher debt results in a sharper rise in DR_t compared with \widetilde{DR}_t , because in the former instance, the denominator decreases when the numerator increases.

³The difference between the two measures has been stable over the past five years, with the highest and lowest relative difference at 1.059 and 1.069, respectively.

The interest burden affects the amount of household income available for consumption. In Norway, there has historically been a strong negative correlation between the interest burden and consumption growth (Chart 2 (a)). Chart 2 (b) shows the correlation between the interest burden and consumption growth relative to their historical averages. Most observations are in the upper-left and lower-right quadrants of the chart: periods characterised by a lower (higher) than average interest burden saw higher (lower) than average consumption growth. Both during the banking crisis and at the beginning of the financial crisis, the interest burden was higher than average and consumption growth lower than average (the yellow circles in the chart).^{4,5}

Chart 3: Interest burden and real house price inflation.^{1);2)} 1979 - 2015



- ¹⁾Real house prices are calculated as house prices deflated by the consumer price index.
²⁾The interest rate burden is lagged one period in chart (b). The yellow circles mark observations during the banking crisis (1988-93) and the financial crisis (2008-09).
Sources: Statistics Norway and Norges Bank

The interest burden also affects the housing market. The interest burden and real house price inflation have historically shown a strong negative correlation (Chart 3(a)). Both during the banking crisis and at the beginning of the financial crisis, the interest burden was high and real house price inflation was negative. The interest burden appears to affect house prices with a time lag. Chart (b) shows the relationship between real house price inflation and the interest burden one year previously, both measured as deviations from their historical averages. There is a strong tendency for years with a higher (lower) than average interest burden to be followed by higher (lower) than average house price inflation the following year. The negative correlation between the interest burden, consumption growth and house price inflation supports the proposition that a high interest burden represents a macroeconomic risk.

Following Emanuelsson et al. (2005), we derive a critical level of the interest burden by using the historical distribution. Chart 4 (a) shows the historical distribution of the interest burden. The 5

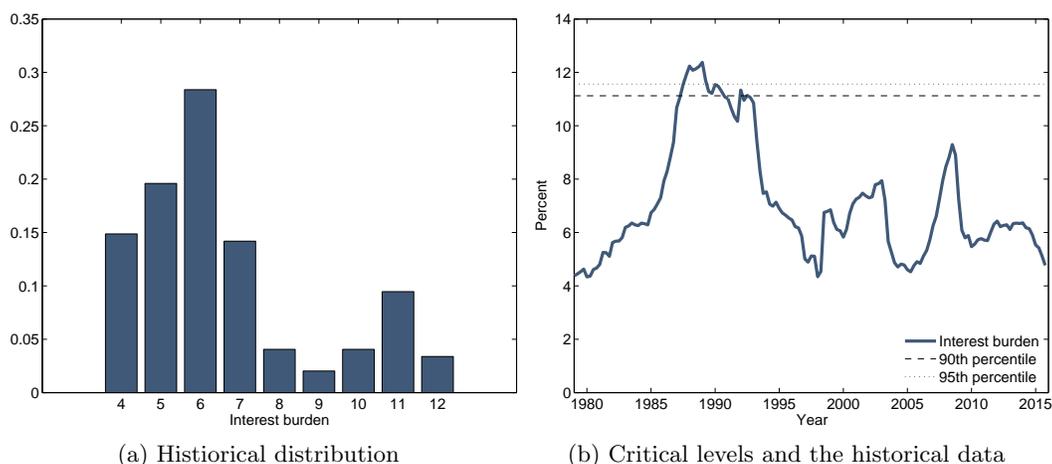
⁴The one yellow circle located outside the lower right quadrant of the chart is the observation for 2009.

⁵Juselius and Drehmann (2015) find that an increase in the debt service burden, defined as interest payments plus amortisations as a share of nominal GDP, has a negative effect on growth in household consumption and investment. The debt service burden in Norway also shows a negative correlation with consumption growth (see Monetary Policy Report 4/15). Vatne (2014) finds that Norwegian household income available for consumption will fall by 8 percent if the interest rate increases by 3 percentage points and house prices fall by 30 percent.

percent highest values of the interest burden are above 11.6 percent, and coincide with the banking crisis (Chart 4 (b)). In the remainder of this analysis, the interest burden is defined as “critical” if it exceeds the 95th percentile.

However, there is considerable uncertainty regarding the critical level. Strong growth in household debt ratios increases the share of income tied up in repaying debt. Household debt service ratios, measured by household interest expenses and estimated principal payments as a percentage of after-tax income excluding tax-deductible interest, are now close to the level reached during the banking crisis (see box on page 53 in Monetary Policy Report 4/15). In isolation, this suggests that a critical level for the interest burden is currently lower than during the banking crisis.

Chart 4: Historical distribution and critical levels of the interest burden. 1979 Q1 - 2015 Q4



Sources: Statistics Norway and Norges Bank

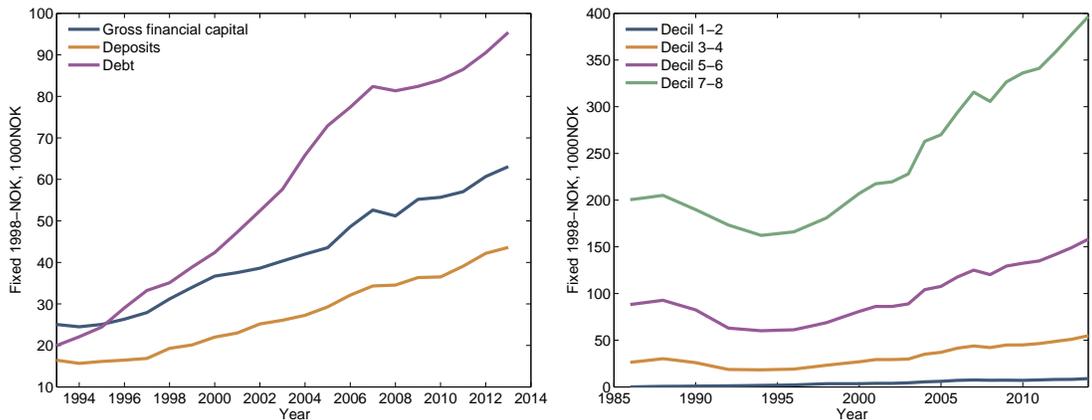
A critical level of the interest burden also depends on households’ financial buffers. Larger financial buffers among households may mitigate the demand risk associated with a negative income shock or interest rate increase. The median value of Norwegians’ gross financial capital, at constant 1998 NOK, has risen steadily since 1993 (Chart 7 (a)). However, the percentage increase in bank deposits and gross financial capital is considerably lower than the increase in debt. Chart 7 (b) shows average gross financial capital for households, at constant 1998 NOK, for gross financial capital deciles 1 through 8. All groups have increased their gross financial capital compared with 1986. Households with medium financial wealth (deciles 3-8) have approximately doubled their gross financial capital, while those with the least financial wealth (deciles 1-2) have approximately 15 times higher gross financial capital today compared with 1986.⁶ The real increase in households’ gross financial capital for all groups indicates that households are currently better positioned to cope with a loss of income or interest rate increase than they were previously.⁷ In isolation, this suggests that a critical level of the interest burden is lower compared with previous periods.

To make the estimates of a vulnerable level of the debt ratio somewhat more robust, we also

⁶Deciles 1 and 2 have experienced a strong increase, but from very low levels. Households with the highest financial wealth (deciles 9 and 10) have been omitted from the chart. This group’s gross financial capital in 2014 was nearly four times higher than in 1986.

⁷In addition to household saving, the government has saved a considerable amount, which probably affects household saving. This is not an immaterial factor, but requires more analysis and has been omitted.

Chart 5: Financial wealth and debt.^{1),2)}



(a) Median. 1993 - 2013

(b) Distribution of gross financial capital.³⁾ 1986 - 2014

¹⁾Deflated by CPI.

²⁾Chart (a) refers to the median person, whereas Chart (b) shows the distribution at the household level.

³⁾Observations are biennial between 1986 and 2000. Synthetic observations for years in between have been generated using linear interpolation.

Sources: Statistics Norway and Norges Bank

refer to calculations where the interest burden is defined as “critical” if it exceeds 9 and 10 percent, respectively. Both of these levels are historically associated with a substantial fall in consumption growth: in 1986, the interest burden was 8.32 percent and consumption growth fell by 4.2 percentage points from 1985. In 2008, the interest burden was 8.7 percent and consumption growth declined by 3.6 percentage points compared with 2007.

“Stressed interest rate”

How high a lending rate is it reasonable to assume in a possible crisis scenario? Following Emanuelsson et al. (2015), we calculate a “stressed interest rate” as the sum of the normal money market rate, a lending margin and a crisis margin.⁸ We assume a long-term normal money market rate of 4 percent, a lending margin of 2 percent and a crisis margin of 2 percent.⁹ This results in a “stressed interest rate” of 8 percent. This estimate of the stressed interest rate is not intended to reflect the most probable interest rate, but is the interest rate that can occur in a scenario where the economy and financial sector are particularly stressed.

⁸In normal times, there will be a tendency for wage growth and the key policy rate to move in the same direction. Underlying the analyses in this commentary is the assumption that total household income is kept constant. Falling incomes in a crisis scenario will amplify the macroeconomic risk associated with a high interest burden and a high debt burden.

⁹Over the past 10 years, the average lending margin has been 1.78 percentage points. During the financial crisis (2008 Q3 - 2009 Q3), the average difference between the key policy rate and the lending rate was 2.7 percentage points, and in 2009 Q1, the difference was 3.49 percentage points. In the stress tests presented in the 2015 Financial Stability Report, the maximum difference between the key policy rate and the lending rate was 4 percentage points.

A vulnerable debt ratio

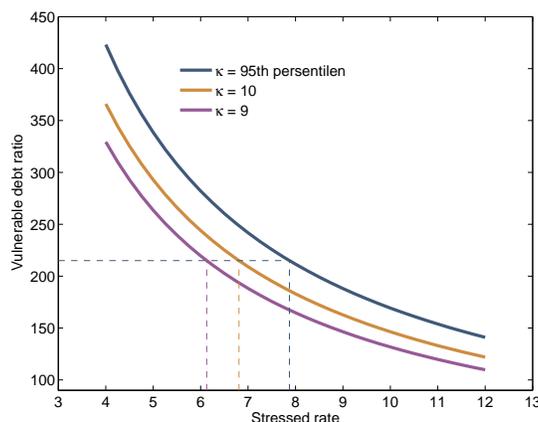
By applying equation (2) and the assumptions of a critical level of the interest burden equal to the 95th percentile and a stressed interest rate of 8 percent, the debt ratio is vulnerable when it exceeds 212 percent.¹⁰ This indicates that the current debt ratio of 215 percent (2015C3) is at a vulnerable level.

However, there is considerable uncertainty linked to these calculations, and they are sensitive to assumptions regarding critical level and stressed interest rate. Chart 6 shows how a vulnerable level of the household debt ratio depends on the assumption of a stressed interest rate and critical interest burden. According to these calculations, if a stressed interest rate is lower than 8 percent, households are able to tolerate a higher debt ratio than the current level. If the interest rate in a crisis scenario can be higher than assumed, the threshold for a vulnerable debt ratio falls. Similarly, the threshold for a vulnerable debt ratio falls if the level of a critical interest burden falls. If we assume a stressed interest rate of 8 percent, the debt ratio is vulnerable when it exceeds 164 percent for a critical interest burden of 9 percent, and 182 percent for a critical interest burden of 10 percent.

On the basis of the current debt ratio of 215 percent, we are vulnerable to a stressed interest rate of 6.1 percent if the interest burden is critical when it exceeds 9 percent (broken line in the chart). Similarly, the calculations show that a debt ratio of 215 percent is vulnerable if the debt burden is critical when it exceeds 10 percent and a stressed interest rate exceeds 6.8 percent.

The calculations do not take into account changes in other factors in the economy during a crisis. Declines in income and/or wealth in a crisis will amplify the consumption response and increase the interest burden and debt ratio.

Chart 6: Vulnerable level of the debt ratio



¹⁾ The horizontal line marks a vulnerable debt ratio of 215 percent. The points of intersection with the lines representing the three measures of a critical interest burden is at interest rates of 6.1, 6.8 and 7.9 percent, respectively.

¹⁰Note that both the calculated level of a critical interest burden and the threshold value of a vulnerable debt ratio may change if the underlying data are revised.

How much can the interest rate rise before households reach a critical interest burden?

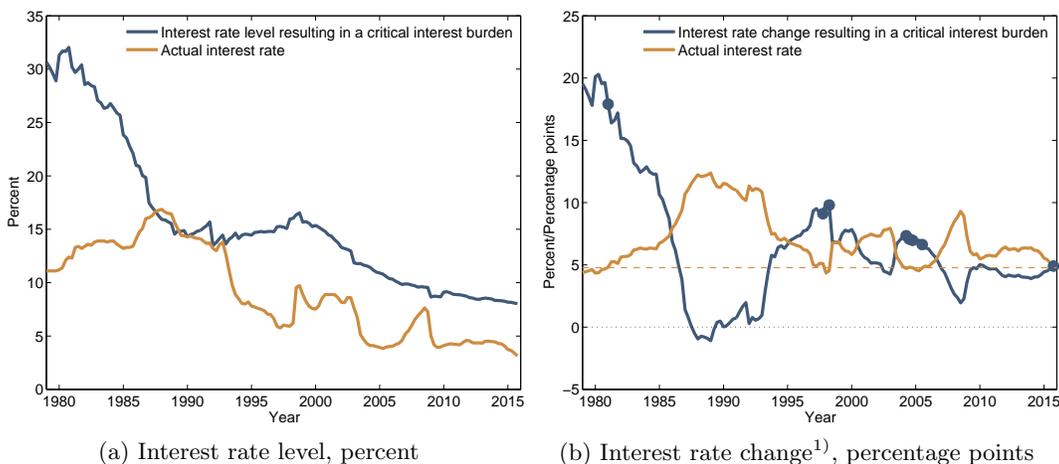
In the analysis above, we find the level of the debt ratio that at a given stressed interest rate results in a critical interest burden, and define this as a vulnerable debt ratio. In this section, we seek to shed light on the vulnerability associated with the household debt ratio by calculating the interest rate sensitivity of the interest burden. We calculate the interest rate increase that, given the historical debt ratio, would result in a level on a par with the critical values.

We assume that household income excluding interest income is unchanged. Let Δi_t be the interest rate change necessary to obtain an interest burden equal to the critical level, κ . Δi_t is given by

$$\Delta i_t = \frac{\kappa y_t - (1 - \tau) i_t b_t}{(1 - \tau) b_t - \kappa (1 - \tau) d_t}, \quad (3)$$

where d_t is household deposits.¹¹ We assume that the interest rate change is identical for debt and deposits, which is supported by data for the relevant period.¹² Chart 7 (a) shows the interest rate level that will result in a critical interest burden, defined as an interest burden above the 95th percentile, along with an actual lending rate for households. The negative trend in the calculated interest rate level that would result in a "critical interest burden" mirrors the trend increase in the debt ratio.

Chart 7: Interest level and change that leads to a critical interest burden. 1979 Q1 - 2015 Q4



¹⁾The yellow dashed line indicate the level of today's interest burden. The blue circles show interest changes which would result in a critical interest burden in periods with an interest burden similar to today's level.

Sources: Statistics Norway and Norges Bank

Chart 7 (b) shows the magnitude of interest rate changes that would have historically resulted in a critical interest burden. Currently (2015 Q4), an interest rate change of 4.9 percentage points

¹¹We find Δi_t by solving the following expression: $\frac{(1-\tau)(i_t + \Delta i_t)b_t}{y_t + (1-\tau)\Delta i_t d_t} = \kappa$, which shows the interest burden following a change in the interest rate equal to Δi_t .

¹²The average difference in the change in households' interest rates on debt and deposits is 0.07 percentage point in the relevant period.

will result in a critical interest burden.¹³ Higher debt has increased households' vulnerability to an interest rate increase: the blue circles show the interest rate change that would result in a critical interest burden in periods with approximately the same interest burden as currently. The household interest burden has been approximately equal to the current level seven times since 1980, but the interest rate change that would result in a critical interest burden, given this interest burden level, has fallen markedly in the same period. The falling trend shown by the blue circles in Chart 7 (b) indicates that households are currently more vulnerable to an interest rate increase than they were previously.¹⁴

Lessons and limitations

The analyses indicate that the household debt ratio is at, or close to, a vulnerable level. The analysis also shows that households' interest rate sensitivity has risen owing to the higher debt ratio. The interest rate increase that would result in a critical interest burden today is smaller compared with previous periods when the interest burden was approximately equal to the current level. If the interest rate increases by 4.9 percentage points today, the interest burden will be critically high, all else being equal.

The analyses are based on an assumption that the interest burden levels observed during the banking crisis are also associated with a considerable macroeconomic risk today. Larger financial buffers indicate that households are better prepared to cope with a loss of income or interest rate increase today compared with previous periods. This suggests in isolation that a vulnerable level of the debt ratio is higher than the analyses indicate. On the other hand, a higher debt ratio results in a larger share of income being tied up in servicing debt. This indicates that households may tighten consumption to a greater extent in the event of a loss of income or interest rate increase today compared with previous periods. This suggests that a vulnerable level of the debt ratio may be lower than the analyses indicate.

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¹³An interest rate increase of 4.7 percentage points will result in a critical interest burden if interest income is kept constant

¹⁴This analysis does not take into account other factors that may have affected vulnerability.