

Financial risks in the household sector

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1. Introduction

For many years, housing prices and household indebtedness in Sweden have risen sharply, primarily in major cities and other growth regions. Reasons for this include structural problems in the Swedish housing market, and ever-declining interest rates. This has led the aggregate household balance sheet, with assets mainly in the form of residential property, equities and funds, as well as debt principally in the form of mortgages, to expand at a pace far in excess of the rate of increase of households' disposable income. It is therefore legitimate to ask whether this trend results in risks that are damaging to the Swedish economy in the long term. Financial crises have often been preceded by rapid growth in lending and housing prices, and high indebtedness risks amplifying the negative effects brought about by a crisis.

The purpose of this study is to attempt to assess what risks could be associated with the Swedish household balance sheet, particularly the level of indebtedness. We will also discuss different indicators that could be useful in such an assessment.

The following section discusses the household balance sheet and economic risks from a fundamental perspective.

Section 3 provides an overview of empirical research on the link between financial crises, housing prices and indebtedness.

Section 4 then tests two different approaches for assessing the risks posed by Swedish households' current indebtedness. In the first approach, we analyse historical outcomes of the aggregate household interest-to-income ratio. The aggregate household interest-to-income ratio refers to household interest expenditure in relation to their income. The intention is to see whether any lessons can be learned from the crisis of the 1990s and experience from other countries. In the second approach, we take a closer look at the distribution of household debt and apply international experience to Swedish micro data.

Section 5 discusses other indicators that could be used to assess financial risks in the Swedish household sector.

Finally, we draw some conclusions in section 6. The findings of both approaches used in this study indicate that the indebtedness of Swedish households is currently at a level that could pose heightened risks to the economy. There is some uncertainty associated with the findings and they should of course be interpreted with caution. Yet, they nevertheless give indications of the Swedish economy being more vulnerable due to high household indebtedness.

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Mediating loans to households and corporations is among the most important functions of the financial system. However, past experience shows that if household debt increases sharply, the risk of a financial crisis, or a drop in housing prices, increases. Theoretical studies have long argued that the level of household debt is also of significance to risks in the economy, and this view has recently gained greater empirical support. This study examines the household balance sheet from a fundamental perspective and describes empirical research in this area. We also examine two approaches for assessing the risks in Swedish households' current indebtedness. The first approach, which is based on aggregate data, indicates that the current aggregate household debt-to-income ratio poses heightened risks to the Swedish economy. However, in order to assess these risks in more detail it is also necessary to study how debt is distributed between households. Using an alternative approach, we apply experience from countries affected by falls in housing prices to Swedish household-level statistics. Using this approach, we are able to illustrate how much household consumption could decrease as a result of high indebtedness in the event of a future macroeconomic shock. We also discuss other indicators that could be of use in assessing the risks in household indebtedness.

2. The household balance sheet and risks to the Swedish economy

The ability to borrow is good for the economy...

Credit is one of the economy's most important lubricants. Access to credit is important to the corporate sector, for example in enabling investment and managing cash flow fluctuations. But, it can also be of great significance to the household sector. Credit enables households to distribute consumption over their lifecycle, for example by borrowing for studies and accommodation when they are young, or to bridge temporary liquidity shortages than can occur in life.² The benefit of being able to spread out consumption over a household's lifecycle can be illustrated as in Figure 2.1.^{3, 4}

It is natural for households to assume debt, and the possibility to borrow contributes to improving the welfare of households and, consequently, also society at large. The intermediation of loans is therefore one of the most important functions of the financial system.⁵

... but high indebtedness also poses risks

However, high indebtedness may also be associated with risks, both for individuals and for society as a whole. For an individual household, high indebtedness may result in the household becoming more sensitive to economic shocks. If the household's cash flow changes, for instance because of reduced income or increased interest payments, its finances can come under strain. If the price of the home that has been mortgaged also falls, it can be difficult for a household to escape from an already challenging situation. Such a household could be stuck with loans on which it finds it difficult to pay interest and amortisation. During long periods of low interest rates and rising housing prices, there can also be a tendency among households to underestimate the risk of economic conditions changing rapidly.⁶ Currently in Sweden, with extremely low interest rates and housing prices rapidly on the rise, there is reason to fear that such tendencies among households will intensify.

Yet, most households are probably not completely unaware of the risks in borrowing. Households considering taking out a loan to purchase a new home must take account of a series of factors. This decision involves a "portfolio" choice involving many separate components. In order for the household to determine, for instance, the size of the loan it will take out, the length of the fixed-interest period and how much to amortise, it must consider factors such as wealth, present and expected income, present and expected mortgage rates, the price of the home and future price development, how much it wishes to consume, the extent of pension saving, etc.⁷ These are not easy decisions, and some studies also suggest that many households choose suboptimal loan contracts.⁸

Nonetheless, most households probably take account of the fact that interest rates may rise and housing prices may fall, although the degree of risk aversion and how realistic expectations are may vary between households and also change over time. The fact that individuals cannot enter bankruptcy as easily as corporations and thereby be released from their debt burden also means that households would probably reduce consumption than default on a loan payment. Finansinspektionen's (the Swedish Financial Supervisory Authority) 2015 stress tests of new mortgage borrowers also suggest that most new mortgage borrowers in Sweden would be able to pay their mortgage in the event of a significant deterioration in macroeconomic conditions, even if this would mean them consuming or saving less. Unemployment insurance and social insurance also provide many households with an additional

2. See Modigliani and Brumberg (1954), Friedman (1957) and Ando and Modigliani (1963).

3. Note that the lifecycle hypothesis is based on loans taken out at present being repaid later on in life. Assets and inheritances are therefore not taken into account in this theory. In reality, it is more complicated, as assets and inheritances do play a role.

4. See, for example, Levine (1997) and Levine (2005). See also Sveriges Riksbank (2013a).

5. See Sveriges Riksbank (2013a).

6. See, for example, Kahneman, Slovic and Tversky (1982), Case and Shiller (2003) and Case et al. (2012).

7. See, for example, Campbell and Cocco (2003) and Jansson (2014).

8. See, for example, Agarwal et al. (2006) and Almenberg and Karapetyan (2010).

safety net. Furthermore, banks also take measures to protect themselves from credit losses, for example by accepting collateral and carrying out credit assessments prior to lending.

These factors, which are largely of an institutional nature, help reduce the risk of problems affecting Swedish households directly spreading to banks via credit losses on mortgages, although this risk cannot be entirely eliminated. If this occurred, it could lead to problems in the financial system as a whole. At the same time, however, the safety nets that are intended to protect households, and which indirectly also protect the banks, can lead to households and banks alike omitting to perform risk assessments as thorough as those they would perform if there were no safety nets. This moral hazard can reinforce both households' and banks' incentives to increase indebtedness in the household sector.

Macroeconomic vulnerability poses the greatest direct risk

For the Swedish economy at large, the greatest direct risk in excessive household indebtedness is probably rather that it brings about greater macroeconomic vulnerability. If one assumes that most individual households take rational decisions when they borrow for a mortgage, the sum of all individual decisions can lead to an undesirable outcome for the economy. If enough households take on debt in a way that makes them extra sensitive to different types of shock, this can result in negative externalities that extend beyond a household's own economy to the economy at large. If enough households simultaneously choose to consume less, the effect on aggregate consumption can hamper growth in the economy as a whole.⁹

Fisher (1933) discusses, as early as in the 1930s, how the economy risks getting stuck in a vicious circle of deflation and recession when household indebtedness is too high. In turn, this can make the debt burden in real terms even greater. Koo (2008, 2013) highlights how, following a sharp and long-term debt adjustment, a recession can reinforce a downturn in demand. In the same way as in Japan, this can, at worst, lead to decades of lost growth, with households and corporations endeavouring to minimise debt rather than maximise profits. Minsky (1986) puts forward the hypothesis of recurring cycles, with periods of economic stability leading to indifference to excessive indebtedness, which in turn paves the way for future crises. King (1994), along with Eggertson and Krugman (2012), takes this theoretical argument further and focuses on how indebted households' sensitivity to shocks can affect aggregate consumption in the economy. Alsterlind et al. (2013) also discuss how high indebtedness can affect households in the event of a drop in housing prices through effects on household wealth and ability to take out new loans. New empirical studies support the hypothesis that if households are highly indebted, the sensitivity of consumption to various types of shocks increases. This applies in particular if asset prices – particularly housing prices – fall (we revert to this in section 3).

Macroeconomic and financial instability are connected

It is also perceivable that the financial system too might come under strain in the event of macroeconomic shocks. This could in turn lead to an intensification of the macroeconomic downturn.

In particular, household indebtedness can have an impact on external expectations of the banks' resilience to macroeconomic shocks. As mortgage lending is such an important part of the Swedish banks' business, heightened vulnerability among the banks' mortgage customers could lead to financial markets' confidence in the banking sector being eroded. This, in turn, could affect the banks' funding terms. For example, it is not entirely unreasonable that a weakened Swedish economy combined with a declining housing market could affect the willingness of financial entities to invest in Swedish covered bonds. In other words, it could become both more difficult and more expensive for Swedish banks to obtain funding on the international capital markets. This could lead to higher interest rates for Swedish borrowers at a time when their financial situation is already under strain, which could further aggravate the recession.

9. See Engel (2014) for a description of these types of externalities and references to relevant literature.

There is also other feedback between the real and the financial sectors. A recession that results in reduced consumption, increased unemployment and more corporate bankruptcies will probably lead to increased loan losses for banks. If banks respond by tightening credit, this has implications for growth and employment, which in turn can lead to further loan losses for banks and so on.

While household indebtedness does not pose a *direct* threat to financial stability, the financial system may thus be *indirectly* affected in various ways that aggravate the negative economic spiral. Figure 2.2 shows the risks associated with high household indebtedness.¹⁰ The fact that the Swedish banking system is large, concentrated and closely interconnected may mean that these risks are greater than in other comparable countries.

Society faces a difficult optimisation problem

When decisions that appear rational from a personal finances point of view are not optimal from a social economic perspective, this is usually referred to as a “market failure”. A market failure may need to be addressed by some form of state intervention or regulation. From the point of view of society, such a measure aims – in this particular context – to avoid major risks building up to the point where they could seriously damage the economy in the event of a future shock.

If some sort of regulation is introduced to avoid major risks, this could entail both costs and benefits. The extent thereof naturally depends on how the regulation is devised.¹¹ Generally, however, costs primarily consist of the loss of welfare involved when more households are not able to borrow and consume when they like. If an increase in credit is unsustainable, such constraints are desirable, but they are not desirable if actions are taken that are not necessary. Economic growth can also be affected negatively. Moreover, regulations are likely to have distribution effects, with some households gaining while others will lose. For example, measures that limit the ability to borrow mainly affect households outside the housing market. At the same time, those households could benefit if the introduction of the measure leads to lower housing prices. Households that already own property could be negatively affected if housing prices fall as a result of measures taken or expected future measures. But they could be even more affected if housing prices fall sharply in a future crisis.

The benefit for society from regulating indebtedness lies in avoiding or at least reducing the most serious economic consequences of a future shock. A crisis in the financial system is serious and can result in corporations entering bankruptcy, people being made unemployed and a deterioration in government finances. It often takes a long time for the economy to recover and it is uncertain whether the losses can be entirely regained (see Chart 2.3).¹²

In a nutshell, society faces an optimisation problem, where it is desirable to have a level of indebtedness among households that capitalises as much as possible on the benefits of debt, without this being outweighed by the risks to the macroeconomy and financial stability (see Figure 2.4.).

In reality, of course, it is very difficult – or impossible – to determine where the exact point of balance lies. As with so many other issues, governments thus face the dilemma of taking decisions without having all the information at their disposal. They essentially need to weigh up the risk of making a “type 1” error, i.e. of taking a costly measure today that then turns out not to have been necessary, against making a “type 2” error, i.e. failing to take action today that later turns out to have serious consequences for the economy. A circumstance that possibly suggests a bias towards type 2 errors is that the political price for taking action that is regarded as unpopular today in the short term may be viewed as higher than the cost of not taking action in time. The cost of taking an action mainly occurs in the near future, whereas the costs of not taking action are uncertain and occur further in the future.

10. See Alsterlind et al. (2014), Marklund (2014) and Sveriges Riksbank (2014) for a more detailed discussion of these different risks.

11. See for example Arregui et al. (2013).

12. See, for example, Haldane (2010) and Reinhart and Rogoff (2010).

Asset value and liquidity vary

When assessing risk, it is important to look at both household debt and assets. In principle, the macroeconomic risks of high debt in relation to disposable income ought to be lower if a household has sufficient assets that can be sold or mortgaged in order to stave off a deteriorated cash flow.

Assets are usually divided into real and financial assets. Real assets include, for example, homes owned by households, mainly houses, tenant-owner apartments and holiday homes. In addition, households may have financial assets in the form of, for example, securities, fund units and pension savings. Furthermore, individuals are sometimes referred to as having human capital in the form of knowledge and skills acquired through education and experience.¹³

However, many types of asset can rapidly fall in value or become difficult to sell and mortgage, particularly in the event of some kind of macroeconomic shock. A drop in asset prices may, for example, be due to erroneous valuation to begin with, i.e. asset prices being higher than motivated based on fundamental economic factors, such as interest rates, income, etc.

At the same time, it is difficult to assess whether or not assets are overvalued. Before the global financial crisis, for example, many claimed that prices in the US housing market reflected fundamental factors.¹⁴ But prices fell a few years later. In terms of the present conditions in Sweden, a number of studies show that there are signs of the Swedish housing market potentially being overvalued.¹⁵ However, whether or not this is the case can hardly be proven with certainty by anyone today.¹⁶

Even if a market is not regarded as overvalued initially, changes in fundamental factors, such as taxes or interest rates, can of course trigger a fall in prices. That risk is particularly large if the fundamental factors themselves are not in equilibrium in the long term, for example if interest rate levels are much lower than normal. When market expectations suddenly change for some reason, this can lead to rapid changes in asset prices, while the value of debts remains fixed in nominal terms. In other words, assets are more volatile than debt.

It is also not unusual, for example, for housing prices and the prices of financial assets to follow one another. Correlation between different asset classes also usually increases in the event of a shock.¹⁷ One reason for this is that both housing prices and the price of financial assets are to some extent affected by the same factors, such as household income, the interest rate level and expectations about future price developments. Households that suffer a fall in the price of their homes may consequently be simultaneously affected by the value of their financial assets, such as securities and fund holdings, also decreasing. In the latest financial crisis, for example, there was a rapid fall in the value of both real and financial assets in large parts of the world.

Beyond the direct impact on the wealth of a household, a fall in equities and housing prices may also indirectly affect a household's incentives and behaviour. Empirical studies have, for example, shown that households often avoid selling assets if the price is lower than the purchase price. This sort of behaviour has been identified in both the stock and housing markets.¹⁸ Also, the household must often pay taxes and fees on a sale.¹⁹ In addition, an active choice by a household is needed in order to sell an asset or borrow more, which leads to further information and transaction costs. These circumstances might mean that heavily indebted households opt to adjust their savings and consumption even if their net worth (assets minus liabilities) is already high (see also section 3).

13. Human capital comprises the net present value of current and future income. In practice, however, the value of future income is very difficult to estimate, which means that current income is often used as an estimate of human capital.

14. See Gerardi et al. (2010). Bernanke (2010) too describes the difficulties the Federal Reserve had in determining whether or not the US housing market was over-valued during the years before the crash in prices.

15. See, for example, the European Commission (2015), International Monetary Fund (2014) and Sørensen (2013).

16. See, for example, Sveriges Riksbank (2011) and Englund et al. (2015).

17. See, for example, Solnik (2006).

18. Gensove and Mayer (2001) demonstrate that households faced with the choice of realising a loss on their property often put a higher starting price on it compared with similar items for sale, take longer to sell assets and also are less inclined to go ahead with a sale. Einjöv et al. (2008) find that households are more than twice as likely to sell their property if they will make a profit compared to if they will make a loss.

19. A sale of a property results, for example, in estate agent fees, as well as capital gains tax and stamp duty.

More detailed data enables better analysis

Aggregate measures of items on the household balance sheet can provide some indication of the risks to the economy, but unfortunately they do not provide the entire picture. It is also possible to interpret such measures in different ways. For example, the level of the aggregate debt-to-income ratio can provide a different view of the risks from aggregate household net worth or the aggregate interest-to-income ratio (see Chart 2.5). High net worth may be interpreted as low risk if it is believed that it is based on fundamental factors and stable asset prices. However, the risk might nevertheless be high if the high net worth is due to assets being overvalued. An asset's value can, of course, also decrease if fundamental factors change unfavourably. In both cases, the net worth would fall drastically in the event of a fall in prices.²⁰ Similarly, a low interest-to-income ratio could be interpreted as low risk, but it could also conceal high risk if the ratio is based on unusually low interest rate levels. If mortgage rates rise sharply, the interest-to-income ratio may increase rapidly. This applies in particular in countries like Sweden, where a high percentage of household loans have a short fixed-interest period.²¹ Similarly, the interest-to-income ratio may increase as a result of a decrease in household income. The debt-to-income ratio, however, is independent of interest rate levels and may thus signal the build-up of risks when interest rates are low.

Similar difficulties of interpretation can occur regarding aggregate measures of household consumption and savings. A high aggregate savings ratio may indicate that the household sector generally has large buffers that could be used in the event of various types of economic shock. However, as saving is probably unevenly distributed between different income groups, this does not necessarily mean that all households have large buffers to cope with unforeseen events. In a number of countries affected by problems in recent years, the aggregate level of household savings was fairly high in the years prior to the crisis (see Chart 2.6). In spite of this, many households experienced problems when the economic outlook deteriorated.²² Interpretation difficulties of this type thus result in difficulty in drawing conclusions based on aggregate measures, although they can of course provide some indications of the risks.

A risk assessment is therefore more comprehensive if data on both debt and assets can be studied at household level. The quality of the risk assessment also increases if it is possible to analyse disaggregated data on household savings and consumption. With regard to income and mortgages, relatively good statistics are already available at individual level in Sweden.²³ However, statistics on households' financial and real assets are more limited. Since the wealth tax was abolished in Sweden, this data is mostly available only in aggregate form. This can make the assessment of risk more difficult, as assets are probably more unevenly distributed between different income groups than is debt.²⁴ For Swedish household consumption and savings too, there is a lack of data at individual household level. In order to study the vulnerability resulting from high indebtedness in more detail, we would also need access to more disaggregated data for these variables.

In order to make a comprehensive assessment, we need to have both an understanding of the fundamental factors in the development of, for example, housing prices and indebtedness and information about how the ability to withstand economic shocks is distributed across households. One should also assess how the different risks in high indebtedness (see Chart 2.2) affect the risks to the macroeconomy and financial stability, both individually and combined, and with different feedback effects between them. In particular, the feedback loops between

20. Other measures that include household assets, such as loan-to-value ratio (debts in relation to the value of the home), the equity/assets ratio (net worth in relation to assets), or debt-to-assets ratio (debts in relation to assets), can also change rapidly if asset values decline.

21. See Holmberg et al. (2015).

22. One reason for this may be that a large share of savings in many countries consist of pension provisions to which households do not have access until they retire. In Sweden, the design of the pension system can also affect households' incentives to amortise their debt and this can also affect the development of household indebtedness (see for example Jansson (2014) and Nilsson et al. (2014)).

23. See, for example, Winstrand and Ölcer (2014), Alfelt and Winstrand (2015) and Finansinspektionen (2015).

24. Sveriges Riksbank (2014a) shows that in 2007 indebted households with the highest incomes owned the majority of real and financial assets.

the macroeconomy and financial stability are difficult to assess. Then, it is also important to understand how households' behaviour and expectations change in the event of different types of shock, such as how households react to a fall in prices on the housing market. Furthermore, one needs to take account of different institutional factors, such as how the housing market functions; not least, regulations and tax legislation that affect households' incentives.

3. What does the empirical literature say about the risks of household debt?

Following the global financial crisis, a large number of studies have been carried out on the relationship between debt, the occurrence of financial crises and the effects on the sensitivity of consumption to shocks.

A significant build-up of debt increases risks of financial crises and falls in housing prices

As mentioned in the introduction, extensive research shows that financial crises and falls in housing prices are often preceded by rapid growth in lending and rising housing prices.

Reinhart and Rogoff (2010) find, for example, that financial crises tend to be preceded by sharp increases in real housing prices, debt, as well as current account deficits. Moreover, Büyükkarabacak and Valev (2010) claim that household indebtedness is a better indicator of risks than indebtedness in the corporate sector. Schularick and Taylor (2012) find that a high rate of growth in lending increases the likelihood of a crisis occurring. According to the study, in addition the likelihood increases further still if there is a high level of lending in relation to GDP.

Borio and Drehmann (2009) study banking crises in 18 advanced economies and find that the credit gap – i.e. lending in the private sector in relation to GDP in terms of deviation from its trend – combined with the asset price gap – which is the equivalent measure for equity and real estate prices – signalled around three quarters of the banking crises that occurred between 1980 and 2003. In a later study, Drehmann et al. (2010) draw the conclusion that the credit gap is the measure that most effectively predicts a financial crisis. Drehmann et al. (2011) also demonstrate that a housing price gap, which measures how housing prices deviate from their trend, is a good indicator when a risk assessment is performed, but that the gap tends to fall 2-3 years before a crisis.

The ESRB (2014a) finds in a study of data from EU member states that some of the best indicators of impending crises are credit, real estate prices and the household debt service ratio, i.e. interest and amortisation in relation to income. In a model combining a number of indicators, useful information can be obtained from both growth in and the level of lending. A strong current account can result in the risks decreasing, but only if both the growth in and the level of lending are low. Drehmann and Juselius (2012) also demonstrate that the debt service ratio often rises to high levels 1-2 years before a financial crisis. Since interest rates and amortisation are affected by the level of the debt-to-income ratio, this also means that a high debt-to-income ratio could indicate increased risks.

Another ESRB study (2014b) also finds that credit and real estate prices are the most important indicators of financial crises linked to real estate market problems. Crowe et al. (2011) also demonstrate that periods of rising real estate prices combined with increased lending are more frequently followed by financial crises or macroeconomic downturns than when property prices rise without lending also increasing.

In a study of 21 advanced economies during the period 1985-2008, the IMF (2009) finds that increased lending, large housing investments and substantial current account deficits increase the likelihood of a fall in housing prices. The Swedish National Institute of Economic Research (Konjunkturinstitutet; 2013) also shows that a high level of housing construction may indicate risks of a price decline on the housing market. However, the study also shows that housing prices have also fallen in countries where the level of housing construction has not been high.

Jordà et al. (2013) study around 10 advanced economies over the period 1870-2008 and find that recessions preceded by a sharp increase in indebtedness tend to be deeper and longer than other recessions. This applies regardless of whether or not the recessions occur in connection with financial crises. Jordà et al. (2014) demonstrate that it is mainly the increase in mortgages that may be associated with risks.

How banks fund increased lending is also of significance to risks. For example, Hahm et al. (2013) discuss how lending that has been funded with “non-core” funding may indicate an increased likelihood of financial crises and find empirical evidence of this.²⁵

There are also studies that show that a low leverage ratio, i.e. banks' capital in relation to their total assets, results in heightened risks to financial stability. Blundell-Wignall and Roulet (2013) and Haldane and Madouros (2012) find that a low leverage ratio increases the risk of banks failing. Other studies show that the leverage ratio is a good measure for predicting a financial crisis (see Barrell et al. (2010) and Behn et al. (2013)).

Of course, these empirical results should not be interpreted such that an increase in debt always results in a crisis. However, there appears to be relatively broad consensus that a major rise in debt indicates increased risks of a financial crisis. Rising housing prices and a high debt service ratio also seem to be associated with heightened risks. Since interest rates and amortisations are affected by the level of the debt-to-income ratio, a high debt-to-income ratio may also be an indicator of increased risks. The current account, the level of housing construction, banks' funding and banks' capital in relation to their total assets may also have a bearing on risks.

High indebtedness increases the sensitivity of consumption to shocks

There are also a number of relatively new studies that suggest that economic sensitivity to macroeconomic shocks is greater amid a high level of household indebtedness. For example, Flodén (2014) demonstrates a link at an aggregate level between changes in consumption following the global financial crisis and the level of the household debt-to-income ratio in different countries. The study shows that consumption between 2007 and 2012 fell by almost 4 per cent more in countries that at the start of the crisis had a debt-to-income ratio of 200 per cent than in countries that had a debt-to-income ratio of 100 per cent.

Recently, studies have been carried out on the link between consumption and indebtedness at household level. These micro data studies show, among other things, that household consumption is affected more by a shock when households are highly indebted to start with.

Andersen et al. (2014) examine the hypothesis that more indebted households in Denmark reduced their consumption more during the financial crisis than less indebted households.²⁶ One finding is that households with a loan-to-value ratio of around 100 per cent reduced their consumption by around 8 per cent of income, while households with a loan-to-value ratio of around 60 per cent did not change their consumption considerably. It also finds that the inverse link between the loan-to-value ratio and consumption only applies to households with loan-to-value ratios over around 40 per cent (see Chart 3.1).

Similarly, there is an inverse link between the debt-to-income ratio and consumption. Above a debt-to-income ratio level of around 200 per cent there is a clear inverse relationship between indebtedness in 2007 and the change in consumption in the following years (see Chart 3.2). The study controls for differences in income and wealth, which suggests that the link applies to households with different financial circumstances. However, this link does not necessarily mean that it was high indebtedness that caused weak development of consumption.

25. Non-core funding refers to the portion of banks' funding that does not consist of deposits from households, for example securities issued on the money and bond markets and liabilities to other financial institutions. So this does not refer to the net stable funding ratio (NSFR), which is a measure of stable funding in the Basel III accord.

26. Consumption is related to income before the fall in housing prices and is defined as the difference between household disposable income and net savings. Since data on household savings are not available, net savings are therefore approximated as the change in the family's net wealth from the beginning to the end of the year. Since the imputed consumption measurement is somewhat noisy the results should be interpreted with some caution.

It is suggested that a contributory factor in the weak development in consumption is that highly indebted households used a large proportion of their income for consumption during the years preceding the crisis. Another finding from the study is that the size of households' financial assets did not reduce the sensitivity of household consumption. Households with substantial financial assets cut back on their consumption more than households with limited financial assets.

In a similar study, Bunn and Rostom (2014) use micro data to study the consumption patterns of UK households in the recession. They find that households with high indebtedness have on average reduced their consumption more since the financial crisis than other households.²⁷ It is assessed that the high indebtedness contributed to reducing aggregate consumption in the UK by around 2 per cent after 2007.

Dynan (2012) also uses micro data and finds that highly indebted households reduced their consumption more than other households when housing prices fell in the US. They did so despite the value of assets among highly indebted households falling less than among lowly indebted households. The findings also apply when controlling for income and wealth effects.

Mian et al. (2013) use, among other things, credit card data to estimate consumption in different geographical regions of the US, and combine this with data on housing prices and wealth. One finding of the study is that the sensitivity of consumption to changes in housing prices is three times larger when households have a loan-to-value ratio over 90 per cent compared with when they have a loan-to-value ratio of no more than 30 per cent.

Dynan and Edelberg (2013) combine responses to a survey on households' attitudes to saving and spending with data on wealth in order to study whether more indebted households in the US reported to a greater extent that they changed their consumption patterns and cut back on spending. They find that households that were highly indebted in 2007 reported to a greater extent that they had cut back on spending.

Sveriges Riksbank (2013b) compares different measures of the financial position of households using data compiled by the European Central Bank (see ECB (2013)). The comparison shows that households in countries that were hit relatively hard by the latest crisis featured relatively higher debt-to-income ratios, higher interest-to-income ratios and fewer liquid assets than households in countries that were less affected. This comparison found no major differences in the loan-to-value ratio between both groups of countries. Moreover, households' debt in relation to their assets was on average around the same in both groups. The study consequently finds that the measures that include cash flows may be of greater significance to the effect of a crisis than balance sheet composition.

Experience thus shows not only that a significant build-up of debt can result in an increased likelihood of financial crises and falls in housing prices, but also that high indebtedness may make the economy more vulnerable to shocks. The fact that studies of micro data seem to indicate a link between the sensitivity of household consumption and indebtedness indicates that both debt-to-income ratios and loan-to-value ratios may be important indicators for assessing the vulnerability of the economy as a whole. The size of households' financial assets, however, does not appear to reduce household consumption sensitivity; rather, it seems to increase it.

One conclusion we draw from the empirical literature is consequently that a high level of indebtedness may make the economy more sensitive to shocks. The fact that these studies show that there is a difference in consumption sensitivity between different levels of household debt also indicates that it is important to study the distribution of debt between different households.

27. The study puts forward the hypothesis that the significant adjustment in consumption among highly indebted households may to some extent be related to more restricted credit terms and increased concern among households about problems of coping with future interest expenses. Bunn and Rostom (2014) also demonstrate that highly indebted households contributed to a large proportion of consumption during the years before the crisis.

There may be different reasons for the empirical results

As indicated by our review of the relevant literature above, sensitivity in household consumption tends to be greatest in countries and among households that are highly indebted to start with. The studies also show that a fall in prices on the housing market may have significant effects on consumption. However, the literature shows that there may be a number of different reasons for the link between housing prices, indebtedness and household consumption.²⁸

The models that attempt to explain the link between housing prices and household consumption often divide households into two groups: “borrowers” and “savers”. The two groups have different degrees of “patience”. Differences in patience, together with credit restrictions, give rise to differences in marginal propensity to consume between the two groups. Households that mortgage themselves have a greater marginal propensity to consume than those that save. The “borrowers” must therefore adapt their consumption more than the “savers” when housing prices change. This means that the overall effect of a fall in housing prices on aggregate consumption is negative. Particularly large effects from a fall in housing prices can occur if households mortgage their properties in order to fund consumption. Housing price increases can help make it easier for households to borrow, while a drop in housing prices can make borrowing more difficult for them. This effect is amplified for households that are already highly indebted to start with. These effects can be illustrated using a general equilibrium model, which has been estimated based on Swedish data by Walentin (2013) (see Chart 3.3).

Another possible explanation of the link is that households have a targeted level for their loan-to-value ratio. In that case, adaptations in saving will be greater if the loan-to-value ratio is higher to start with, because the adaptations are made in order to restore the loan-to-value ratio after a drop in housing prices (see, for example, Dynan (2012) and Dynan and Edelberg (2013)). Andersen et al. (2014) are however of the opinion that this was not the case for the households in Denmark because the study shows that the highly indebted households adapted their consumption to a more normal level following the crisis. According to Bunn and Rostom (2014), this also applies to UK households. Both studies instead suggest that increased precautionary savings may have been of significance to how the highly indebted households in Denmark and the UK adapted their consumption in the years following the crisis. Increased precautionary savings are also mentioned as a possible explanation by Dynan and Edelberg (2013).

Another hypothesis, put forward by Dynan (2012) and Mian et al. (2013), is that it became more difficult for highly indebted households to take out further loans to finance their consumption when housing prices dropped in the US. Andersen et al. (2014), however, do not find support for credit restrictions explaining the inverse relationship between consumption and indebtedness in Denmark. One reason for this was that the decline in consumption was not greater among households that might be expected to have poorer opportunities to obtain credit, for example young households and households with limited financial assets.

As our review of the literature demonstrates, there are a number of mechanisms that could explain that highly indebted households reduce their consumption more in the event of a fall in housing prices or some other macroeconomic shock. Unfortunately, it is difficult to distinguish between what proportion of the reduction in consumption is due to changes in households' behaviour, and what proportion is due to factors beyond the control of households, such as banks' supply of credit.

In general, the mechanisms that affect the behaviour of households can be divided into two groups. The first is related to household income and expenditure, i.e. cash flow. The other is related to the relationship between assets and debt, i.e. the balance sheet. Both households' cash flow and the household balance sheet are consequently of significance in assessing financial risks in the household sector. Experiences from Denmark and the UK also indicate that a high level of savings among highly indebted households could mitigate the risks. Yet, based on experience from Denmark

28. See for example Case et al. (2013). Alsterlind et al. (2013) also provide a more detailed theoretical and empirical description in this area.

and other countries, greater financial assets do not however appear to reduce consumption sensitivity.

4. What risks are posed by different levels of household indebtedness?

Different conditions generate different risks

The fiscal problems that hit many countries in the aftermath of the global financial crisis of 2008-2009 have raised the issue of what level of public-sector debt is sustainable in the long run.²⁹ A corresponding question can be raised about household-sector debt. While empirical studies can provide some guidance, their findings are often associated with significant uncertainty.³⁰ This uncertainty largely depends on household debt being difficult to compare between countries. Debt is often measured in different ways, and countries' structural conditions may differ significantly and can also change over time.³¹ This means that a level of debt that is excessive for the household sector in one country is not necessarily problematic for the household sector in another country.

As we described in section 2, the sum of all individual decisions regarding indebtedness do not necessarily result in sustainable level of indebtedness for the macroeconomy. An individual household's decisions depend on factors such as where it is in its lifecycle and its preferences, such as its degree of risk-aversion. However, individual households have no incentive to take into account the effects of their decisions regarding indebtedness on the economy as a whole. As we also mentioned in section 2, it is also possible that at least some households may take financial decisions based on unrealistic expectations about future interest rates, housing prices or income.

It is, of course, difficult to set a level of debt that is sustainable for the economy as a whole.³² A level of debt that may be regarded as being economically acceptable may also change as households' preferences change. Household indebtedness in Sweden has increased sharply in recent decades. This trend is due to a number of factors, such as falls in interest rates.³³ Ever-lower interest rates could also be one cause of the increase in the proportion of the Swedish population with debt.³⁴

It is not just in Sweden that household debt has increased sharply in recent decades. A similar credit expansion has taken place in a large number of countries. Although, at an aggregate level, debt-to-income ratios differ between these countries, the trend has been the same. However, in a number of countries debt-to-income ratios have also declined since the financial crisis. This is mainly the case in countries that have faced problems due to a drop in housing prices, including Denmark, the Netherlands, the UK and the US. Although there are a number of reasons for these problems in those countries, one reason may be that the indebtedness that these countries reached in the years prior to the fall in prices was based on increasingly optimistic expectations, especially regarding housing price trends.³⁵ Based on this explanatory

29. See Reinhart and Roghoff (2010) and Reinhart et al. (2012).

30. Cecchetti et al. (2011) show that growth can be hampered if aggregate household debt exceeds 85 per cent of GDP. The findings, however, are highly uncertain and not statistically significant.

31. For example, the structure of one country's capital markets, housing market and tax system may affect the sustainable level of debt. Coletta et al. (2014) also show that debt is higher in countries where GDP per capita and household assets are greater.

32. Lindquist (2012) describes how Norges Bank is trying to take account of a long-term sustainable level of household indebtedness in its task to safeguard financial stability and low, stable inflation.

33. See Hansen (2013) for a description of what factors have contributed to the rise in the household debt-to-income ratio in recent decades.

34. There is no longer time series regarding how large a proportion of the Swedish population is indebted. According to Hansen (2013), the percentage of households with net interest expenditure has, however, increased from 48 per cent in 1994 to 55 per cent in 2008, an increase of 15 per cent. Englund (2015) shows instead that the share of the population that lives in a home that it owns increased from 59 to 64 per cent between 1992 and 2012, which is an 8 per cent increase. It can thus be assumed that the proportion of indebted households has increased by around 8-15 per cent since the beginning of the 1990s.

35. US studies, for example Case and Shiller, (2003) and Case et al. (2012), show that housing buyers tend to extrapolate past price development, which contributes to further price increases during an upturn phase. The fact that this was the case for US households prior to the latest financial crisis was confirmed by further research results (see, for example, Gelain and Lansing (2013)). Denmark's Nationalbank (2011) also shows that households' expectations of housing prices played a major role in the creation of the housing bubble in Denmark.

model, the decline in debt-to-income ratios observed in these countries in recent years could be regarded as households adapting to a new and more sustainable level.³⁶

Households adapted their indebtedness in a similar way in Sweden in connection with the crisis of the 1990s. The debt-to-income ratio of the Swedish household sector increased in the years before the crisis as housing prices rose, but it then fell rapidly when housing prices fell, the growth outlook for the Swedish economy deteriorated and interest rates rose. There was a similar development in the household sector interest-to-income ratio. Household interest expenditure rose gradually for a number of years and then increased rapidly when interest rates rose during the crisis before falling back as interest rates fell and incomes increased (see Chart 2.5).³⁷ One interpretation of this is that the debt-to-income ratio and interest-to-income ratio experienced by households during the crisis years were too high based on the circumstances at that time and they were forced to adapt to a more sustainable level.

An interesting question in this context is whether it is possible to use historical experience to assess the risks of current household indebtedness. In the following section, we therefore examine what can be inferred from the data at an aggregate level based on circumstances in Sweden. We then apply international experience to Swedish circumstances based on data at household level.

4.1 What can be inferred from aggregate data?

As mentioned previously, the assessment of what constitutes a risky level of debt differs from country to country. In order to assess what aggregate level of debt could result in risks in Sweden, some different approaches might be used. For example, one might examine how high a level of debt Sweden can tolerate if the historically highest figures are repeated.

Historical household interest-to-income ratio figures as a basis

In order to conduct such an analysis, we can start by estimating the probability breakdown of the interest-to-income ratio of the household sector using data on historical figures. Because households' interest expenditure affects their cash flows and allows less scope for other consumption, the level of the aggregate interest-to-income ratio could illustrate the macroeconomic risks of high indebtedness. When the interest-to-income ratio is high, households' borrowing costs leave little room for other consumption. The interest-to-income ratio could therefore provide an indication of the possible loss of consumption in the event of an economic shock. Juselius and Drehmann (2015) find that consumption and investment decrease when the debt service-to-income ratio is above its normal level. The interest-to-income ratio level is affected not only by debt levels, but also by changes in income and the prevailing interest rate level. As both household income and the interest rate level can change rapidly, this is a dynamic risk measure. Also, the interest-to-income ratio has a direct effect on the debt service ratio. The debt service ratio has proven to be a good indicator of financial crises in a 1-2 year horizon (see ESRB (2014a) and Drehmann and Juselius (2012)).³⁸

By studying quarterly interest-to-income ratio figures between 1963 and 2014 it is possible to see which figures are above the 95th percentile of this probability breakdown (see Chart 4.1).³⁹ The interest-to-income ratio in Sweden was at its highest from the first quarter of 1989 through the third quarter of 1993. So, this period coincides largely with the 1990s crisis.

36. See for example Albuquerque et al. (2014), who, using an error correction model, shows how the US aggregate debt-to-income ratio has adjusted to a more long-term sustainable level since the financial crisis.

37. One of the main reasons for the significant increase in the interest-to-income ratio may be related to the Riksbank's defence of the Swedish krona. In the early 1990s, however, a larger percentage of residential mortgages were taken out with fixed interest, which help reduce the effects of interest rate hikes. Today, over half of all residential mortgages are taken out at a variable rate, which indicates that households' sensitivity to an interest rate hike is greater (see, for example, Holmberg et al. (2015)). Another reason for the increase in the interest-to-income ratio at the beginning of the 1990s is that tax relief on mortgage interest decreased in connection with a change to the tax system.

38. Unfortunately there is an absence of information about household amortisations over an extended period of time, which means there is no extended time series available on Swedes' debt service ratio. The debt service ratio can also be problematic as a risk indicator since a mechanical interpretation indicates that the risks of household indebtedness decrease if households choose not to amortise their loans.

39. Data on the interest-to-income ratio is only available from the fourth quarter of 1963.

The level of the interest-to-income ratio varied during this period between 8.1 per cent and 10.9 per cent, and the average was around 10 per cent. Hereinafter in the analysis we use 10 per cent as an estimate of the expected level of the interest-to-income ratio in the highest possible outcomes. Above this critical interest-to-income threshold, the loss of consumption in the event of a shock might be unacceptably large and the risk of a financial crisis might be high. The threshold is of course arbitrary in the strict sense, but using an average of the five per cent highest historical figures in Sweden, given the data we have available, may be a reasonable starting point for an analysis.

That level is also approximately in line with the level of the debt service ratio for households (11 per cent) which according to the ESRB (2014a) indicate a heightened risk of a financial crisis. Since the study by the ESRB uses the debt service ratio instead of the interest-to-income ratio, the corresponding critical level for the interest-to-income ratio would be lower. In light of this, 10 per cent appears to be a conservative choice of critical level for the interest-to-income ratio. It also coincides well with the findings of the study by Drehmann and Juselius (2012), which shows that a debt service ratio of 6 percentage points above the historical average suggests that a crisis may be impending.⁴⁰ However, their measure of the debt service ratio does not only include the household debt service ratio, but also the corporate debt service ratio, so the measures in the different studies are not entirely comparable.

How do we establish a "stressed" mortgage rate?

By taking the critical level for the interest-to-income ratio as our starting point, it is possible to calculate what levels of the aggregate debt-to-income ratio mean that the interest-to-income ratio does not exceed the critical level.⁴¹ However, this requires an assumption about the mortgage rate. As our aim is to assess the risk in a stressed scenario, it is appropriate to use a "stressed" mortgage rate.

As a basis for determining the "stressed" mortgage rate, we can use the long-term "neutral" repo rate. If the real long-term neutral rate corresponds to long-term productivity growth of 2 per cent and if inflation is 2 per cent, the nominal long-term neutral repo rate is 4 per cent.⁴² This interest rate level then needs to be adjusted for the difference between the repo rate and the average mortgage rate, which can be set at approximately 2 percentage points. In order to represent a financially stressed scenario, the interest rate level can be adjusted upwards by a further 2 percentage points. Such a situation could for example arise in the event of a confidence crisis in the Swedish banking sector that leads to higher funding costs for the banks. Because cutting the repo rate in such a strained situation might not necessarily have the same impact as in normal circumstances, it is not certain that the rising mortgage rates could be fully counteracted using monetary policy.

Based on this rationale, a stressed mortgage rate could be assumed to be around 8 per cent. That level is, of course, very high in relation to the current level of mortgage rates in Sweden, but it does not seem unreasonable in a longer perspective. After all, the aim is to illustrate a stressed scenario following a rise in the repo rate to a more normal level than at present.

This stressed interest rate level is also consistent with the interest rates that some banks use in their "discretionary income"-calculations, which are performed to stress-test individual borrowers' debt servicing ability.⁴³ In other words, 8 per cent constitutes the mortgage rate that at least some banks require individual borrowers to be able to cope with in order for the credit risk to not be regarded as excessive.

40. The historical average for the interest-to-income ratio in Sweden is around 4.6 per cent.

41. The interest-to-income ratio is calculated by (1) $\bar{c} = \frac{(1-\tau)i^*D}{Y}$ where \bar{c} is the interest-to-income ratio after tax, τ is the size of the tax relief on mortgage interest, i^* is the interest rate and D/Y shows the debt's proportion of disposable income. Based on (1) it is then possible to establish the debt-to-income ratio implied by households being prepared to spend the proportion \bar{c} of their disposable income on interest expenditure, given the interest rate i^* , $\frac{D}{Y} = \frac{\bar{c}}{(1-\tau)i^*}$

42. There is also significant uncertainty about what long-term normal interest rate levels are and the interest rate may be lower than normal for an extended period (see Armelius et al. (2014)).

43. See Sveriges Riksbank (2014a).

The current debt-to-income ratio appears to imply heightened risks ...

Chart 4.2 shows the debt-to-income ratio associated with an interest-to-income ratio of 10 per cent, given a stressed mortgage rate of 8 per cent. The result of this approach suggests that an aggregate debt-to-income ratio of around 180 per cent could be associated with heightened risks in the long term. At that debt-to-income ratio, the aggregate interest-to-income ratio in a stressed scenario would end up at levels around the historically highest outcomes. There would therefore be a risk of a great reduction in aggregate consumption in the event of a macroeconomic shock, and a heightened risk of a financial crisis. We also note that the current level of the aggregate debt-to-income ratio of just over 170 per cent is close to that level. According to the Riksbank's latest forecast, the debt-to-income ratio is expected to exceed 180 per cent by the end of 2016.⁴⁴

If the aggregate debt-to-income ratio continues to increase, households' interest burden in a stressed scenario will increase significantly compared with the current level and the level during the 1990s crisis. If, for example, the debt-to-income ratio rises to 250 per cent and the mortgage rate rises to 8 per cent, the aggregate interest-to-income ratio will be 14 per cent, which is significantly higher than the current interest-to-income ratio of just over 3 per cent and higher than the 1990s crisis level of around 10 per cent. This indicates that the loss of consumption in such a scenario could be even greater than during the 1990s crisis.

... but the calculations are sensitive to underlying assumptions

The above calculations are sensitive to assumptions of the long-term levels of the repo rate and potential growth. If we set the stressed mortgage rate at 6 per cent instead of 8 per cent, the debt-to-income ratio that could be associated with heightened risks to the economy is instead around 240 per cent. However, we make the assessment that a mortgage rate of 6 per cent in this context would be far too low to provide an appropriate stress scenario. This would in fact require an extreme assumption of a long-term neutral repo rate of 2 per cent, which with an inflation target of 2 per cent implies a long-term real repo rate of 0 per cent and an end to growth in productivity.

Although a mortgage rate of 6 per cent is too low for a meaningful stress test, this level is close to what could be considered to be a long-term normal level for Swedish mortgage rates. To gain some perspective on the calculations for the stressed scenario, it may help to momentarily experiment a little with historically "normal" values for interest-to-income ratios and mortgage rates.

Let's say that in the long term the mortgage rate is 6 per cent, which is the level that is estimated to be the long-term normal level. The interest-to-income ratio in Sweden would then be just over 7 per cent at the current debt-to-income ratio. Given the current debt-to-income ratio, a return to a normal interest rate level would thus imply an interest-to-income ratio that is much higher than the historical average of 4-5 per cent.

Let's also assume that both the mortgage rate and the interest-to-income ratio in the long term will be in line with the historical "norm", i.e. 6 per cent and 4-5 per cent. The debt-to-income ratio would then need to decrease to around 110 per cent (see Chart 4.3). The current debt-to-income ratio is thus well above the debt-to-income ratio that would correspond to a long-term "normal" mortgage rate and interest-to-income ratio.

Structural changes have a bearing

Of course, these calculations should be interpreted with caution. Since the 1990s crisis, the Swedish economy has undergone extensive structural reforms, and for a number of reasons it is difficult to make mechanical comparisons with the current level of indebtedness. For example, Sweden has changed its exchange rate regime from a fixed to a floating exchange rate. Moreover, inflation is now much lower than in the early 1990s, which affects the real interest payments that a household makes (see

44. See Sveriges Riksbank (2015).

Chart 4.4).⁴⁵ It is also possible that the proportion of income that households spend on housing has changed over time, for example as disposable income has changed.⁴⁶

Another aspect to consider is that more households are indebted now than at the beginning of the 1990s. Hence, aggregate debt is distributed across a greater number of households. If we take account of the fact that the proportion of households with debt has increased by about 8-15 per cent since the early 1990s, the aggregate debt-to-income ratio that can be assumed to result in a heightened risk can be adjusted up by 15 per cent.⁴⁷ This means that the risky aggregate debt-to-income ratio would instead be around 210 per cent.⁴⁸ Another change is that the net worth of the household sector today is greater than what it was in the 1990s. At the same time, social safety nets have become less generous than they were 10-15 years ago. In addition, the proportion of variable-rate mortgages has increased since the 1990s, making households more sensitive to changes in interest rates.

Furthermore, it cannot be ruled out that in the future there will not be further structural changes to the housing market or changes in the tax system, which could affect the critical level of households' debt-to-income ratio. It is, however, difficult to assess the likelihood of or quantify the effects of such changes. One measure that has been discussed is scrapping or gradually phasing out tax relief on mortgage interest, as this tax break incentivises households to take on debt. If the tax relief on mortgage interest were scrapped overnight, the critical debt-to-income ratio limit would indeed fall in purely mechanical terms to around 125 per cent, as households' interest expenditure after tax would increase given their current indebtedness. On the other hand, the incentive for households to assume debt would also decrease, which would help reduce risks in the economy. If the tax relief on mortgage interest were gradually phased out, households would also be able to gradually adjust their indebtedness. Moreover, the government would reap more tax revenue if it scrapped the tax relief, which in principle could create fiscal scope for other measures that increase households' disposable income.

Aggregate data provide guidance – but not the full picture

Overall, therefore, there are a number of factors that could affect the assessment in different ways. However, based on the available aggregate data, and given our conservative assumptions in this analysis, it seems the critical limit for the Swedish household aggregate debt-to-income ratio is in the interval of 180-210 per cent.

These are also debt levels that the Swedish household sector will soon reach unless the trend of recent years is reined in. But even if this trend is arrested, and the debt-to-income ratio stops at just over 170 per cent, it cannot be ruled out that the effects on consumption from a future economic shock could be considerable for the economy.

It is, however, important to not draw too far-reaching conclusions from this analysis. For example, our analysis does not say anything about causality between household indebtedness and financial crises. The 1990s Swedish financial crisis was mainly caused by other direct factors than high household indebtedness. Furthermore, the effects of the decrease in household consumption as a result of high interest-to-income ratios were probably only one of a number of reasons that contributed to the economic slump that occurred in connection with the 1990s crisis being so deep.

45. Svensson (2014a) states that real interest payments are more relevant than nominal interest payments when assessing long-term sustainable debt-to-income ratios. It is true that a real interest-to-income ratio may contain valuable information about how much households actually pay for a loan (particularly over a long time period), but real interest-to-income ratios are not necessarily the most accurate measure in this context. Our aim is to illustrate the household sector's ability to withstand a stressed scenario and at a given point in time. We therefore focus on a nominal interest-to-income ratio that shows how households' actual cash flows are affected. The fact that real interest expenditure is actually lower does not help households when the interest has to be paid to the bank.

46. However, empirical studies indicate that demand for housing is increasing at the same pace as household income (see, for example, the references in Englund et al. (2015)). According to Statistics Sweden's microdata study, "Household expenditure", the proportion of income that households spend on housing has also been roughly constant over the past decade.

47. See footnote 34.

48. This simple calculation for the aggregate debt-to-income ratio, however, does not take account of the risks that may have increased if those households that have taken on debt since the 1990s have a high debt-to-income ratio. It is therefore important to also study changes in the distribution of indebtedness (see section 3). Correspondingly, increased home construction would mean that the limit for the risky aggregate debt-to-income ratio could be adjusted upwards, but the risks could still increase if the new indebted households are highly indebted.

The aggregate statistics may also conceal factors that may be of major significance to an overall assessment. It is important to remember that aggregate measures such as the debt-to-income ratio and interest-to-income ratio include individuals who are not indebted, but who have an income. The main risks are probably not posed by the average household, but are instead posed by households with higher than average indebtedness. In order for the analysis to progress, it is therefore important to take a closer look at how the debt is distributed among households.

4.2 Debt distribution is of great significance.

Micro data are needed for more detailed analysis

Most agree that statistics at household level are required in order to be able to analyse the sustainability of household debt levels more deeply. Our review of the literature shows that the more households that have a debt-to-income ratio or loan-to-value ratio above a certain level, the greater the risks. Moreover, the risks appear to be greater the more outlying in the debt distribution a household is.

As we noted in section 2, access to data on Swedish households' assets has deteriorated in recent years. There is also a lack of micro level statistics on Swedish household consumption and savings. As mentioned previously, this makes it more difficult to perform an in-depth analysis of the risks posed by high indebtedness based on circumstances in Sweden.

But, although more comprehensive micro level data would in many ways facilitate this analysis, it is uncertain that this would be sufficient to perform a comprehensive analysis of how sustainable household indebtedness is in Sweden. As set out in section 3, it is often not until the economy has been hit by a shock that household sector indebtedness has proven problematic. As long as growth is healthy and households have optimistic expectations, increased indebtedness may rather appear to benefit economic performance through positive wealth effects and increased consumption.

Experience from other countries may be of use

In order to analyse the risks associated with different levels of debt it would instead be necessary to try to draw lessons from experience in countries that have faced problems. In this context, the studies of household behaviour patterns in Denmark, the UK and the US that we referred to in section 3 are of particular interest. For example, Bunn and Rostom (2014) show that UK mortgage borrowers reduced their consumption more during an economic shock the more indebted households were prior to the crisis. As Chart 4.5 shows, the negative effects on consumption were greater for households with a debt-to-income ratio as a percentage of gross income of over 200 per cent and the greatest effect was found for households with a debt-to-income ratio of over 400 per cent.

Similar empirical findings are identified by Andersen et al. (2014) (see Chart 3.2). As with UK households, the downturn in consumption was greater the more debt Danish households had before the crisis. This applied to debt both in relation to disposable income and to property value. Households with a debt-to-income ratio above 200 per cent and households with a loan-to-value ratio above 40 per cent reduced their consumption more than less indebted households.

Based on these studies, it appears that the level of indebtedness is of significance in terms of how much households adapt their consumption if the economy were to suffer a shock. The threshold for the debt-to-income ratio that households in the UK and Denmark regarded as problematic was around 300 per cent of disposable income.

Structural differences between countries are significant

It is, of course, difficult to know to what extent the findings of these empirical studies can be generalised, as the structural conditions differ from country to country. Moreover, there can be considerable differences in the pattern of both consumption and savings between households in different countries. Households' behaviour before a crisis also appears to be of significance for any risks (see section 3). While a debt-to-income ratio of around 300 per cent seems to constitute a critical limit for the sensitivity of household consumption in both Denmark and the UK, this is not

necessarily the case in Sweden, for example if Swedish households that have a debt-to-income ratio of over 300 per cent also have a high level of savings.⁴⁹

Although savings at aggregate level are high in Sweden, there is a lack of detailed information about how savings are distributed between different households. However, recent studies appear to indicate that households with a high debt-to-income ratio have low savings on average. This could entail highly indebted households being particularly sensitive to higher interest rates, lower income or a drop in prices on the housing market. Kilström et al. (2014) demonstrate that savings among Swedish households in 2007 were lower the more indebted households were in relation to their income. Households with a debt-to-income ratio of over 600 per cent even had negative savings. This corresponds to the circumstances among households in Denmark during the years before the crisis. The findings of Kilström et al. (2014), however, are preliminary and based on a sampling of just over 2,000 households.

Application to Swedish data gives clear effects on consumption

In spite of the above reservations, it may still be of benefit to use the findings of foreign studies and try to translate them to Swedish circumstances. One way of doing this is to apply the consumption sensitivities for Danish households with different debt-to-income ratios obtained from Andersen et al. (2014) to the distribution of Swedish mortgage borrowers. We can then calculate what the effects on consumption could be in Sweden in the event of an economic shock like that which affected Denmark in the most recent crisis. It is worth noting that the calculations below are based on the Danish findings reflecting a causal link between high indebtedness and weak development of consumption, which may not necessarily be the case (see section 3).

According to the Danish study, there is an inverse relationship between initial indebtedness and the change in consumption during the crisis among households with a debt-to-income ratio over 200 per cent. Households with a debt-to-income ratio below 300 per cent increased their consumption during the crisis, while households with a higher debt-to-income ratio reduced their consumption. As the purpose of this study is to examine how highly indebted households could possibly adjust their consumption in the event of an economic shock, we are focusing on households with a debt-to-income ratio over 300 per cent.

In 2014, almost 40 per cent of Swedish households with mortgages, or approximately 590,000 households, had a debt-to-income ratio of more than 300 per cent.⁵⁰ The equivalent proportion among new residential mortgage borrowers is almost 60 per cent (see Chart 4.6). Tables 4.1 and 4.2 illustrate the possible effects on consumption for households with a debt-to-income ratio over 300 per cent in the mortgage stock and in new lending on the assumption that housing prices and the economy develop as they did in Denmark in the latest crisis.⁵¹ If Swedish households with a debt-to-income ratio of 300 per cent or more in a crisis were to adjust their consumption in the same way as equivalent Danish households did during the 2007-2009 period, their consumption would decrease by just over 5 per cent.

It is difficult to translate these findings to effects on aggregate consumption, but the findings of studies that use statistics at household level indicate that a fall in consumption among highly indebted households may be an important cause of the negative effects on consumption when housing prices drop and that have been noted in studies that use macroeconomic statistics. The studies show that a 20 per cent fall in housing prices usually leads to a 1-2 per cent decrease in GDP and a reduction in

49. Svensson (2014b) states that households' high savings at an aggregate level make it unlikely that Swedish households with a high debt-to-income ratio use the loans to fund unsustainably high consumption.

50. The number of indebted households is probably slightly underestimated as the data material only includes information about borrowers with the eight largest banks and covers 94 per cent of all mortgages. See Winstrand and Ölcer (2014) and Finansinspektionen (2015) for more information about the underlying data material.

51. Danish GDP fell by just under 7 per cent and consumption by over 5 per cent from the end of 2007 until 2009. Real house prices fell by around 16 per cent. The fall in prices was particularly large for apartments, which fell by around 25 per cent between 2007-2009. As a result of the difficulties on the financial markets, Denmark's Nationalbank also had to raise the interest rate slightly in order to defend the Danish krona. The lending rate was then cut from around 5.5 per cent to 1 per cent within a matter of months. See Ministry of Business and Growth Denmark (2013) for a more detailed description of economic development in Denmark during the years before and after the crisis.

aggregate consumption by just shy of 2 per cent.⁵² Bunn and Rostom (2014) state that highly indebted households may have contributed to reducing aggregate consumption in the UK by around 2 per cent after 2007. Limiting the maximum indebtedness could thus contribute to mitigating the effects on consumption of a fall in housing prices.

Table 4.1. Estimate of consumption effects on Swedish households in the mortgage stock

LEVEL OF DEBT-TO-INCOME RATIO	SHARE OF HOUSEHOLDS (MORTGAGE STOCK)	PERCENTAGE OF HOUSEHOLDS WITH A DEBT-TO-INCOME RATIO OF OVER 300 PER CENT		CONSUMPTION EFFECTS IN DENMARK BETWEEN 2007-2009	ESTIMATED CONSUMPTION EFFECTS AMONG SWEDISH HOUSEHOLDS WITH A DEBT-TO-INCOME RATIO OF OVER 300 PER CENT
300-400	13.2	33.5		-2.2	-0.7
400-500	9.1	23.1		-5.8	-1.3
500-600	5.9	15.0		-7.8	-1.2
600-700	3.6	9.1		-8.1	-0.7
>700	7.6	19.3		-8.1	-1.6
Total	39.4	100			-5.5

Note. The Danish consumption effects describe the change in consumption as a percentage of disposable income in 2007. The effect of each interval is calculated as an average. The figures in the columns of estimated Swedish consumption effects are calculated by multiplying the Danish consumption effects for different intervals with the percentage of households in different intervals among households with a debt-to-income ratio over 300 per cent.
Sources: Andersen et al. (2014) and the Riksbank

Table 4.2. Estimation of consumption effects on Swedish new mortgage borrowers

LEVEL OF DEBT-TO-INCOME RATIO	SHARE OF HOUSEHOLDS (NEW LENDING)	PERCENTAGE OF HOUSEHOLDS WITH A DEBT-TO-INCOME RATIO OF OVER 300 PER CENT		CONSUMPTION EFFECTS IN DENMARK BETWEEN 2007-2009	ESTIMATED CONSUMPTION EFFECTS AMONG SWEDISH HOUSEHOLDS WITH A DEBT-TO-INCOME RATIO OF OVER 300 PER CENT
300-400	19.8	33.7		-2.2	-0.7
400-500	16.3	27.8		-5.8	-1.6
500-600	10.6	18.1		-7.8	-1.4
600-700	5.6	9.6		-8.1	-0.8
>700	6.3	10.7		-8.1	-0.9
Summa	58.7	100			-5.4

Note. The Danish consumption effects describe the change in consumption as a percentage of disposable income in 2007. The effect of each interval is calculated as an average. The figures in the columns of estimated Swedish consumption effects are calculated by multiplying the Danish consumption effects for different intervals with the percentage of households in different intervals among households with a debt-to-income ratio over 300 per cent.
Sources: Andersen et al. (2014) and the Riksbank

The effects on consumption can also be significant for individual households

The calculations in the tables above illustrate possible consumption effects in the event of macroeconomic shock. It may also be of use to calculate which effects an increase to interest rates could have on the consumption of individual households. For example, more than 10 per cent of new mortgage borrowers currently have a debt-to-income ratio of over 600 per cent. At current low interest rate levels, a debt-to-income ratio of 600 per cent would mean that a household's interest payments after tax account for around 8 per cent of disposable income. When mortgage rates rise to more normal levels, like 6 per cent, interest payments would increase to around 25 per cent of disposable income. For a household with disposable income of, for example, SEK 30,000 a month, this would mean that interest expenditures after tax deductions would rise from SEK 2,500 to SEK 7,500 a month. With a stressed mortgage rate of 8 per cent, interest payments would be around 35 per cent of disposable income. This would mean interest expense of around SEK 10,000 a month, which is four times more than the current interest expense. Although these calculations are simple, they may nevertheless provide a reasonable illustration of the consumption effects that could occur for highly indebted households in the event of a future macroeconomic shock.

52. See Claussen et al. (2011) and The Swedish National Institute of Economic Research (2014). Both of the studies, however, indicate that the effects on the economy would probably be greater if the fall in housing prices coincided with a general economic downturn instead of it being an isolated event, which is the main scenario analysed in these studies. Another important condition for the findings is that monetary policy may mitigate the effects of the fall in housing prices, which should not be taken for granted.

On the whole, both the aggregate debt-to-income ratio and how it is distributed are key indicators when assessing risk. Our analysis suggests that the current debt-to-income ratio and its distribution imply risks to the economy, particularly in the longer term. But, the household debt-to-income ratio is not the only relevant measure of risks and it is important to examine other indicators too.

5. Quantitative indicators of financial risks

As we described in section 3, the empirical literature shows that there are a number of quantitative indicators that may be of use when assessing the risks in the financial system. This applies to both the risk of financial crises and of the economy's sensitivity to shocks. This section therefore examines the indicators that, in our view, are the most relevant for analysing the risks related to household indebtedness in Sweden. Individual indicators, however, may provide a misleading picture of the risks, which makes it important to study a number of different indicators and make an overall assessment. It should also be emphasised that one or more indicators may signal heightened risks without necessarily being followed by a financial crisis. We also discuss what other indicators may be of significance for such an assessment of risks. As stated in section 2, it is also important to analyse the fundamental factors in the development of, for example, housing prices and indebtedness and information about how financial robustness is distributed across households.

Increased lending and rising housing prices indicate heightened risks

One indicator that has proven to be a good warning of financial crises in the past is what is known as the *credit gap*. The credit gap is defined as the difference between actual lending in relation to GDP and the lending trend in relation to GDP. If the gap has at any point in recent times had a high value, this has been shown to be an indication of heightened risks. In Sweden, lending in relation to GDP increased sharply over a long period and the credit gap has been positive since 2005 (see Chart 5.1). The credit gap is greater than 2 percentage points, which according to the guidance from the Basel Committee on Banking Supervision indicates heightened risks.⁵³ Most of the credit gap is due to the increase in household lending. Since 2011 the credit gap has declined somewhat, but it is believed that this decrease gives a misleading picture of the risks. This is because the decline is largely due to Sweden having had high credit growth over an extended period, so the trend has continued to increase mechanically in recent years. Now that lending in relation to GDP is increasing at a slower rate than before, the trend is catching up, which means that the credit gap is decreasing.⁵⁴

The fact that housing prices in Sweden increased over an extended period is another sign of heightened systemic risks. Experience shows that *the housing price gap*, defined as the difference between real housing prices and their trend, is a good indicator of risks on the housing market. In Sweden, the housing price gap was positive for the majority of the period since the second half of the 1990s (see Chart 5.2). In recent years, the gap has occasionally decreased and has even been negative as housing prices in Sweden have increased sharply over an extended period. However, the decline of the housing price gap is believed to give a misleading picture of the risks in the same way as the decline in the credit gap. Furthermore, the housing price gap tends to decline 2-3 years before a crisis strikes. A decrease in the housing price gap therefore does not necessarily mean that risks are decreasing. Recently, the gap has increased again because housing prices are rising at a faster rate. However, if the housing price gap is interpreted in purely mechanical terms, it still appears to be below the level that indicates heightened risks.⁵⁵ However, it is important to remember that this indicator underestimates the increase in housing prices as it is based on the prices of houses and does not capture the sharp increase in the prices of tenant-owner apartments in Sweden. A more fundamental problem is that the mechanical trend

53. See BCBS (2010).

54. See the text box, *The countercyclical capital buffer*, in Sveriges Riksbank (2014). See also the recommendation from ESRB on the countercyclical capital buffer.

55. Drehmann, Borio and Tsatsaronis (2011) find that the critical level is around 15-25 per cent. The ESRB (2014b), however, shows that the critical level may be much lower, depending on how risk-averse the decision-maker is.

does not contain any information about the valuation of housing prices based on fundamental factors.

The literature shows that the debt service ratio is a good indicator in a 1-2 year horizon. However, the debt service ratio ought not to be interpreted mechanically. Because of currently low interest rates, it is important to study the current debt service ratio, but also what it will be in future given the current debt-to-income ratio. Furthermore, loan amortisation contributes to strengthening households' financial robustness by gradually reducing indebtedness. It may therefore be better to use the *interest-to-income ratio* rather than the debt service ratio. As we discuss in section 3, Swedish historical experience may indicate that 10 per cent could be a reasonable choice for the critical level of the interest-to-income ratio. However, based on international experience, a lower critical level could be justified. The household interest-to-income ratio is currently low as a result of the low interest rate environment, which could be interpreted as the risks of a financial crisis in 1-2 years' time being limited. But depending on what assumptions are made, for example with regard to the long-term interest rate, the possible future interest-to-income ratio, given the current debt-to-income ratio, is close to the critical level for the interest-to-income ratio.

How banks fund increased lending is also of significance to risks. The fact that the proportion of loans issued with *non-core funding* has risen indicates that the banking system's vulnerability has increased (see Chart 5.3).⁵⁶ However, it is difficult to establish a specific critical level for this indicator.

High indebtedness increases the sensitivity of the economy to shocks

Since the *debt-to-income ratio* affects both the interest-to-income ratio and the debt service ratio, it is an important indicator with regard to the long-term risks of financial crises. As interest rates vary over time, so too will the interest-to-income ratio, even if the debt-to-income ratio is unchanged. The interest-to-income ratio is, after all, the interest rate multiplied by the debt-to-income ratio. The interest-to-income ratio may therefore give a misleading impression of risks if interest rates are low. The debt-to-income ratio may therefore be preferable in assessing imbalances as it is independent of the prevailing interest rate level. Depending on the assumptions made, for example with regard to long-term interest rates, the current debt-to-income ratio implies that the possible future interest-to-income ratio is close to the critical level for the interest-to-income ratio (see the discussion on the interest-to-income ratio above). However, aggregate data does not suffice to analyse the resilience of households to shocks.

The *distribution of the debt-to-income ratio* is of major significance to how sensitive consumption is to shocks. International studies show that households with a debt-to-income ratio of around 300 per cent tend to reduce their consumption more than low indebted households in the event of macroeconomic shocks. The sensitivity of consumption also increases the higher a household's debt-to-income ratio. It is therefore of interest to study the development of how the debt-to-income ratio is distributed to see how the risks change over time. Not least, it is of interest to see how the distribution has developed for new mortgage borrowers. As shown in Chart 5.4, the percentage of new mortgage borrowers with a debt-to-income ratio over 300 per cent has increased slightly in recent years.

The *distribution of the loan-to-value ratio* is of significance to how sensitive consumption is to shocks. Experience from Denmark shows that households with a loan-to-value ratio over around 40 per cent have greater consumption sensitivity than households with a lower loan-to-value ratio. As with the debt-to-income ratio, sensitivity is greater the higher a household's loan-to-value ratio is. In light of this, Finansinspektion (the Swedish Financial Supervisory Authority) uses the percentage of new mortgages with a loan-to-value ratio of over 50 per cent as an indicator.⁵⁷ The distribution of the loan-to-value ratio for new mortgage borrowers may provide an indication of how the risks develop (see Chart 5.5). The percentage of new mortgage borrowers with a loan-to-value ratio over 50 per cent has also increased in recent years.

56. See Juks and Melander (2012).

57. See Chart 41 in Finansinspektionen (2014).

Other indicators may also be relevant to assessing risks

As our review of the literature shows, there are also other indicators at an aggregate level that are of significance for assessing risks. For example, a substantial *current account surplus* could reduce the risks. Sweden has a positive current account, in part as a result of high levels of savings among households, which could indicate that the risks are smaller than what they would otherwise be. However, although the aggregate savings ratio is currently high in Sweden, we do not know the status of saving at household level, because no such information is available.

In certain cases, a high level of *housing construction* may accompany a housing bubble and thus indicate increased risks. While the level of housing construction in Sweden is indeed low, it is difficult to assert that this means that risks are low. A low level of construction is more likely to lead to limited supply, which contributes to a rise in housing prices.

The level of households' *financial assets* may also affect the assessment of risks since liquid assets may be divested during a crisis and used to stave off financial disruption. However, there is currently a lack of information about Swedish households' assets. Experience from Denmark for instance indicates, however, that the size of financial assets is of limited significance in terms of how households adapt their consumption in the event of shock.

Another relevant indicator at an aggregate level is banks' *leverage ratio*, i.e. banks' capital in relation to their total assets. If the banks have sufficient capital, they are better able to withstand credit losses that may occur when highly indebted households reduce their consumption in the event of a macroeconomic shock. International studies show that a low leverage ratio implies heightened risk of bank failures and financial crises. The major Swedish banks have relatively lower capital levels in relation to total assets than many other European banks. This indicates that the Swedish banks are less resilient to financial stress than many other comparable banks in Europe.⁵⁸

6. Household indebtedness may pose risks to the economy

Empirical studies show that if household debt increases sharply, the risk of a financial crisis, or a drop in housing prices, increases. This applies in particular if housing prices have also risen rapidly. The studies also show that the level of household debt is of significance for risks to the economy.

To assess the risks posed by Swedish households' current indebtedness, we have examined two different approaches. First, we have used historical data at the aggregate level. Second, we have applied experience from abroad to Swedish micro data.

The results of the first approach indicate that an aggregate debt-to-income ratio of 180-210 per cent can pose a heightened risk to the Swedish economy. At those levels, the interest burden of households could create problems when interest rates approach stressed levels.

The findings from the second approach, in which we looked in more detail at how household debt is distributed, also indicate heightened risks. If Swedish households with a debt-to-income ratio above 300 per cent in a crisis were to adjust their consumption in the event of a shock in the same way as equivalent Danish households did during the crisis period of 2007-2009 period, their consumption would decrease by around 5 per cent. More than 590,000 Swedish households, or nearly 40 per cent of households with mortgages in Sweden, currently have debt which, combined, can pose a risk to the Swedish economy. The equivalent proportion among new mortgage borrowers is almost 60 per cent. These findings indicate that the risks increase over time both for individual households and for society if lots of new mortgage borrowers have high indebtedness and do not amortise their debt or amortise it at a slow rate.

58. See the article *A Swedish leverage ratio requirement* in Sveriges Riksbank (2014b) for a more detailed discussion of the leverage ratio from a Swedish perspective.

The results of both approaches used in this study indicate that the indebtedness of Swedish households is currently at a level that could result in heightened risks for the Swedish economy. At the same time, the findings should be interpreted with caution. The quantifications of the macroeconomic risks that we have established in this context should be seen as an illustration of possible effects rather than an estimate of probable effects.

But other relevant indicators, such as changes in housing prices in relation to their trend and the funding of increased lending from banks, also suggest that the risks from Swedish household indebtedness are not insignificant. The large current account surplus and high levels of savings in Sweden could, however, mitigate the risks somewhat, although there is a lack of information on savings at household level. There is, of course, some uncertainty associated with our findings. However, along with other indicators they still provide clear indications of increased vulnerability in the Swedish economy as a result of high household indebtedness.

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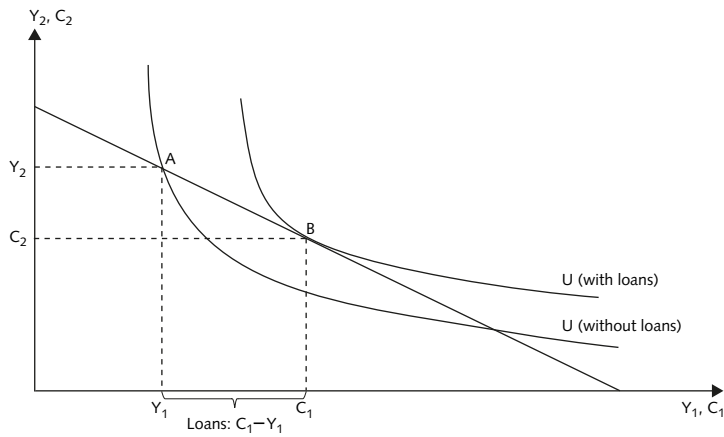
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Chart appendix

Figure 2.1. Levelling-out of consumption over the lifecycle



Y_1 = Household income in period 1 ("when young")

Y_2 = Household income in period 2 ("when older")

C_1 = Household consumption in period 1 given opportunities to borrow

C_2 = Household consumption in period 2 given loans in period 1

U = Household utility function

Without the ability to borrow, a household cannot consume more than its income in period 1 (point A).

The ability to borrow the amount $C_1 - Y_1$ in period 1 enables a household to even out its consumption over its lifecycle (point B), for example to buy a home or invest in human capital (education). This ability to borrow increases welfare (U (with borrowing) $>$ U (without borrowing)).

Figure 2.2. Risks associated with high indebtedness

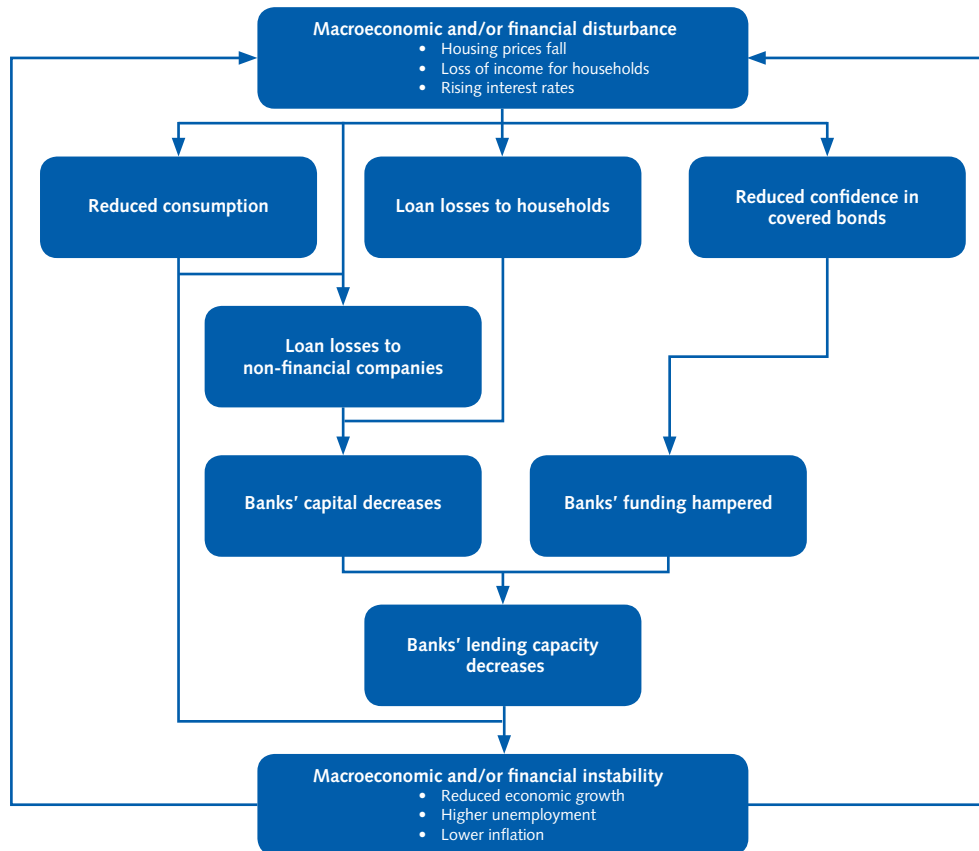
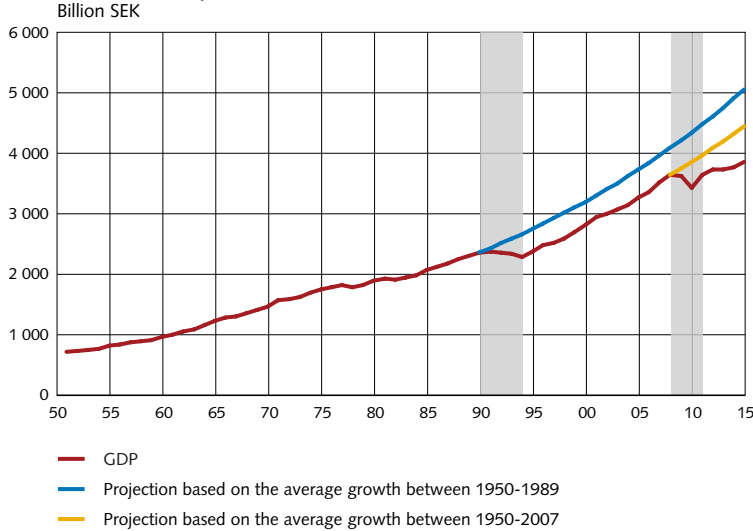
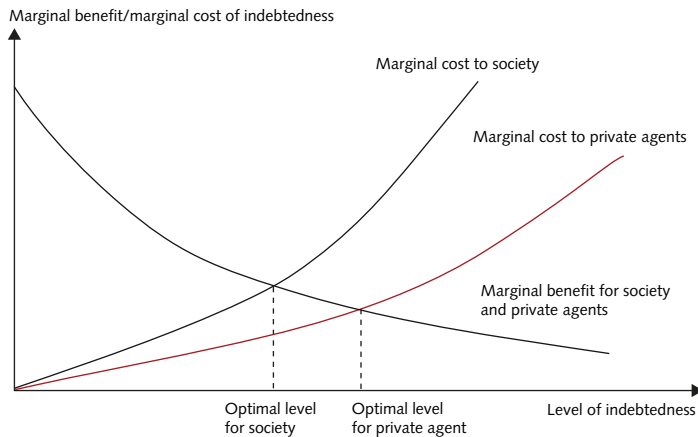


Chart 2.3. Development of Swedish GDP before and after a financial crisis



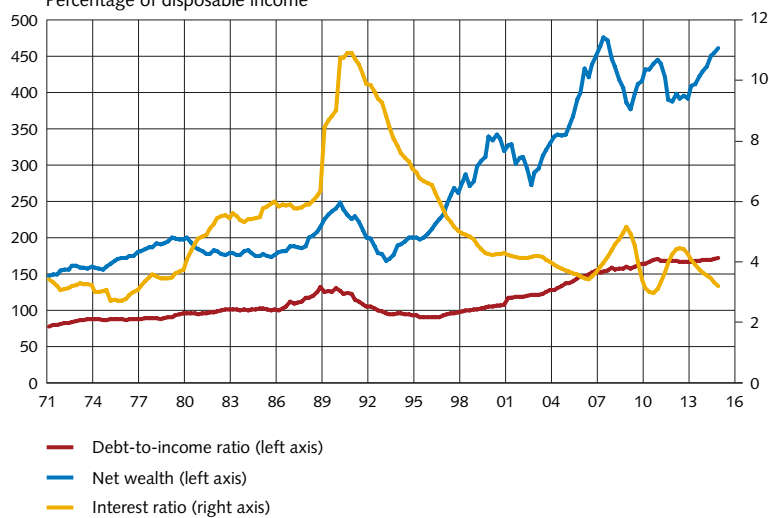
Note. The gray areas represent the crisis in the 1990's and the 2008-2009 financial crisis.
Sources: National Institute of Economic Research and the Riksbank

Figure 2.4. Society's marginal benefit and marginal cost of household indebtedness



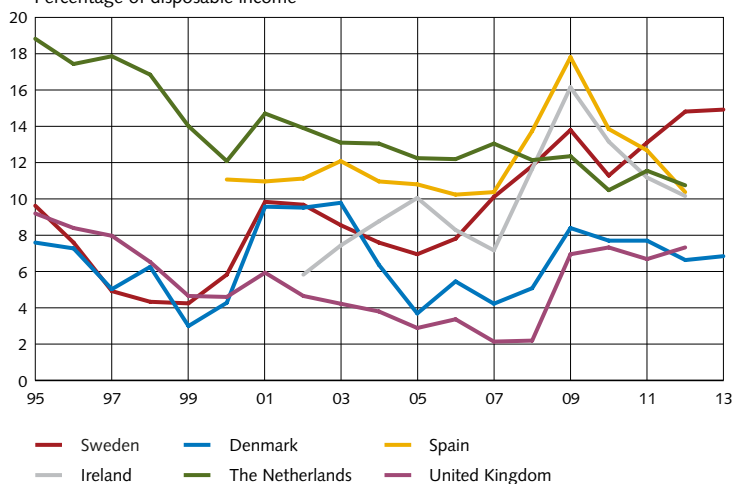
Note. Households' ability to borrow results in welfare gains for society. The marginal benefit from increased indebtedness is at its highest when indebtedness is initially low. The marginal benefit then diminishes as indebtedness rises. The marginal costs to society in the form of increased vulnerability to economic disturbances and shocks increases as indebtedness rises. Costs to private agents are lower than the cost to society. Ideally, society would like to set a level on household indebtedness at the intersection where the marginal cost and the marginal benefit to society are equal. This intersection occurs at a level of indebtedness that is lower than the optimal level for the private agents. In practice, however, it is not possible to establish such an intersection.

Chart 2.5. Household aggregate debt-to-income ratio, net wealth and interest ratio
Percentage of disposable income



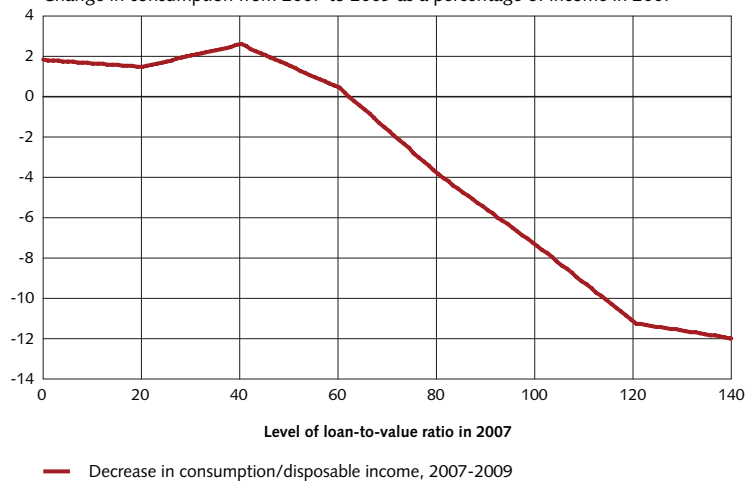
Sources: Statistics Sweden and the Riksbank

Chart 2.6. Household aggregate saving in different countries
Percentage of disposable income



Note. The chart shows household sector gross savings, which include household pension savings.
Source: Eurostat

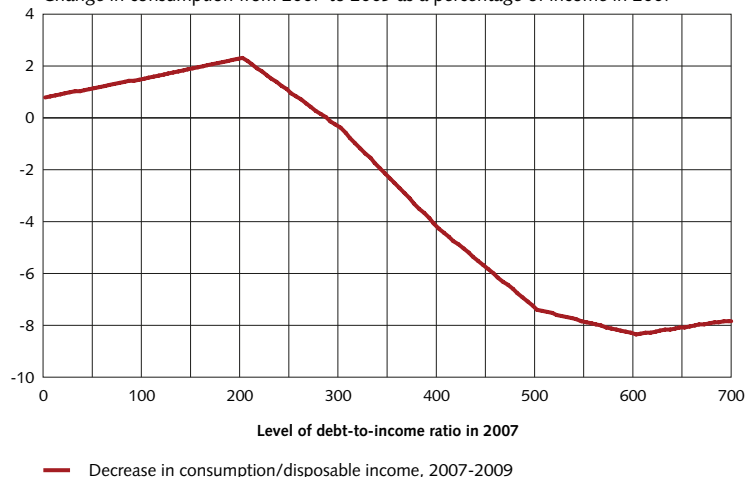
Chart 3.1. Estimated change in consumption among Danish households at different loan-to-value ratios
Change in consumption from 2007 to 2009 as a percentage of income in 2007



Note. See Andersen et al. (2014) for assumptions and calculations.
Source: Andersen et al. (2014)

Chart 3.2. Estimated change in consumption among Danish households at different debt-to-income ratios

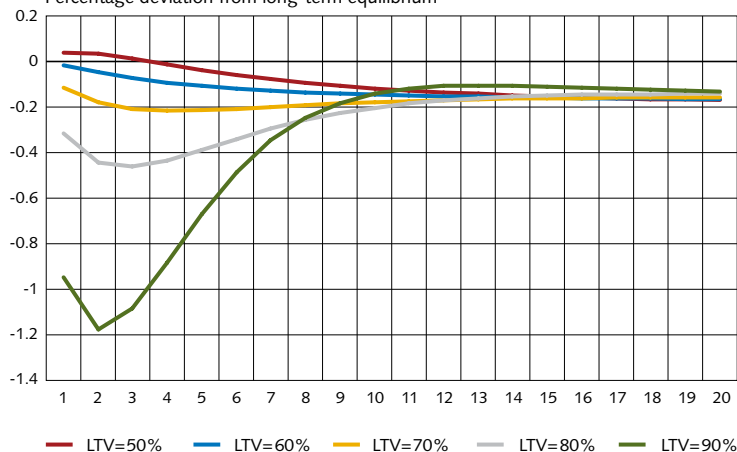
Change in consumption from 2007 to 2009 as a percentage of income in 2007



Note. See Andersen et al. (2014) for assumptions and calculations.
Source: Andersen et al. (2014)

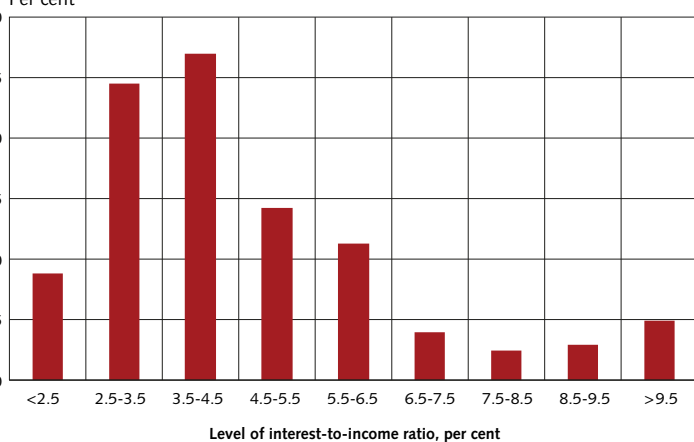
Chart 3.3. Effects on household aggregate consumption of a fall in house prices by 10 percent at different LTV ratios

Percentage deviation from long-term equilibrium



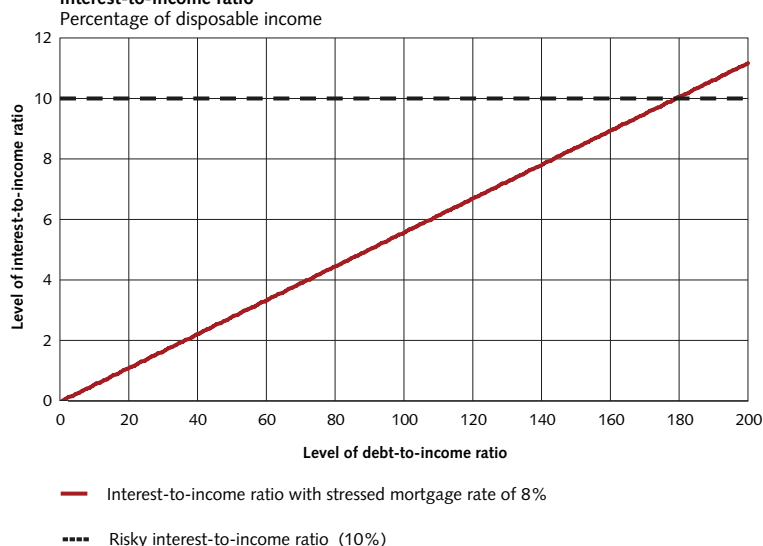
Source: The Riksbank

Chart 4.1. Distribution of levels on the aggregated interest-to-income ratio since 1964



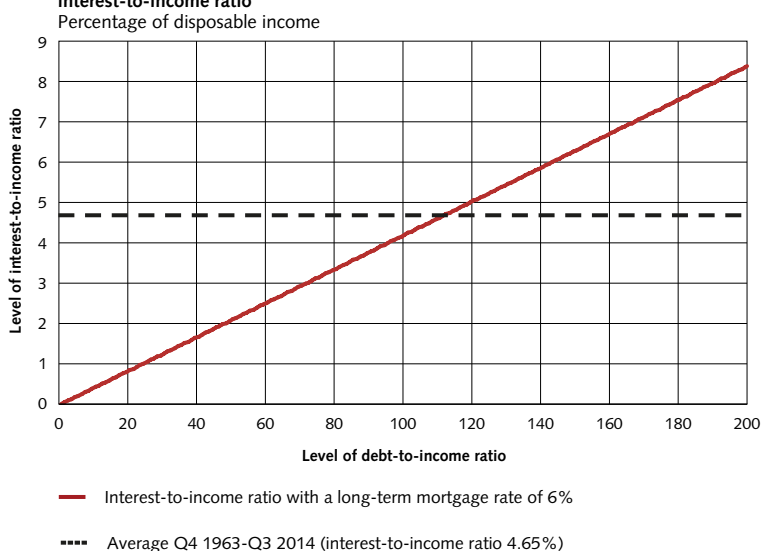
Sources: Statistics Sweden and the Riksbank

Chart 4.2. Interest-to-income ratio at different debt-to-income ratios, stressed interest-to-income ratio



Sources: Statistics Sweden and the Riksbank

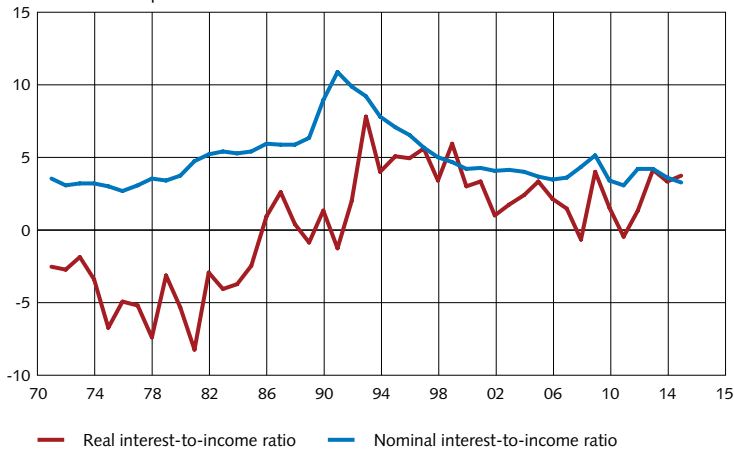
Chart 4.3. Interest-to-income ratio at different debt-to-income ratios, historical average interest-to-income ratio



Sources: Statistics Sweden and the Riksbank

Chart 4.4. Real and nominal interest-to-income ratio

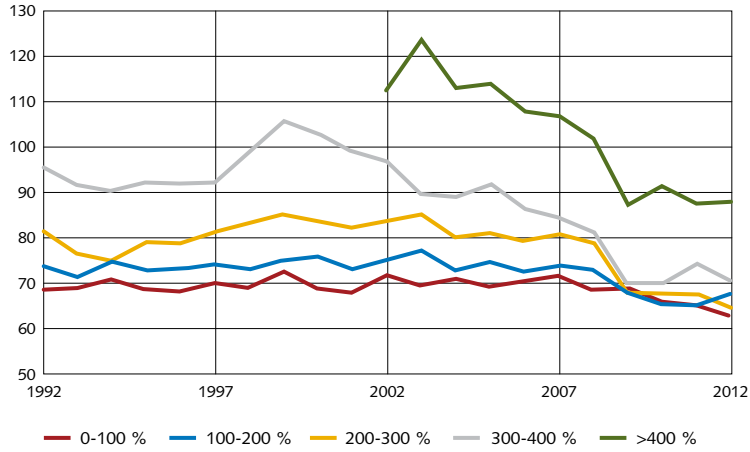
Per cent of disposable income



Note. The real interest-to-income is calculated by multiplying a real implicit interest rate with the debt-to-income ratio.

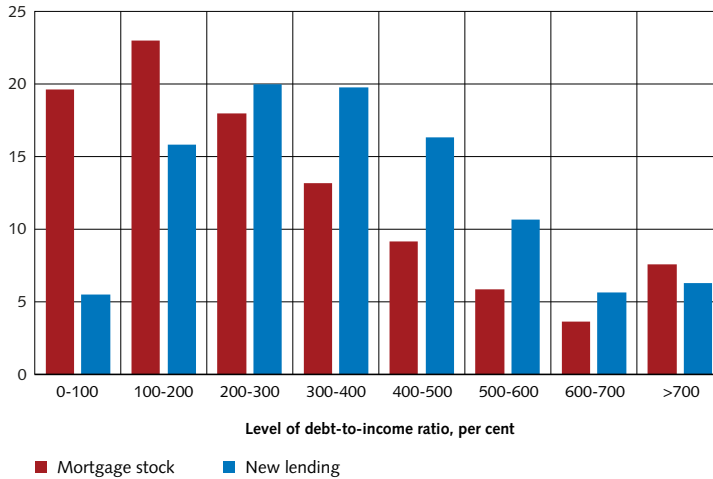
Sources: Statistics Sweden and the Riksbank

Chart 4.5. Non-housing-related consumption as a proportion of gross income among UK mortgage borrowers, given different debt-to-income ratio levels
Per cent



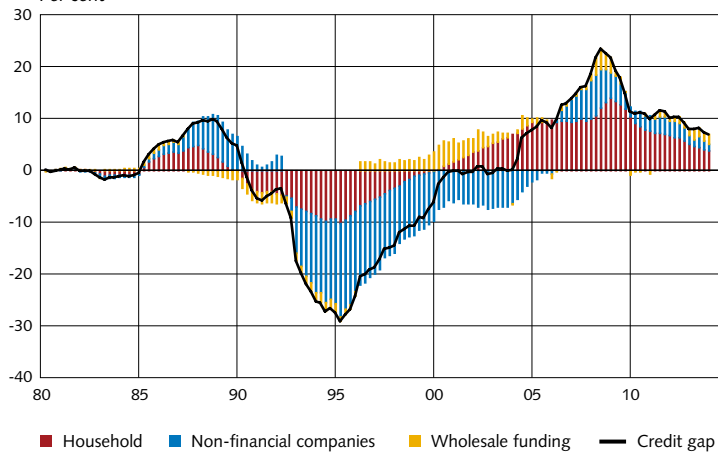
Source: Bunn and Rostom (2014)

Chart 4.6. Distribution of debt-to-income ratios for households in Sweden, 2014
Per cent



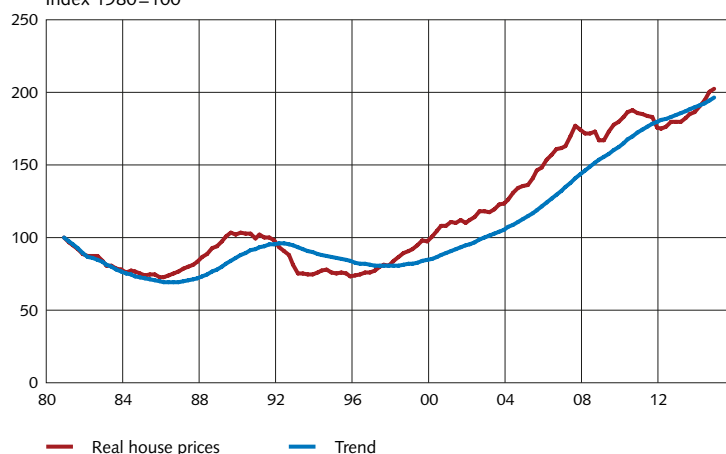
Note. The chart shows the percentage of households with different debt-to-income ratios in the mortgage stock and in new lending during 2014.
Sources: Finansinspektionen and the Riksbank

Chart 5.1. Credit gap in Sweden
Per cent



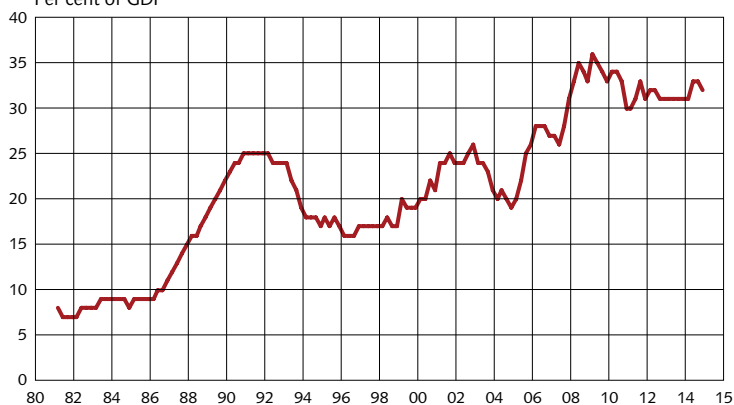
Note. The credit gap is defined as the distance from the underlying trend in total debt in relation to GDP. The total debt consists of total lending to the public and the non-financial companies' market funding.
Sources: Statistics Sweden and the Riksbank

Chart 5.2. House price gap in Sweden
Index 1980=100



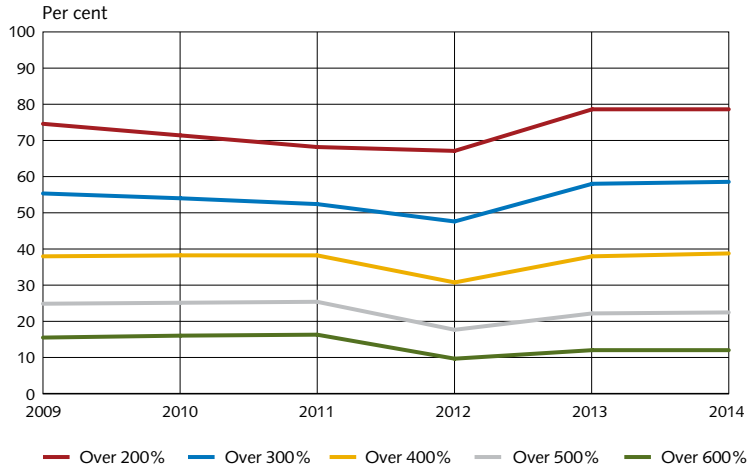
Note. Real house prices are defined as Statistics Sweden's real estate price index deflated by the CPI. The statistical trend is calculated using a one-sided HP filter with the smoothing parameter equal to 400,000.
Sources: Statistics Sweden and the Riksbank

Chart 5.3. Lending financed with non-core funding
Per cent of GDP



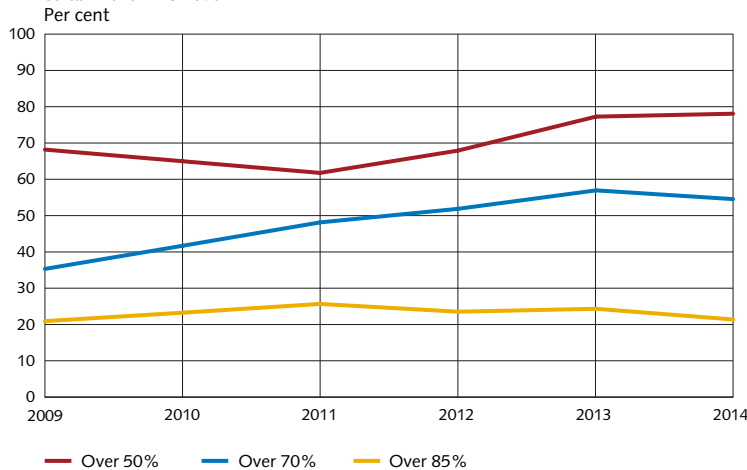
Note. Lending funded with non-core funding is defined as the difference between total lending and lending funded with stable funding. Total lending is defined as monetary financial institutions' lending to the private non-financial sector. Lending financed with stable funding is calculated as lending funded with deposits from the public, long-term market funding from the private non-financial sector and equity. The series is shown in relation to GDP. GDP is expressed in nominal terms and is defined as total GDP for the past four quarters.
Sources: Statistics Sweden and the Riksbank

Chart 5.4. The percentage of new mortgage borrowers with a debt-to-income ratio over a certain level in Sweden



Note. The vertical axis shows what percentage of new borrowers are over the given debt-to-income ratio. Data is based on BLU 2009, 2011, 2012, 2013 and 2014. The values for 2010 are interpolated between the values 2009 and 2011. The debt-to-income ratios are winsorised at the 99th percentile for each year.
Sources: Finansinspektionen and the Riksbank

Chart 5.5. Percentage of new mortgage borrowers with a loan-to-value ratio over a certain level in Sweden



Note. The vertical axis shows what percentage of new borrowers are over the given LTV ratio. Data is based on BLU 2009, 2011, 2012, 2013 and 2014. The values for 2010 are interpolated between the values 2009 and 2011. For 2011, 2012 and 2013, the LTV ratio is calculated as housing-related loans/price. The variable of housing-related loans is not included in the data for 2009. This data instead uses total loans scaled by a factor corresponding to the median ratio of housing-related loans/total loans in the data from 2011. LTV is winsorised at the 99th percentile for each year.
Sources: Finansinspektionen and the Riksbank