

An analysis of the debt-to-income limit as a policy measure

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1. Introduction

The aggregate debt-to-income ratio (DTI) of Swedish households, i.e. their total debts in relation to their total disposable income, has grown over the past 20 years. If this trend continues, it will constitute a growing risk to both financial stability and macroeconomic developments.² An increasingly wider base of empirical research is showing that there is a relationship between increased borrowing in the household sector and an increase in the probability of the occurrence of financial crises as well as a fall in housing prices, and that the domestic economy becomes more vulnerable to disruptions if households have large loans. Studies of microdata also show that there is a relationship between households having large debts, in terms of the debt-to-income ratio, and the extent to which their consumption is affected during a macroeconomic disruption.³ Therefore, the households' debt-to-income ratio is an important indicator for determining the vulnerability of the economy as a whole. A high debt-to-income ratio also means that the interest-to-income ratio, i.e. households' interest payments in relation to their disposable income, could potentially rise more. In other words, household become more sensitive to changes in interest rates if they have large debts.⁴

Since households' individual loan decisions also affect the entire domestic economy, it is possible to make the statement that household indebtedness leads to externalities. The same applies to the banks' lending decisions, for example since their credit assessments, which show that a household can pay for its loan, do not take into consideration that the household would need to reduce its consumption to do so. From an economic policy perspective, intervention by authorities in the form of different policies can therefore be justified by the fact that households and banks do not take into consideration the risks that their decision introduce to the domestic economy as a whole. This means, in other words, that the State introduces new rules to avoid a market failure that could have resulted from the households' decisions.

In Sweden, the discussions about how we should introduce different policies to limit lending have intensified in recent years. In 2010 Finansinspektionen introduced a loan-to-value limit of 85 per cent and in November 2014 the same authority recommended an amortisation requirement on mortgages with a loan-to-value ratio in excess of 50 per cent.⁵ However, Finansinspektionen had to withdraw this requirement in April of this year and it is currently unclear if a requirement on the amortisation of mortgages will be introduced, and if it will, when. However, other measures to slow the indebtedness of households are being discussed in Sweden and on an international scene.

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2. See Emanuelsson, Melander and Molin (2015).

3. For more information see Flodén (2014), Andersen et al. (2014), Bunn and Rostom (2014), Dynan (2012), Mian et al. (2013), Dynan and Edelberg (2013), Drehmann and Juselius (2012), and Sveriges Riksbank (2013).

4. See Emanuelsson, Melander and Molin (2015).

5. A loan-to-value limit constrains the size of the mortgage in relation to the value of the property.

The trend of rising housing prices continues, as does household indebtedness. This development introduces risks to both financial stability and the macroeconomy. A debt-to-income limit is one of several conceivable policies that could be used to mitigate these risks. In this economic commentary we will discuss the advantages and disadvantages of a debt-to-income limit as a policy measure in Sweden. Using two examples of debt-to-income limits, we will also present calculations that show which households would be affected by the debt-to-income limit and to what extent. We also analyse the effects a debt-to-income limit could have on the aggregate debt-to-income ratio as well as GDP, consumption and housing prices.

The analysis shows that if a debt-to-income limit of 600 per cent were introduced for new mortgage borrowers, 12 per cent would not be able to borrow as much as they could previously. If the debt-to-income limit were set at 400 per cent, the percentage of new mortgage borrowers who would not be able to borrow as much as previously would increase to 39 per cent. Furthermore we show that the effects of the debt-to-income limit on individual households vary based on a household's income, age group, region and the bank with which it does business. In the long run, the effects on the macroeconomy are limited.

A debt-to-income limit is a policy measure that an increasing number of countries with high debt levels in their household sector have begun to use as a complement to a loan-to-value limit. A loan-to-income limit establishes an upper limit for how large a household's loan may be in relation to its disposable income. However, there is no general definition of how a debt-to-income limit should be designed and its effects can vary depending on the choices made when constructing it. For example, a debt-to-income limit can be introduced for individual households or target the banks' lending stock.

1.1 Debt-to-income limit can slow procyclical lending

In a situation where both household debt and house prices are increasing sharply, the debt-to-income limit can have several advantages. Since high indebtedness increases both the risk of a financial crisis and the effects of such a crisis should one occur, a debt-to-income limit could contribute to promoting financial and macroeconomic stability. Since a debt-to-income limit decreases the households' willingness to borrow, it can suppress both lending growth and house prices. It can also affect households' expectations about how house prices will change in the future and thus result in less speculation on the housing market. One important advantage of the debt-to-income limit is that it can slow the procyclicality of lending. The issuance of credit does not increase to the same extent with a limit on the debt-to-income ratio as it does with a limit on the loan-to-value ratio since households' income tend to be relatively stable even when house prices are rising sharply.^{6,7} According to the Riksbank's analysis, Finansinspektionen's previous proposal for an amortisation requirement was also not expected to slow household indebtedness to any major extent during periods of sharp increases in house prices since this requirement was also linked to the household's loan-to-value ratio and thus the property's value. However, it could be an effective solution to complement the loan-to-value limit with a debt-to-income limit.⁸ From a financial stability perspective, the debt-to-income limit also complements the loan-to-value limit. A loan-to-value limit decreases the probability that households will find themselves in positions of negative equity, which would entail that the household would have an outstanding debt if forced to sell the home. This could also mean credit losses for banks. The debt-to-income limit decreases the probability that the debt would be so large in relation to the household's income that the household would not be able to make interest or amortisation payments, which increases the probability that the household in the end can pay for its debts. The debt-to-income limit thus decreases *the probability of default*, while the loan-to-value limit decreases *the loss given default*. In this context it must be emphasised that households in Sweden have long-reaching obligations to fulfil their mortgage payments, which decreases the risk that the banks would suffer credit losses on mortgages.⁹

1.2 Debt-to-income limits constrain households' ability to smooth their consumption

However, there are also disadvantages to implementing a debt-to-income limit. A debt-to-income limit entails that some households are forced to borrow less than what they consider to be optimal. This means that the households' ability to smooth their consumption over the life cycle is limited, which in turn leads to the households achieving a lower welfare than if they were able to borrow more. For example, young households in general have lower salaries at the beginning of their professional lives, but often very good salary potential. By applying a debt-to-income limit, the banks' possibilities of assessing the households' potential payment capacity disappear to some extent since it is current income that forms the basis for the credit assessment even though a mortgage has a term of many years. A debt-to-income limit can thus make it difficult for young households with good creditworthiness to enter the housing market. A debt-to-income limit is also more limiting for households in the

6. A dynamic application of the loan-to-value limit over time, such that it is tightened during periods when housing prices are rising sharply, could mitigate this problem, but this requires the ability to implement changes with little advance notice, which in practice is probably very difficult.

7. See, for example, Almeida, Campello and Liu (2006).

8. One advantage of using a debt-to-income limit as a complement instead of tightening the loan-to-value limit is that the debt-to-income limit does not obstruct first-time buyers to the same extent from entering the property market.

9. See, for example, Andersson and Lindh (2011).

higher income groups than, for example, limits to discretionary income.^{10, 11} By limiting how much households may borrow, a debt-to-income limit also entails a decrease in both consumption and GDP, at least in the short term.

1.3 Other policies also based on income

There are other policies that function in a similar manner as the debt-to-income limit. The debt service ratio limit (DSTI limit, Debt-service-to-income limit), which is a loan ceiling based on borrowing costs, makes it possible to limit how much a household may borrow based on an assessment of its ability to make interest and amortisation payments. The debt service ratio limit constitutes an upper limit for how large the share of disposable income a household may be expected to use for borrowing costs every month. Another method that is similar to the debt-to-income limit is to limit discretionary income. When calculating discretionary income, the bank estimates how much income the household will have left after paying for taxes, interest expenses, operating costs and maintenance costs for the property as well as living expenses. Even if all banks calculate discretionary income, their methodologies differ significantly, which means that the assessment of an individual borrower's economic capacity is different for each bank.¹²

1.4 Debt-to-income limit more common internationally

More and more countries are introducing a debt-to-income limit or a debt service ratio limit as a complement to a loan-to-value limit. However, the requirements take on different forms. South Korea has limited the debt service ratio for several years. The limitations have varied over time and between regions, and there are indications that these have helped slow the growth of house prices and the indebtedness of households.¹³ In 2011 Lithuania introduced a loan-to-value limit of 85 per cent as well as a limit of 40 per cent for the debt service ratio.¹⁴ In the UK, the Bank of England's Financial Policy Committee (FPC) recommended in June 2014 that the share of mortgages with a debt-to-income ratio exceeding 450 per cent of gross income should be limited to a maximum of 15 per cent of all mortgages granted by the credit institution.¹⁵ The British approach thus targets the banks' portfolios rather than individual households. In 2015, Estonia will introduce requirements on both a loan-to-value limit and a debt service ratio limit. A maximum of 15 per cent of the new mortgages may have a total debt service ratio of more than 50 per cent of net income assuming a mortgage rate of 6 per cent or higher.¹⁶ In addition, a maximum of 15 per cent of mortgages may have an amortisation period of longer than 30 years. The Central Bank of Ireland also announced in January 2015 that it would introduce a loan-to-value limit and a debt-to-income limit.¹⁷ The debt-to-income limit entails that a maximum of 20 per cent of all new mortgages may have a debt-to-income ratio in excess of 350 per cent of gross income. Altogether, it is possible to make the statement that limits to the debt service ratio and the debt-to-income ratio are becoming more common as a complement to the loan-to-value limit in countries that have high levels of indebtedness in the household sector. International experience thus shows that these policies can be introduced with more or less flexibility

10. Discretionary income shows how much of a household's disposable income is left after housing costs and other living costs have been paid.

11. The question can be raised about whether it is these households that are considered to represent the largest risk to financial and macroeconomic instability since these households tend to also have the largest assets. If households with high debt-to-income ratios also have large assets or high savings, these risks would be somewhat alleviated. Since Sweden does not have updated statistics about assets and savings at the household level, it is difficult to know if households with high debt-to-income ratios have such buffers. At the same time, international experience shows that even households in the higher income groups or with large assets decrease their consumption in the event of a disruption if they have high debt-to-income ratios.

12. The Riksbank recommended in June 2014 that Finansinspektionen review the minimum levels of the standard amounts and/or the limit values in the discretionary income calculations used by the banks.

13. Presentations at the Macro-prudential Supervision Conference, Stockholm, November 2014 and Igan and Kang (2011). The presentations from the conference are available at www.riksbank.se/sv/Finansiell-stabilitet/Makrotillsynskonferens-november-2014/.

14. See Bank of Lithuania (2011).

15. See Bank of England (2014).

16. See Eesti Pank (2014).

17. See Central Bank of Ireland (2015).

In this context, we can also mention that the International Monetary Fund (IMF) suggested in its annual review of the Swedish economy that even Sweden should consider introducing a debt service ratio limit as a complement to the loan-to-value limit. According to the IMF's recommendation, Sweden should also lower the level of the loan-to-value limit.¹⁸

2. Debts of Swedish households

The debts of Swedish households in relation to their disposable income have increased over the past 20 years with the exception of some, short interruptions. In Q4 2014, the aggregate debt-to-income ratio for the Swedish household sector as a whole was 172 per cent (see Diagram B1 in the Appendix).¹⁹ This is relatively high, even from an international perspective (see Diagram B2 in the Appendix). If we assume that debts and income in the future will develop at the same rate as they have done in the past ten years, the aggregate debt-to-income ratio will be more than 225 per cent in ten years.

According to the Riksbank's credit data, around four million individuals and just under two million households are in debt to the eight largest banks. The average debt-to-income ratio for the households was 265 per cent in July 2014. The same data also shows that around three million people and one and a half million households have mortgages in Sweden. The average debt-to-income ratio for households with mortgages was 315 per cent in July 2014.²⁰

Looking instead at the flow of new borrowers, the sample from Finansinspektionen's mortgage market survey 2015 shows that the average debt-to-income ratio among new mortgage borrowers was 371 per cent in September 2014. The random sample is based on 28,400 new mortgage borrowers in the eight largest banks in Sweden.²¹ The analysis in this economic commentary is based primarily on data from the mortgage market survey. Table B1 in the Appendix presents descriptive statistics for different variables from the mortgage market survey.²² Also refer to Diagram B3 in the Appendix for a comparison of how the debt-to-income ratios are distributed among mortgage borrowers in the lending stock and among new mortgage borrowers.

2.1 New mortgage borrowers' debt-to-income and loan-to-value ratios

Table 1 presents the break-down of mortgage borrowers by their loan-to-value ratio and debt-to-income ratio in order to see how indebted new mortgage borrowers are. The loan-to-value ratio relates the household's total loans collateralised by the property (including other loans that can be traced to the property financing) to the value of the property. The debt-to-income ratio includes the household's total loans, even if some are not related to the property.²³

The average loan-to-value ratio for new mortgage borrowers in the sample is 66 per cent. In Table 1 it is apparent that almost half of the households in the random sample had a loan-to-value ratio of between 70 and 90 per cent. Since the loan-to-value limit is 85 per cent, most of the households in the category 80-90 per cent are under or at an 85-per cent loan-to-value ratio. Around 40 per cent of the new mortgage borrowers have a debt-to-income ratio of between 200 per cent and 400 per cent. It is most common to have a debt-to-income ratio of 300 to 400 per cent, as well as a loan-to-value ratio of between 80 and 90 per cent.

18. International Monetary Fund (2014).

19. In December 2014, the total debt stock of the household sector was SEK 3,403,525 million, of which 73 per cent consisted of mortgages.

20. For more information about the Riksbank's credit data and descriptive statistics about household debt, please refer to Winstrand and Ölcer (2014) and Alfelt and Winstrand (2015).

21. These banks are Nordea, SEB, Handelsbanken, Swedbank, Länsförsäkringar, Danske bank, Skandia and SBAB.

22. Some of the statistics here differ slightly from the statistics presented in Finansinspektionen's report, "The Swedish Mortgage Market 2015". This commentary includes all of the loans from the mortgage market survey. Finansinspektionen's report is based on filtered data that only includes mortgages where the borrower's loan-to-value ratio has increased by at least 50 per cent.

23. Information about the household's income and debts in the mortgage market survey are both obtained from UC and self-reported. As a result, some answers should be carefully interpreted. According to Finansinspektionen, the random sample is representative of new mortgage borrowers in all of Sweden.

Table 1. Percentage of new mortgage borrowers with a certain debt-to-income ratio and loan-to-income ratio

DEBT-TO-INCOME RATIO	LOAN-TO-VALUE RATIO											TOTAL
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	>100	
	PER CENT											
0-100	0.7	0.9	0.8	0.5	0.5	0.3	0.4	0.5	0.8	0.0	0.1	5.5
100-200	0.3	1.2	1.4	1.6	1.5	1.6	1.8	2.2	3.5	0.4	0.5	15.8
200-300	0.1	0.4	1.1	1.4	1.7	2.1	2.8	3.5	5.6	0.6	0.6	20.0
300-400	0.1	0.3	0.6	0.8	1.4	1.8	3.1	4.3	6.4	0.6	0.4	19.8
400-500	0.1	0.2	0.3	0.6	0.8	1.3	2.5	3.9	5.8	0.6	0.2	16.3
500-600	0.1	0.1	0.2	0.3	0.5	0.9	1.8	2.6	3.9	0.3	0.1	10.6
600-700	0.0	0.1	0.1	0.2	0.3	0.5	0.9	1.3	2.1	0.1	0.1	5.6
700-800	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.6	0.9	0.1	0.0	2.5
800-900	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.3	0.4	0.0	0.0	1.3
900-1000	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.0	0.0	0.7
>1000	0.0	0.0	0.0	0.1	0.2	0.2	0.3	0.4	0.5	0.0	0.0	1.7
TOTAL	1.4	3.3	4.6	5.7	7.0	9.1	14.3	19.7	30.1	2.7	2.1	100

Note. Data based on the random sample in Finansinspektionen's 2015 mortgage market survey. The definition of loan-to-value includes the household's total loans collateralised by the collateral object and other loans that can be traced to the property financing.

Sources: Finansinspektionen and the Riksbank

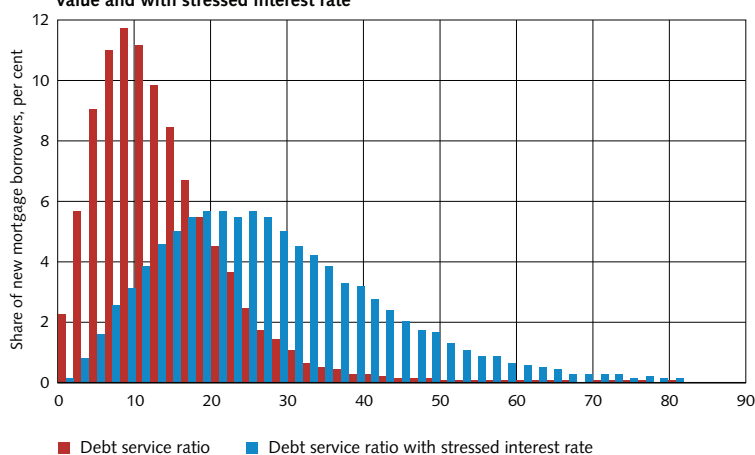
2.2 Household debt service ratios – present value and with a stressed interest rate

Diagram 1 presents instead the households' debt service ratio (interest and amortisation payments in relation to disposable income) and how it is distributed. The red bars show the actual distribution. The diagram is based on the interest and amortisation payment the households make in accordance with their loan contracts. The average debt service ratio was 13 per cent and the median 12 per cent for all of the mortgage borrowers' loans. If we instead calculate the debt service ratio using a more normal repo rate, for example four per cent, and add a surcharge of two per cent to illustrate a stressed scenario, the average debt service ratio would be 29 per cent and the median 26 per cent (blue bars).²⁴ Almost 18 per cent of all new mortgage borrowers in Sweden would thus need to borrow less if a debt service ratio limit of 40 per cent was introduced as in South Korea or Lithuania.²⁵

24. In the different models four per cent is assumed to be a "normal" repo rate. In addition to the repo rate, there is a surcharge for the mortgage as well as two per cent for a stressed scenario.

25. These calculations of the debt service ratio have taken the interest rate deduction into consideration. If the interest rate deduction is not taken into consideration, around 35 per cent of all new mortgage borrowers would need to take a smaller loan.

Diagram 1. Break-down of debt service ratio for new mortgage borrowers, present value and with stressed interest rate



Note. The red bars are based on the households' interest rates, amortisation payments and contractual debts (interest expenses are adjusted for interest rate deductions). The blue bars illustrate the debt service ratio in a stressed situation. The calculation of the stressed debt service ratio assumes an interest surcharge of 3.75 per cent (since the repo rate was 0.25 per cent in September–October 2014 and we assume a normal repo rate is four per cent) and two per cent (for stress). Amortisation payments are assumed to be the same in both cases, i.e. as per the contract.

Sources: Finansinspektionen and the Riksbank

3. Different debt-to-income limits and their effects

The effects of the debt-to-income limit depend on how it is designed, for example if it applies to all borrowers or only new borrowers. In its discussions surrounding the amortisation requirement, Finansinspektionen made the assessment that an amortisation requirement on the total mortgage stock, including all existing loans, would be both principally and legally difficult to introduce. Finansinspektionen thus proposed that only new loans should be subject to its new amortisation requirements. Even when the loan-to-value limit was introduced in 2010, it only applied to new loans. Therefore, in the two examples below, we have also assumed that the debt-to-income limit only applies to new loans, or more specifically, the total loans of new mortgage borrowers.

We present below two examples of how to calculate the debt-to-income limit. In the first example we assume that new borrowers may borrow no more than 400 per cent of their disposable income. In the second example we assume instead that new borrowers may borrow no more than 600 per cent of their disposable income. These two debt-to-income limits are only used for calculation purposes and should not be interpreted as optimal levels.²⁶ Since we base these calculations on the mortgage market survey, they are made ex-post. This means that we assume that the same households will want to take a loan even in the presence of a debt-to-income limit, but for a smaller amount. We therefore do not take into consideration potential changes to loan behaviour, for example that the household does not take a loan at all if it does not get to borrow the amount that it wants to borrow.

The red bars in Diagram 2 show the distribution of the debt-to-income ratios of households in the mortgage market survey. If a debt-to-income limit of 400 per cent is introduced, the new requirement would have an impact on 39 per cent of the borrowers in the mortgage market survey and they would not be able to borrow as much as they had previously. If a debt-to-income limit is instead introduced at 600 per

26. The calculation using the debt-to-income limit of 400 per cent has approximately the same effect on the aggregate debt-to-income ratio as Example 1 in the amortisation memorandum that was used for the Financial Stability Council's meeting on 11 November 2014 (in the example all new mortgages have 35-year amortisation schedules). In the same matter, the calculation using the debt-to-income limit of 600 per cent has approximately the same effects on the aggregate debt-to-income ratio as Finansinspektionen's previous proposal for the amortisation requirement. In addition, these two examples can be justified by the fact that they are lower than the limit the two banks in the mortgage market survey believe that households should not exceed in the long run. Two banks believe that long-term debt as a percentage of gross income should not exceed 500 per cent, which corresponds to 714 per cent of disposable income, at a tax level of 30 per cent.

cent, 12 per cent of the new borrowers are affected by the new requirement and need to borrow less.²⁷

Before we analyse which types of households are affected by these two examples of debt-to-income limits, it can also be interesting to illustrate the breakdown of the debt-to-income ratios over time. When the banks conduct a credit assessment, they normally calculate the household's income using a discretionary income calculation.²⁸ One possible situation is that, if property prices continue to rise, households that today are constrained by a loan-to-value limit but that also have income left over after a discretionary income calculation could be able to borrow more. Thus, credit growth would increase. If we make a more concrete assumption that households with a discretionary income calculation greater than zero can borrow up until the point that their discretionary income calculation is equal to zero, the households' debt-to-income ratios would rise,²⁹ since income generally grows a lot slower than property prices. The blue bars in Diagram 2 shows what the distributions of the debt-to-income ratios would be if all households increased their debts to the point that their discretionary income calculations equalled zero.

If we want to avoid such a development, a debt-to-income limit could function as a "back-stop" for the discretionary income calculation. This means that households which in reality could be able to borrow more based on their discretionary income calculation are instead constrained by a debt-to-income limit. A debt-to-income limit thus stops lending that could be allowed under the loan-to-value limit and discretionary income calculation. For low-income households, the discretionary income calculation is probably more limiting than the debt-to-income limit, but for households in the higher income groups, a debt-to-income limit is more constraining. Therefore, in general it can be said that it is primarily households with high income levels that would be affected by a debt-to-income limit. Diagram B4 in the Appendix provides a theoretical illustration of this.

The two calculations that we present in this commentary focus on how the debt-to-income limit could be used to limit households' demand for credit. An alternative way to design a debt-to-income limit is to target the banks' portfolios. Since 12 per cent of all new mortgage borrowers have a debt-to-income ratio of more than 600 per cent, such a debt-to-income limit would, for example, be designed such that the banks may not grant loans with a debt-to-income ratio of more than 600 per cent to more than 12 per cent of its customers. The requirement would not affect new borrowers today. However, future borrowers would be limited, thus making it possible to avoid a future development where debts and property prices both rise sharply. A similar theory formed the basis for the newly designed debt-to-income limit in, for example, the UK and Ireland. In other words, there are other motives behind such a regulation. The aim is to prevent an increase in indebtedness in the future, while the debt-to-income ratio limitations that directly target households can be said to aim to suppress credit growth in the immediate future. Diagram B5 in the Appendix we compare the distribution of the debt-to-income ratios today to how they could be in the future, with and without a debt-to-income limit targeted at the banks.³⁰

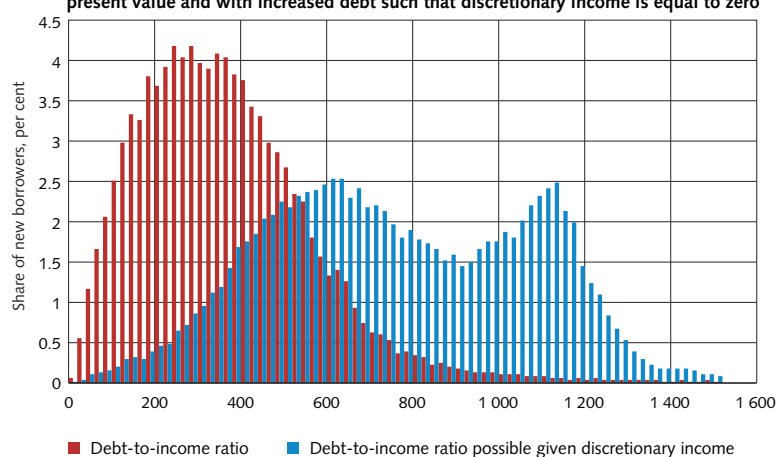
27. Diagram B3 in the Appendix shows that 26 per cent of mortgage borrowers in the Riksbank's credit data of the loan stock has a debt-to-income ratio of more than 400 per cent and 11 per cent a debt-to-income ratio of more than 600 per cent. If Finansinspektionen's proposed amortisation requirement presented on 11 November 2014 were to go into effect in 2013, 41.5 per cent of the households in the 2013 mortgage market survey would need to amortise faster than what they have opted to do.

28. The banks use a discretionary income calculation during their credit assessments to determine how much a household has to live on after accommodation costs and other living expenses are paid. If a discretionary income calculation is zero, this means that the household has SEK 0 to live on after accommodation and living costs are paid.

29. By borrowing more, households' lending costs increase and they thus have a smaller discretionary income. Here the assumption is made that households' living expenses have not changed and that the households are amortising at the same rate as before they increased their loan.

30. The calculations in Diagram B4 in the Appendix are based on simple assumptions about how income and property prices are increasing. These should not be interpreted as forecasts.

Diagram 2. Distribution of the debt-to-income ratio for new mortgage borrowers, present value and with increased debt such that discretionary income is equal to zero



Note. The red bars show the distribution of households' debt-to-income ratios based on existing debts and income in the mortgage market survey. The blue bars show the debt-to-income ratios if the households were allowed to borrow such that their discretionary income calculation is zero. In other words, the blue bars are hypothetical and illustrate the debt-to-income ratios without taking the loan-to-value limit into consideration. This could be a similar set-up as, for example, housing prices rising sharply and household debts only being limited by discretionary income. The calculations of the households' discretionary income use the banks' standard values for interest and the amortisation rate and take interest deductions into consideration.

Sources: Finansinspektionen and the Riksbank

3.1 Who is affected by the debt-to-income limit and by how much?

By breaking the borrowers in the mortgage market survey down into groups by income, age and location, we can analyse which households are affected by the debt-to-income limit and by how much.³¹ We then also analyse if there are differences between the eight largest banks and do calculations using three different typical households to see how much less they are allowed to borrow under the two debt-to-income limits.

3.1.1 To what extent are different income groups affected?

Our analysis shows that a debt-to-income limit of both 400 per cent and 600 per cent would affect a large percentage of households regardless of their income group. These ceilings would also entail far-reaching limitations on how much the households would be allowed to borrow. The effect on the aggregate credit growth would mainly come from the higher income groups.

The average debt-to-income ratio in every income decile is presented in Diagram 3. We can see there that the highest debt ratios are in the income deciles three to four and nine to ten. In other words, households with disposable income between around SEK 27,000 and 32,000 have approximately the same debt-to-income ratio as households with incomes between SEK 58,000 and SEK 82,000.

If a debt-to-income limit of 600 per cent were to be introduced before the various households took out their loans, at least 5 per cent of the borrowers in each income decile would need to borrow less than before (see Diagram 4). If a debt-to-income limit of 400 per cent were instead introduced, more than 25 per cent of the borrowers in every income decile would have needed to borrow less. In the third, fourth, ninth and tenth income decile, more than 40 per cent of the decile's borrowers would be constrained by a debt-to-income limit of 400 per cent.

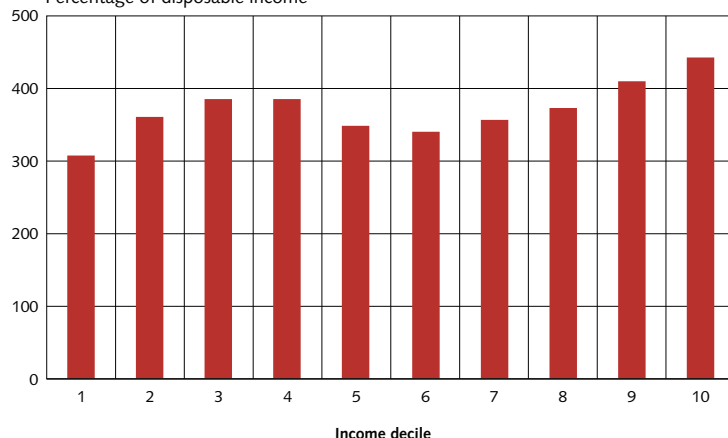
In addition to looking at how many in each income group are affected by the debt-to-income limit, it is also interesting to analyse how much less the households that are affected by the debt-to-income limit can borrow. Diagram 5 shows that regardless of the income group to which they belong, households that are affected by the debt-to-income limit of 600 per cent need to borrow on average at least 18 per cent less.

31. According to Finansinspektionen, the mortgage market survey's random sample is representative of new mortgage borrowers in Sweden. Data that is presented is at the household level. For age-based analyses, however, the primary borrower's age is used.

The stricter debt-to-income limit of 400 per cent would mean that these households would need to decrease their debts by 23 per cent or more.

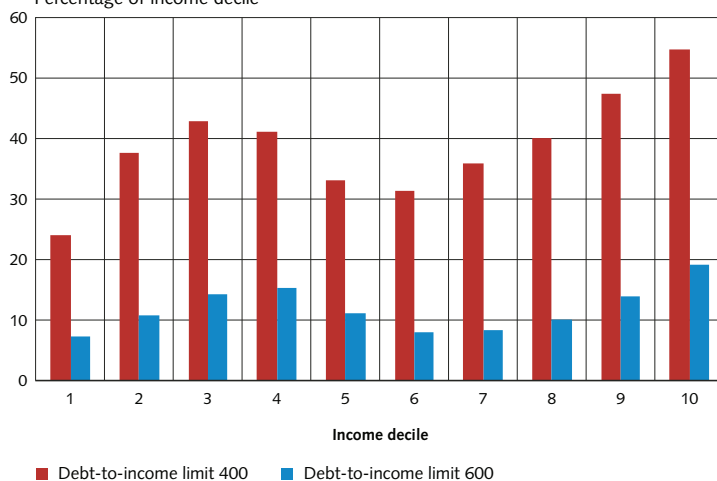
To get an idea of what these percentual decreases correspond to, Diagram 6 shows by how much the households that are affected by the debt-to-income limit in each income group need to reduce their debts (in SEK). Since the higher income groups also take out larger loans, the loan limit is larger in SEK for these income groups. A debt-to-income limit of 600 per cent means that the households that are affected by the limit may borrow between SEK 600,000 and SEK 1.8 million less. The effects in SEK of a debt-to-income limit of 400 per cent are more or less the same.³² That said, we are able to determine that the debt-to-income limit's total slow-down effect on credit growth would largely come from loan limits on the higher income groups.

Diagram 3. Average debt-to-income ratio per income decile
Percentage of disposable income



Note. The average disposable income in each income decile; 1: SEK 17,507, 2: SEK 22,570, 3: SEK 26,683, 4: SEK 31,666, 5: SEK 36,927, 6: SEK 41,369, 7: SEK 45,861, 8: SEK 51,003, 9: SEK 58,426, and 10: SEK 81,947.
Sources: Finansinspektionen and the Riksbank

Diagram 4. Share of borrowers per income group affected by the debt-to-income limit
Percentage of income decile

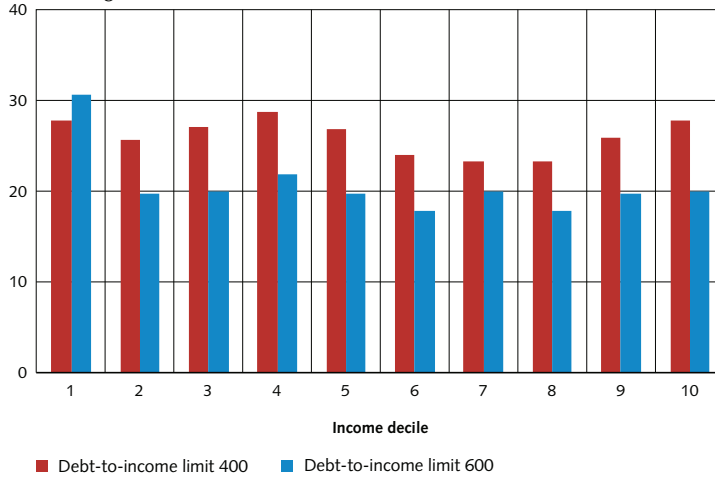


Note. The average disposable income in each income decile; 1: SEK 17,507, 2: SEK 22,570, 3: SEK 26,683, 4: SEK 31,666, 5: SEK 36,927, 6: SEK 41,369, 7: SEK 45,861, 8: SEK 51,003, 9: SEK 58,426, and 10: SEK 81,947.
Sources: Finansinspektionen and the Riksbank

32. This is because more people are affected by the 400 per cent debt-to-income limit and that many of those that are affected only need to reduce their loan by a small amount. This affects the average.

Diagram 5. Reduction of debt for households affected by the debt-to-income limit per income group

Percentage of the household's debt

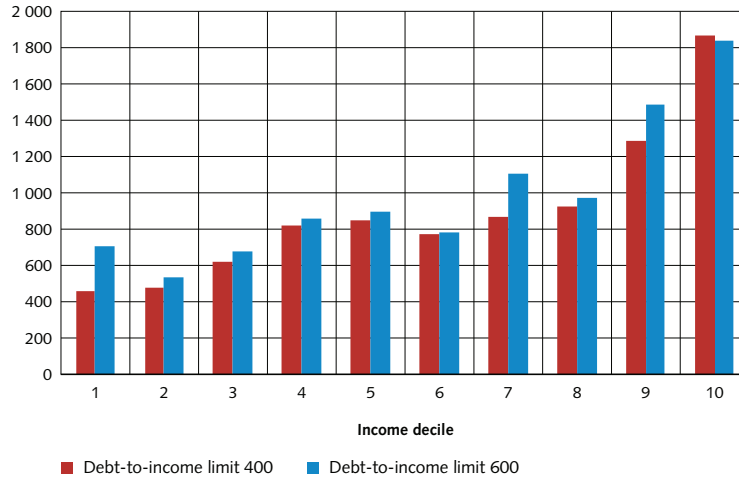


Note. The average disposable income in each income decile; 1: SEK 17,507, 2: SEK 22,570, 3: SEK 26,683, 4: SEK 31,666, 5: SEK 36,927, 6: SEK 41,369, 7: SEK 45,861, 8: SEK 51,003, 9: SEK 58,426 and 10: SEK 81,947.

Sources: Finansinspektionen and the Riksbank

Diagram 6. Reduction of debt for households affected by the debt-to-income limit per income group

Reduction in SEK thousand



Note. The average disposable income in each income decile; 1: SEK 17,507, 2: SEK 22,570, 3: SEK 26,683, 4: SEK 31,666, 5: SEK 36,927, 6: SEK 41,369, 7: SEK 45,861, 8: SEK 51,003, 9: SEK 58,426 and 10: SEK 81,947.

Sources: Finansinspektionen and the Riksbank

3.1.2 To what extent are different age groups affected?

Since household debt also varies by age, it is important to analyse the extent to which different age groups would be affected by a debt-to-income limit.

Overall our analysis shows that a debt-to-income limit would have a significant effect on households in all age groups, although the largest portion of the debt-to-income limit's total slow-down effect on credit growth would come from loan limits for mortgage borrowers who are 35 years of age and older.

When analysing the debt-to-income ratios in different age groups, it would have also been interesting to have had information about education since this is a good indicator of expected salary growth. The reasoning is that large debts are less of a risk for a young household with a high level of education than a low level of education since the highly educated household's expected salary growth in general is larger. Unfortunately, this data is not available for such an analysis.

Diagram B6 in the Appendix shows the average debt-to-income ratio in each age decile, where the age is based on the age of the primary borrower. It shows that

individuals between the ages of 32 and 41 have the highest indebtedness. This is natural since many in that age range start their families and move to larger homes, but even among the other age groups the debt-to-income ratios are at least 320 per cent.

Diagram B7 in the Appendix shows that a debt-to-income limit of 600 per cent would mean that around 12 per cent of the borrowers in each age decile would need to borrow less. Another interesting observation is that a debt-to-income limit of 600 per cent would have an impact on a large percentage of the older age groups. If the debt-to-income limit is instead set at 400 per cent, around 30 per cent or more of the households in each age decile would need to borrow less. In the third and fourth age deciles, where the average age is 32 and 37 years, respectively, almost 50 per cent of the borrowers would need to borrow less.

Diagram B8 in the Appendix shows how much less households that are affected by the debt-to-income limit in the different age deciles would need to borrow on average. We can see that a debt-to-income limit of 600 per cent would entail that the households that are limited may borrow more than 15 to just under 25 per cent less. A debt-to-income limit of 400 per cent would entail that households in the different age groups would need to reduce their debts by between 25 and 30 per cent.

For the three youngest age groups, these reductions in debt would correspond to between SEK 550,000 and SEK 860,000 depending on the age decile and debt-to-income limit (see Diagram B9 in the Appendix). For the other age groups, the debts for the households on average would decrease by around SEK 1 million regardless of the age group and whether the debt-to-income limit was 400 per cent or 600 per cent.

3.1.3 To what extent are different regions affected?

In order to get an idea of which regions are affected by the two debt-to-income limits, we divided the households into four regions: large city, city, densely populated and sparsely populated.³³ Our analysis shows that a debt-to-income limit would mainly affect households in the large city regions since households there generally have higher indebtedness. Under the stricter debt-to-income limit, more than half of the borrowers in the large city regions would have to borrow around one million less than what would have been the case without a debt-to-income limit. But our analysis also shows that even households in the other regions would be affected to a large extent if a debt-to-income limit were introduced.

According to a random sample in Finansinspektionen's 2015 mortgage market survey, 42 per cent of the new loans were in the large city regions, 32 per cent in the city regions, 23 per cent in the densely populated regions and 3 per cent in the sparsely populated regions. Diagram B10 in the Appendix shows that the households in the large city region have the highest debt-to-income ratios, 461 per cent on average, and that households in the city region have a debt-to-income ratio of more than 330 per cent. Even in the sparsely populated regions where housing prices can be expected to be lower, the average debt-to-income ratio is 210 per cent.

Diagram B11 in the Appendix shows that a debt-to-income limit of 600 per cent would affect around 20 per cent of the mortgage borrowers in the large city regions. In the city and densely populated regions, just under seven per cent of the borrowers would need to borrow less, and in the sparsely populated regions just under 1 per cent would be affected. A debt-to-income limit of 400 per cent would affect 60 per cent of the mortgage borrowers in the large city regions, and just under 30 per cent of the borrowers in the city regions. In the densely populated regions, more than 20 per cent of the mortgage borrowers would need to borrow less, and in the sparsely populated regions, eight per cent.

Diagram B12 in the Appendix shows that a debt-to-income limit of 600 per cent would entail that households that are affected by the debt-to-income limit would

33. Large city is defined as large city municipalities and the suburb municipalities of large cities. Cities are defined as larger cities and suburb municipalities to larger cities. Densely populated region is defined as commuting municipalities, tourism municipalities, goods-producing municipalities and municipalities in a densely populated region. Sparsely populated region is defined as sparsely populated municipalities and municipalities in a sparsely populated region. For more details regarding the four groups, please refer to "Regionala indelningar i Sverige den 1 januari 2011", MIS 2011:1, Statistiska centralbyrån.

need to reduce their debts by around 20 per cent in the large city, city and densely populated regions. Households in the sparsely populated regions would need to reduce their debts on average by 13 per cent. Households in the large city regions would need to reduce their debts by around SEK 1 million while households in the sparsely populated regions would need to reduce their debts by SEK 200,000 (see Diagram B13 in the Appendix). A debt-to-income limit of 400 per cent would mean that the affected households would borrow 28 per cent less in the large city regions and somewhat less in the other regions. In SEK these percentages correspond to around SEK 1 million for the large city regions, SEK 730,000 for the city regions, SEK 850,000 for the densely populated regions and more than SEK 500,000 for the sparsely populated regions.

3.1.4 To what extent are different banks affected?

A debt-to-income limit can be expected to affect different banks to different degrees depending on how much the banks usually lend to their customers, which regions the banks lend the most to and the types of households to which they extend loans.

The average debt-to-income ratio for new mortgage borrowers varies between 340 per cent and 458 per cent for the different banks (see Diagram B14 in the Appendix).

Diagram B15 in the Appendix shows the amounts by which a debt-to-income limit of 600 per cent and 400 per cent, respectively, would affect different banks. Under the lower debt-to-income limit, between 32 per cent and 57 per cent of a bank's new mortgage borrowers would be affected. Under the higher debt-to-income limit, between 7 per cent and 24 per cent would be affected.

Diagram B16 in the Appendix shows that the households that are customers at the different banks would need to take out loans that are between 14 per cent and 23 per cent less under a debt-to-income limit of 600 per cent. Under a debt-to-income limit of 400 per cent, the households need to borrow between 22 per cent and 30 per cent less. Looking instead at how much less the households can borrow in SEK, Diagram B17 in the Appendix shows that the different banks' customers can borrow on average between SEK 610,000 and SEK 1.3 million less if they are affected by one of the debt-to-income limits.

In addition to analysing how much less individual households would be forced to borrow if they are affected by the debt-to-income limit, it is also interesting to investigate how much less each bank would need to lend in order for the banks' customers to be under the debt-to-income limits of 400 per cent and 600 per cent.³⁴ Diagram B18 in the Appendix shows that a debt-to-income limit of 600 per cent would mean that each bank would need to lend between 3 per cent and 9 per cent less. For a debt-to-income limit of 400 per cent the corresponding numbers would instead be between 13 per cent and 25 per cent.

3.1.5 Effects for individual households

In order to get a feel for the extent to which a debt-to-income limit constrains a typical household's debts, Table 2 below shows a household with a disposable income of SEK 480,000 per year or just under SEK 40,000 per month. This corresponds to approximately the median income in the mortgage market survey's random sample. This is followed by an example of the extent to which the household is affected by the debt-to-income limit based on how much it originally wanted to borrow. In other words, the example in the table can be interpreted as illustrating a household choosing between buying a larger or smaller home or buying in a less expensive or more expensive region. In order to illustrate the interest rate effects, we assume that the household pays a rate of 2.5 per cent.

If the household borrows SEK 1.2 million, it will have a debt-to-income ratio of 250 per cent and thus not be constrained by a debt-to-income limit. This would be the case for households that choose a relatively small home or a home that is not as centrally located.

³⁴ The assumption is made here that the banks' market shares are unaffected.

If the household instead borrows SEK 2.16 million, it has a debt-to-income ratio of 450 per cent. If a debt-to-income limit of 400 per cent were to be introduced before the household took the loan, the household would need to borrow SEK 240,000 less, i.e. 11 per cent less, than what it would have wanted to borrow.

If the household wants to take a loan for a large home or a home in a large city region, and thus borrow SEK 3.12 million, the household will have a debt-to-income ratio of 650 per cent. A debt-to-income limit of 600 per cent would mean that the household needs to borrow eight per cent less, i.e. SEK 240,000 less. If the stricter debt-to-income limit of 400 per cent were instead introduced, the household would have needed to borrow SEK 1.2 million less, i.e. 38 per cent less than what it had originally wanted.

Table 2. Three examples of loans and how households are affected by the debt-to-income limit

	EXAMPLE 1	EXAMPLE 2	EXAMPLE 3
Disposable income (SEK/year)	480,000	480,000	480,000
Debt (SEK)	1,200,000	2,160,000	3,120,000
Debt-to-income ratio (%)	250	450	650
Interest-to-income ratio (%)	2.5	2.5	2.5
Interest expenditures (SEK/year)	30,000	54,000	78,000
Interest-to-income ratio (%)	6.25	11.25	16.25
DEBT-TO-INCOME LIMIT 600 PER CENT			
Reduction in debt (%)	0	0	7.7
Reduction in debt (SEK)	0	0	240,000
Reduction in interest expenditure (SEK/year)	0	0	6,000
New interest-to-income ratio (%)	6.25	11.25	15
DEBT-TO-INCOME LIMIT 400 PER CENT			
Reduction in debt (%)	0	11	38
Reduction in debt (SEK)	0	240,000	1,200,000
Reduction in interest expenditure (SEK/year)	0	6,000	30,000
New interest-to-income ratio (%)	6.25	10	10

Note. Disposable income of SEK 480,000 per year and just under SEK 40,000 per month corresponds to approximately the average income for households in the 2015 mortgage market survey. For households with a disposable income of between SEK 450,000 and SEK 500,000 a year, a debt of SEK 1.2 million corresponds approximately to the 37th percentile, a debt of SEK 2.16 million to the 78th percentile and a debt of SEK 3.12 million to the 94th percentile. In the entire random sample from the mortgage market survey, a debt of SEK 1.2 million corresponds approximately to the 39th percentile, a debt of 2.16 million to around the 68th percentile and a debt of SEK 3.12 million to approximately the 84th percentile.

Sources: Finansinspektionen and the Riksbank

3.2 Macroeconomic effects

In this section we calculate the effect on the Swedish household sector's aggregate debt-to-income ratio, consumption, GDP and housing prices of households' smaller loans due to the introduction of a debt-to-income limit.³⁵

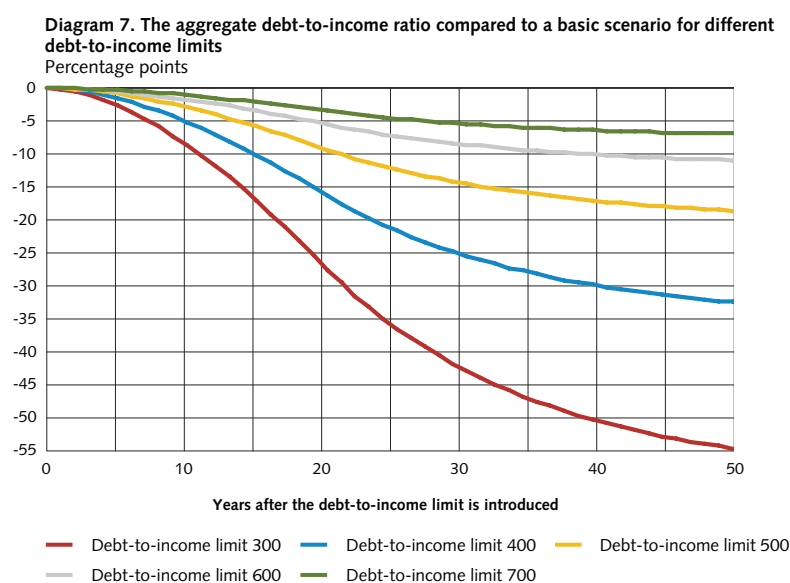
Households use their loans together with their income to finance their housing purchases and consumption of goods and services. A debt-to-income limit means that households may borrow a smaller percentage of their income. As a natural result, the debt-to-income ratio falls over time. With a smaller loan, the household can be expected to purchase a less expensive property and consume less. This presses house prices down and the lower consumption contributes to slowing demand and the GDP. In the longer run, however, lower debts also mean lower loan costs for the household in the form of interest expenses, allowing the household to consume a little more. At the same time, the fall in house prices is offset by the ability of new households and existing households that are not affected by the debt-to-income limit to purchase homes at lower prices, which applies upward pressure to the price level. The aggregate effects in the long run are thus small.

Since not all households have debts, the effects at the macro level are rather small. A household with high indebtedness is limited to a greater extent, which also means

35. The analysis conducted here is inspired by the analysis that the Riksbank conducted on amortisation requirements and presented during the fall 2014 (see Sveriges Riksbank (2014)). That analysis was based on how much household debts diminishes, while also taking into account minor and major house price effects. In our analysis, we assume that the relationship between the effects on household debt and effects on the macroeconomy is similar to the one presented in the analysis of the amortisation requirement. See also Guibourg and Lagerwall (2015) for a description of the effects of various macro-prudential tools on the economy.

that this to a greater extent contributes to the aggregate effects. At the same time, a household with low indebtedness is not affected at all by the debt-to-income limit. As previously mentioned, the two debt-to-income limits in this economic commentary only refer to new loans, which correspond to approximately five per cent of the loan stock. This also means that the effects at the macro level are relatively small.

Diagram 7 shows how the aggregate debt-to-income ratio is affected after the introduction of a debt-to-income limit for individual households. In the short run, the aggregate debt-to-income ratio is not really affected much, mainly due to the fact that the debt-to-income limit only affects new borrowers. However, the effects become more visible in the long run.³⁶ A debt-to-income limit of 400 per cent for new borrowers would slow down the aggregate debt-to-income ratio by around 33 percentage points in the long run. A debt-to-income limit of 600 per cent would reduce the aggregate debt-to-income ratio by around 11 percentage points in the long run. Diagram 7 below also shows the effects when using other debt-to-income limits.



Note. The effects on the aggregate debt-to-income ratio is based on the assumption that the debt-to-income limit apply to all new loans.
 Source: The Riksbank

Table 3 below shows the macroeconomic effects of a debt-to-income limit of 400 per cent and 600 per cent, respectively. We can see in the short term that the effects of the stricter debt-to-income limit of 400 per cent would at the most be a decrease in the GDP of just under two per cent, a decrease of 2.5 per cent in consumption and a decrease of 12.5 per cent in real house prices. The effects of the higher, less strict debt-to-income limit would be just over a 0.5 per cent decrease in GDP, just under a one per cent decrease in consumption and just over a four per cent decrease in real house prices. For both of the examples of debt-to-income limits, the long-term effects are relatively small.³⁷

One uncertainty factor in the analysis is the extent to which house prices are affected by a debt-to-income limit and that the debts as a percentage of disposable income would thus need to fall. For more information about the calculations of the macroeconomic effects, see Sveriges riksbank (2014) as well as Guibourg and Lagerwall (2015).

36. However, it is important to remember that the forecast become more and more uncertain the further into the future the forecast is made. These debt-to-income ratio tracks should thus be interpreted with some caution.

37. In the models, monetary policy is assumed to function as normal and become more expansive.

Table 3. Average macroeconomic effects of debt-to-income limit (deviations from the level in a basic scenario in per cent)

	DEBT-TO-INCOME LIMIT 400 PER CENT		DEBT-TO-INCOME LIMIT 600 PER CENT	
	BASELINE (PER CENT)	CHANGE IN THE LONG TERM, PERCENTAGE POINT	BASELINE (PER CENT)	CHANGE IN THE LONG TERM, PERCENTAGE POINT
Debt-to-income ratio	180	-32.6	180	-11
Macroeconomic effects with small effects on house prices				
	MAXIMUM EFFECT (%)	LONG-TERM EFFECT (%)	MAXIMUM EFFECT (%)	LONG-TERM EFFECT (%)
GDP	-0.8	-0.3	-0.3	-0.1
Consumption	-1.8	-0.3	-0.6	-0.1
Real house prices	-1.3	-0.8	-0.4	-0.3
Macroeconomic effects with major effects on house prices				
	MAXIMUM EFFECT (%)	LONG-TERM EFFECT (%)	MAXIMUM EFFECT (%)	LONG-TERM EFFECT (%)
GDP	-2	-0.3	-0.7	-0.1
Consumption	-2.5	-0.3	-0.8	-0.1
Real house prices	-12.5	-0.8	-4.2	-0.3

Note. "Long-term change" refers to around 50 years after the debt-to-income limit is introduced. The long-term effects can be interpreted as permanent effects at each level.

Source: The Riksbank

4. Discussion and conclusions

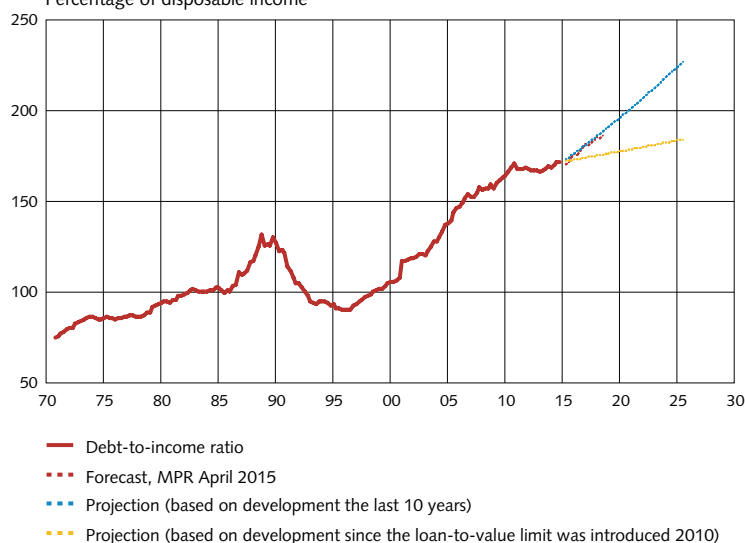
Both international experience and our calculations indicate that the introduction of a debt-to-income limit could be an effective measure for limiting households' indebtedness. A debt-to-income limit can serve as a complement to the loan-to-value limit in that the debt-to-income limit constrains how much the banks lend when housing prices are rising faster than the households' incomes. It could also prevent households with excess income following a discretionary income calculation from borrowing more if housing prices continue to rise.

However, the advantages of introducing a debt-to-income limit should be weighted against potential disadvantages. If a debt-to-income limit is introduced, it is important that it is calibrated so that it does not cause undesired effects, for example by slowing down the issuance of credit to the point that housing prices and household consumption demand fall sharply. In this economic commentary, we show that households are affected to differing extents by the two examples of debt-to-income limit that we have analysed here. This is due to the households' income, age group, region and bank to which they are a customer. These distribution effects are also important to consider. If a debt-to-income limit instead is directed to the bank's mortgage stock, the measure allows for a certain degree of flexibility. It is then left to the banks to determine which households may have a higher or lower debt-to-income ratio.

There are currently no macroeconomic models that capture all aspects of the effects of a debt-to-income limit on the economy. The calculations that form the basis for this analysis are thus associated with uncertainty. In order to be able to conduct a full assessment, it is naturally also important to calculate the benefit a debt-to-income limit. In other words, we would have needed to calculate what society would have gained by avoiding a financial crisis, or at least decrease the probability that a crisis would occur, but these types of calculations fall outside the framework of this analysis.

Diagram B1. Debt-to-income ratio of Swedish households

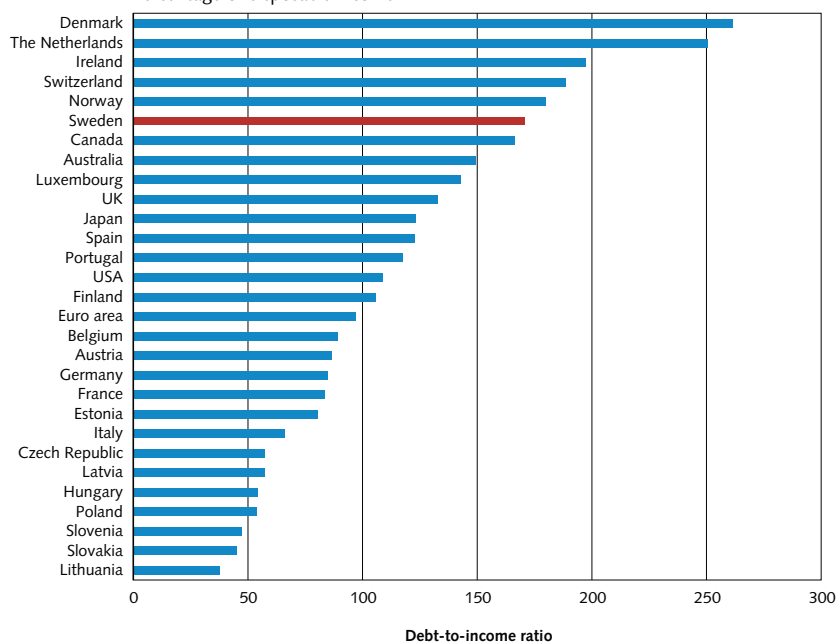
Percentage of disposable income



Note. The red dotted line refers to the Riksbank's forecast. The blue dotted line is a projection of the debt-to-income ratio based on the assumption that debts and income increase at the same rate on average as they did over the past ten years. The yellow dotted line shows how the debt-to-income ratio would progress if the debts and income increase like they have done since the loan-to-value limit was introduced in 2010.
Sources: Statistics Sweden and the Riksbank

Diagram B2. Household debt ratios in other countries

Percentage of disposable income



Note. Data for Australia, Denmark, Canada and the Euro area is from 2013. For Japan and Switzerland, the data is from 2011 and for Sweden from Q2 2014. Data for other countries is from 2012. Data for Australia, Canada, Japan, Switzerland and the USA comes from OECD or national statistics authorities. For other countries the data comes from Eurostat. In Eurostat's data the debt-to-income ratio in Sweden is 150 per cent in 2013.
Sources: Eurostat, OECD, national statistics authorities and the Riksbank

Table B1. Descriptive statistics regarding certain variables from the mortgage market survey.

All new borrowers

Variable	AVERAGE	MEDIAN	MIN	MAX	SD	N
Age	44	43	18	94	14	28,400
Income	41,402	39,156	2,206	732,315	21,048	28,400
Discretionary income	14,467	10,999	-51,400	645,018	14,748	28,237
PD	0.003	0.001	0	0.024	0.004	28,166
Debt	1,914,000	1,515,000	20,000	68,800,000	1,646,000	28,400
Mortgage rate	2.21	2.17	0	6.25	0.41	28,400
Amortisation	3,117	2,291	0	147,831	3,281	28,400
Loan-to-Value ratio	66	73	0.64	104	22	28,400
Debt-to-income ratio	371	344	8.3	1,159	208	28,400
Interest-to-income ratio	6.3	5.7	0	21	3.6	28,400
Debt service ratio	13	12	0	45	8.3	28,400
Stressed interest-to-income ratio	22	20	0.4	73	13	28,400
Stressed debt service ratio	29	26	0.6	96	17	28,400

All new borrowers with a debt-to-income ratio in excess of 400 per cent

Variable	AVERAGE	MEDIAN	MIN	MAX	SD	N
Age	43	41	19	94	13	11,045
Income	43,968	41,458	2,206	278,499	20,117	11,045
Discretionary income	12,299	9,087	-51,400	163,378	11,956	11,041
PD	0.003	0.001	0	0.024	0.005	10,948
Debt	3,072,000	2,664,000	268,500	68,800,000	1,942,000	11,045
Mortgage rate	2.10	2.04	0.00	6.25	0.38	11,045
Amortisation	4,626	3,866	0	147,831	4,246	11,045
Loan-to-Value ratio	71	75	0.64	104	17	11,045
Debt-to-income ratio	575	524	400	1,159	170	11,045
Interest-to-income ratio	10	8.8	0	21	3.3	11,045
Debt service ratio	20	19	0	45	8.7	11,045
Stressed interest-to-income ratio	34	31	4.4	73	11	11,045
Stressed debt service ratio	44	41	12	96	16	11,045

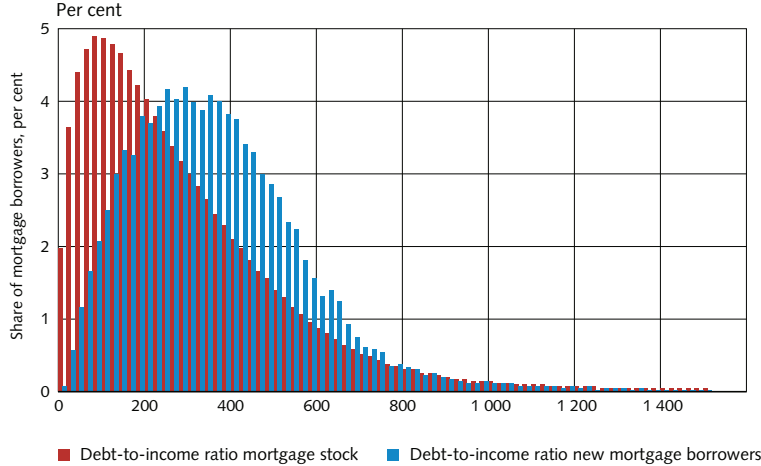
All new borrowers with a debt-to-income ratio in excess of 600 per cent

Variable	Average	Median	Min	Max	SD	N
Age	45	43	20	93	14	3,393
Income	43,983	39,584	2,206	217,175	21,034	3,393
Discretionary income	10,568	8,043	-51,400	101,170	11,122	3,390
PD	0.003	0.001	0	0.024	0.005	3,384
Debt	4,223,000	3,653,000	268,500	68,800,000	2,681,000	3,393
Mortgage rate	2.06	2.00	0.00	5.10	0.37	3,393
Amortisation	6,212	5,233	0	147,831	5,772	3,393
Loan-to-Value ratio	70	75	0.64	104	18	3,393
Debt-to-income ratio	775	710	600	1,159	171	3,393
Interest-to-income ratio	13	12	1.1	21	3.6	3,393
Debt service ratio	26	26	1.1	45	10	3,393
Stressed interest-to-income ratio	47	43	4.4	73	12	3,393
Stressed debt service ratio	61	57	12	96	17	3,393

Note. Age refers to the age of the primary borrower. Income refers to the household's total monthly disposable income. Discretionary income is based on the banks' calculations and standard values (and includes a stressed interest rate and adjustments for interest rate deductions). PD stands for "Probability of Default" and is based on the banks' own calculations. The debt in the variables "debt" and "debt-to-income ratio" refers to the household's total debts and not just mortgages. However, the "loan-to-value ratio" variable includes only the household's housing-related debts, i.e. not total debts. "Mortgage rate" is calculated as the interest rate for the observed mortgage contract, weighted by every sub-mortgage amount. It does not take into consideration any interest on the households' other debts or interest rate deductions. The "amortisation" variable refers to the total monthly amortisation payments in accordance with the contract and amortisation payments on the households' other debts, for which an annual amortisation rate of 2.66 per cent has been assumed (which is the annual amortisation rate calculated from the Riksbank's credit data). Interest-to-income ratios and debt service ratios are based on the household's interest expenses (adjusted for interest rate deductions) both for observed mortgages and other debts as well as scheduled amortisations and amortisations for other debts. In the calculation of these variables, the annual interest rate expense for other debts has been assumed to be 2.77 per cent (average rate for all outstanding loans issued by Swedish MFI in September 2014, Financial market statistics March 2015). In the calculation of the variable "stressed interest-to-income ratio", a surcharge of 3.75 per cent is assumed (for adjustment to what can be considered to be a normal repo rate) and 2 per cent (for stress). Since the repo rate was 0.25 per cent in September-October 2014 and we are assuming that the mortgage surcharge is 2 per cent, this means that the interest rate that the households may pay in a stressed situation is assumed to be in total 8 per cent. The stressed debt service ratio is also based on the same assumptions regarding interest rates as the interest-to-income ratio. For the loan-to-value ratio, the debt-to-income ratio, the interest-to-income ratio, the debt service ratio, the stressed interest-to-income ratio, the stressed debt service ratio and PD the outliers have been Winsorised down to the 99th percentile.

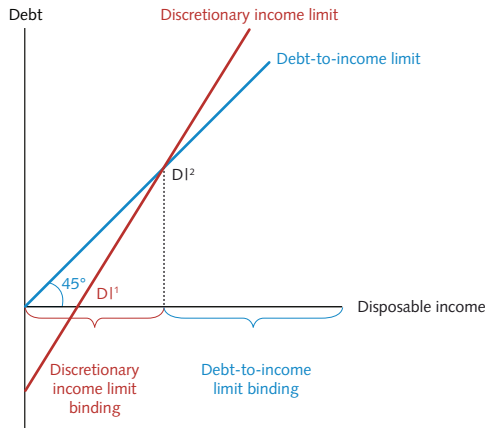
Sources: Finansinspektionen and the Riksbank

Diagram B3. Distribution of debt ratios for the mortgage borrowers in the loan stock and for new mortgage borrowers



Note. Data for the debt ratios in the mortgage stock is based on the Riksbank's credit data for the eight largest banks' mortgage borrowers and refers to July 2014. The debt ratios for new mortgage borrowers are based on Finansinspektionen's mortgage market survey that was published in 2015 (although the data refers to September-October 2014).
Source: Finansinspektionen and the Riksbank

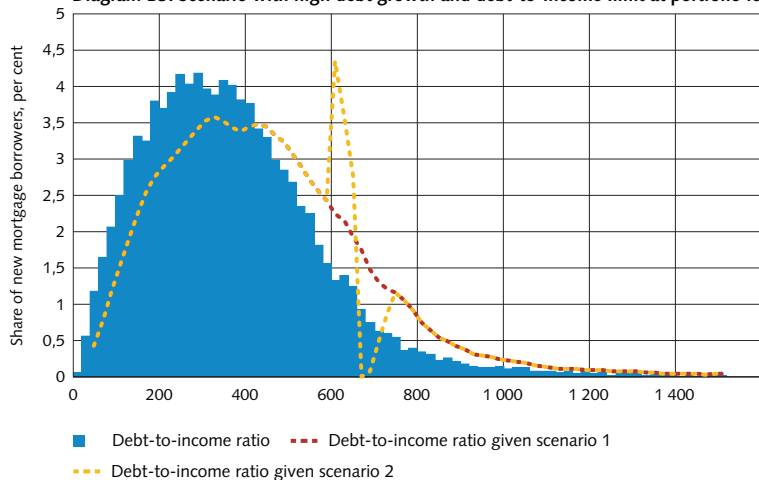
Diagram B4. Illustration of how households are limited by discretionary income and debt-to-income



Note. This picture shows theoretically how to approach a discretionary income limit and a debt-to-income limit for households with the same expenses but different incomes. The red line shows a discretionary income limit that can be assumed to be 0. If the household has a combination of debts and disposable income and thus lies to the left of the discretionary income limit, the household has a negative discretionary income calculation. To the right of the red line the household has a positive discretionary income calculation. DI1 shows the minimum level for how much the household's disposable income must be to cover the household's total expenses. The blue line shows the debt-to-income limit. If the household has a combination of debts and income and thus is to the left of the blue line, the household has a debt-to-income ratio that is higher than the limit, and to the right lower than the limit. For households with lower income, the discretionary income limit will be binding before the debt-to-income limit. For households with higher income, the debt-to-income limit will constrain the level of debt the household may have before the discretionary income limit (since they have high income there is a lot of room in their discretionary income calculations). DI2 shows the turning point in the income that determines whether the discretionary income limit or debt-to-income limit become binding first. The slope of the discretionary income line will always be greater than the slope of the debt-to-income limit line.
Source: The Riksbank

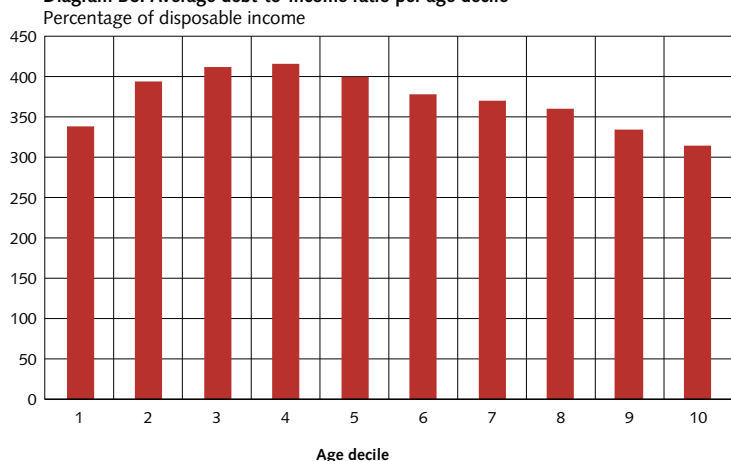


Diagram B5. Scenario with high debt growth and debt-to-income limit at portfolio level



Note. The blue bars show the debt-to-income ratio distribution for new mortgage borrowers in 2014. The red dashed line shows the debt-to-income ratio distribution given Scenario 1, in which income increased by 12 per cent and debt growth by 30 per cent in three years. The yellow dashed line shows the debt-to-income ratio distribution given Scenario 2, in which income and debt growth increased as in Scenario 1, but a debt-to-income limit at the portfolio level was introduced at the start. This debt-to-income limit entails that at the most 12 per cent of new borrowers may have a debt-to-income ratio of more than 600 per cent. In Scenario 2, the assumption is also made that borrowers who are closest but in excess of a debt-to-income ratio of 600 per cent must reduce their debt so that their debt-to-income ratio is 600 per cent, until no more than 12 per cent are above the debt-to-income limit. The total new lending in Scenario 2 is then 0.7 per cent lower than in Scenario 1. One alternative is to place a debt-to-income ratio requirement on the banks' lending volume instead of the number of borrowers. It would then be more attractive for banks to decrease lending to borrowers with large loan volumes.

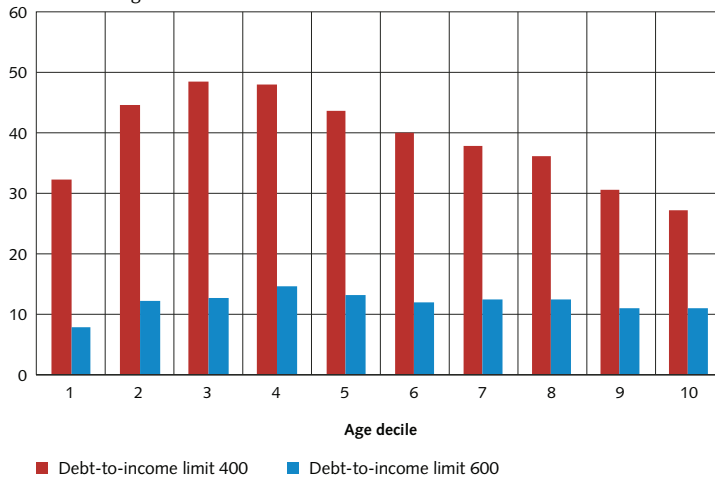
Diagram B6. Average debt-to-income ratio per age decile



Note. The average age in each income decile; 1: 24 years old, 2: 29 years old, 3: 32 years old, 4: 37 years old, 5: 41 years old, 6: 45 years old, 7: 49 years old, 8: 54 years old, 9: 61 years old and 10: 71 years old.

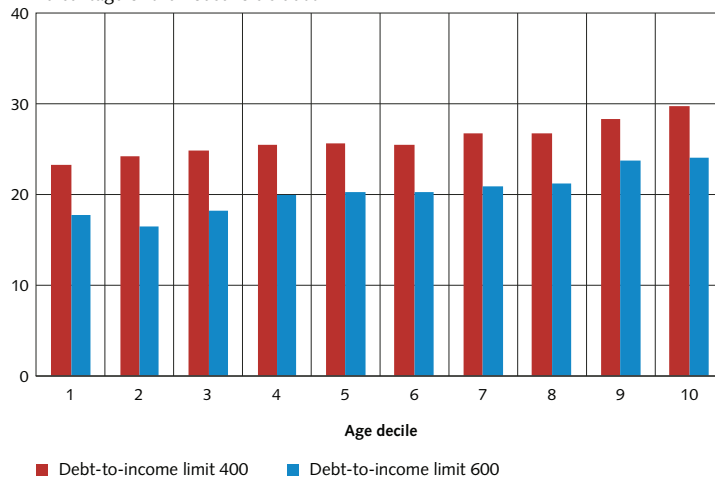
Sources: Finansinspektionen and the Riksbank

Diagram B7. Percentage of age group affected by the debt-to-income limit
Percent of age decile



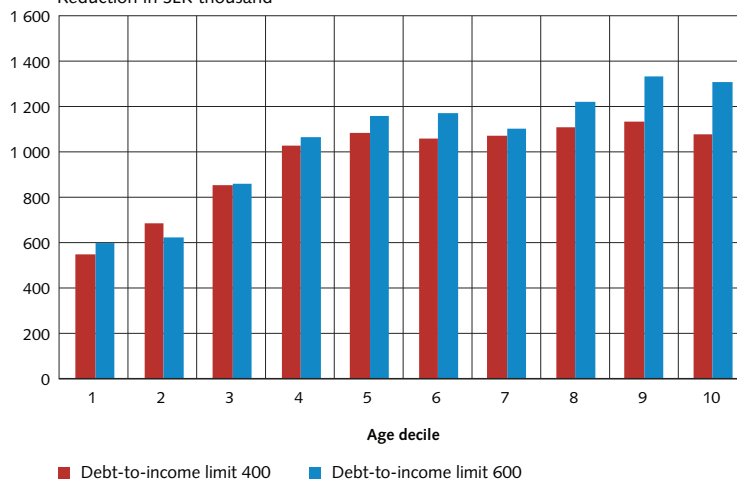
Note. The average age in each income decile; 1: 24 years old, 2: 29 years old, 3: 32 years old, 4: 37 years old, 5: 41 years old, 6: 45 years old, 7: 49 years old, 8: 54 years old, 9: 61 years old and 10: 71 years old.
Sources: Finansinspektionen and the Riksbank

Diagram B8. Reduction of debt for households affected by the debt-to-income limit per age group
Percentage of the household's debt



Note. The average age in each income decile; 1: 24 years old, 2: 29 years old, 3: 32 years old, 4: 37 years old, 5: 41 years old, 6: 45 years old, 7: 49 years old, 8: 54 years old, 9: 61 years old and 10: 71 years old.
Sources: Finansinspektionen and the Riksbank

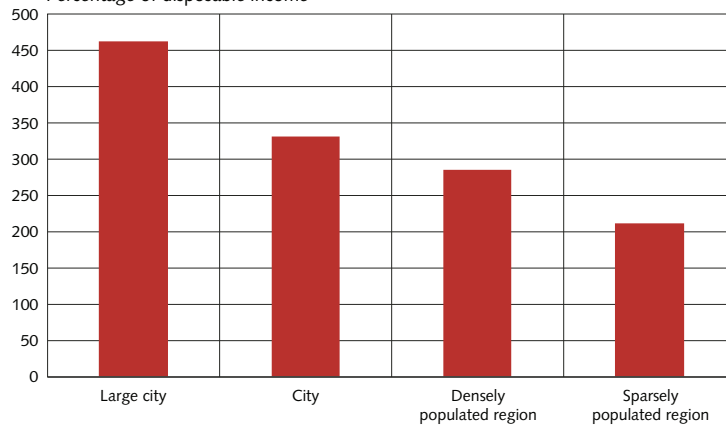
Diagram B9. Reduction of debt for households affected by the debt-to-income limit per age group
Reduction in SEK thousand



Note. The average age in each income decile; 1: 24 years old, 2: 29 years old, 3: 32 years old, 4: 37 years old, 5: 41 years old, 6: 45 years old, 7: 49 years old, 8: 54 years old, 9: 61 years old and 10: 71 years old.
Sources: Finansinspektionen and the Riksbank

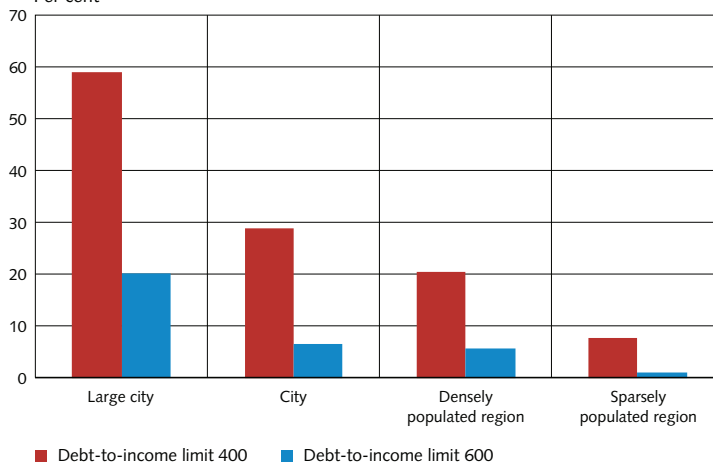


Diagram B10. Average debt-to-income ratio per region
Percentage of disposable income



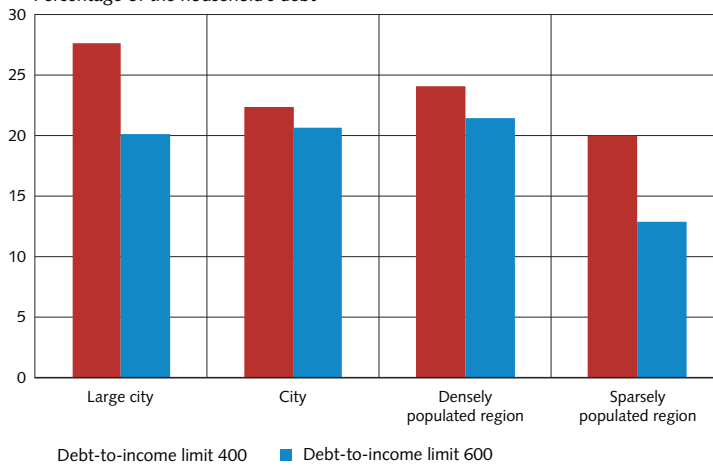
Sources: Finansinspektionen and the Riksbank

Diagram B11. Percentage of the region's new mortgage borrowers affected by the debt-to-income limit
Per cent



Sources: Finansinspektionen and the Riksbank

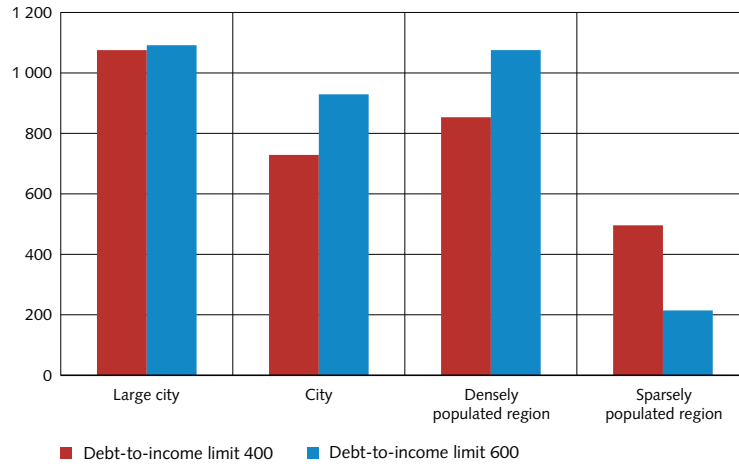
Diagram B12. Reduction of debt for households affected by the debt-to-income limit per region
Percentage of the household's debt



Sources: Finansinspektionen and the Riksbank

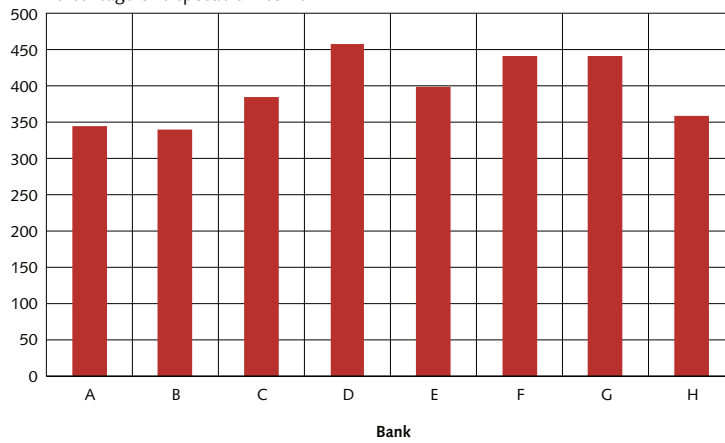


Diagram B13. Reduction of debt for households affected by the debt-to-income limit per region
Reduction in SEK thousand



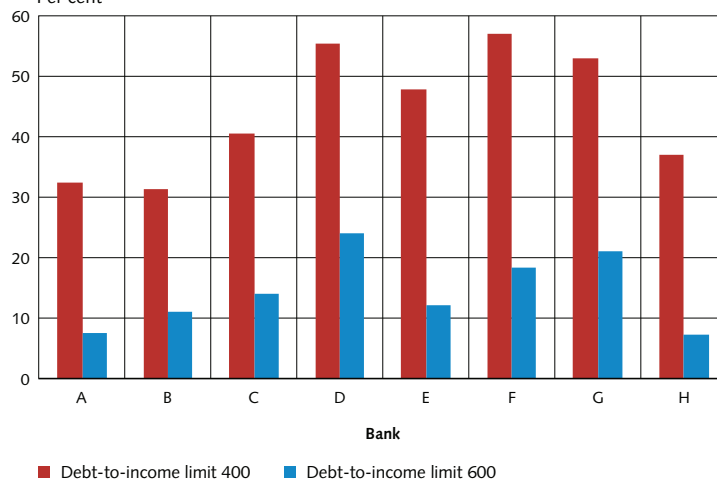
Sources: Finansinspektionen and the Riksbank

Diagram B14. Average debt-to-income ratio per bank
Percentage of disposable income



Sources: Finansinspektionen and the Riksbank

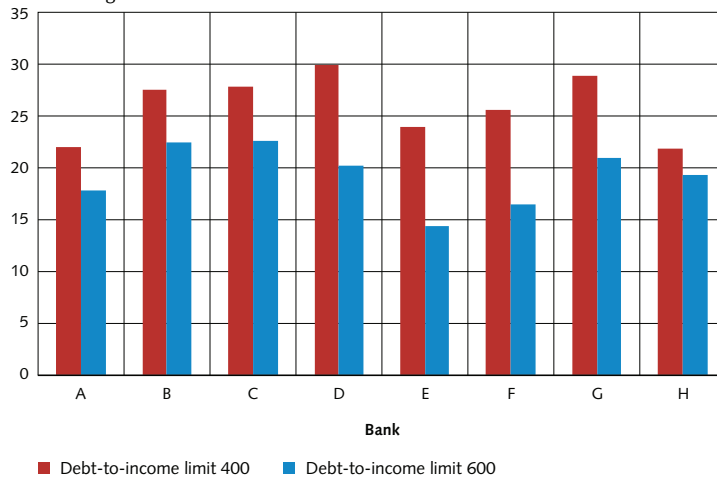
Diagram B15. Percentage of the banks' new mortgage borrowers affected by the debt-to-income limit
Per cent



Sources: Finansinspektionen and the Riksbank

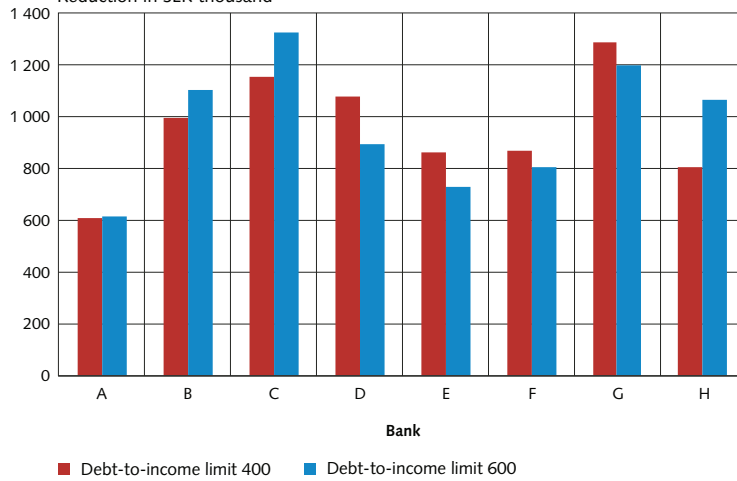


Diagram B16. Reduction of debt for households affected by the debt-to-income limit per bank
Percentage of the household's debt



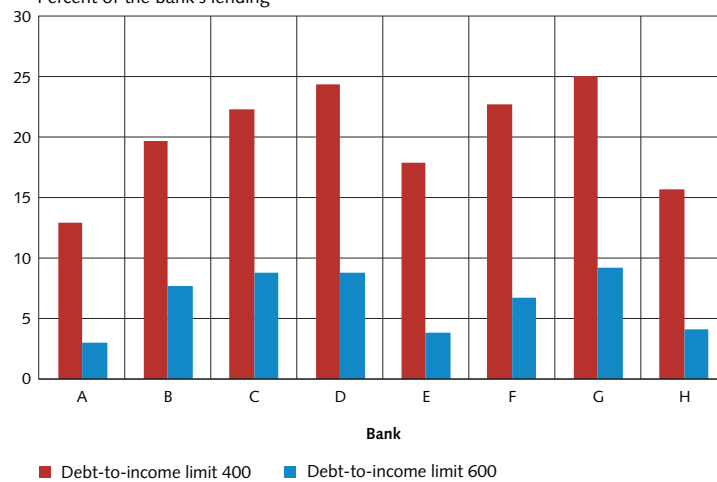
Sources: Finansinspektionen and the Riksbank

Diagram B17. Reduction of debt for households affected by the debt-to-income limit per bank
Reduction in SEK thousand



Sources: Finansinspektionen and the Riksbank

Diagram B18. Reduction of the bank's lending to households
Percent of the bank's lending



Sources: Finansinspektionen and the Riksbank

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