

Appendices

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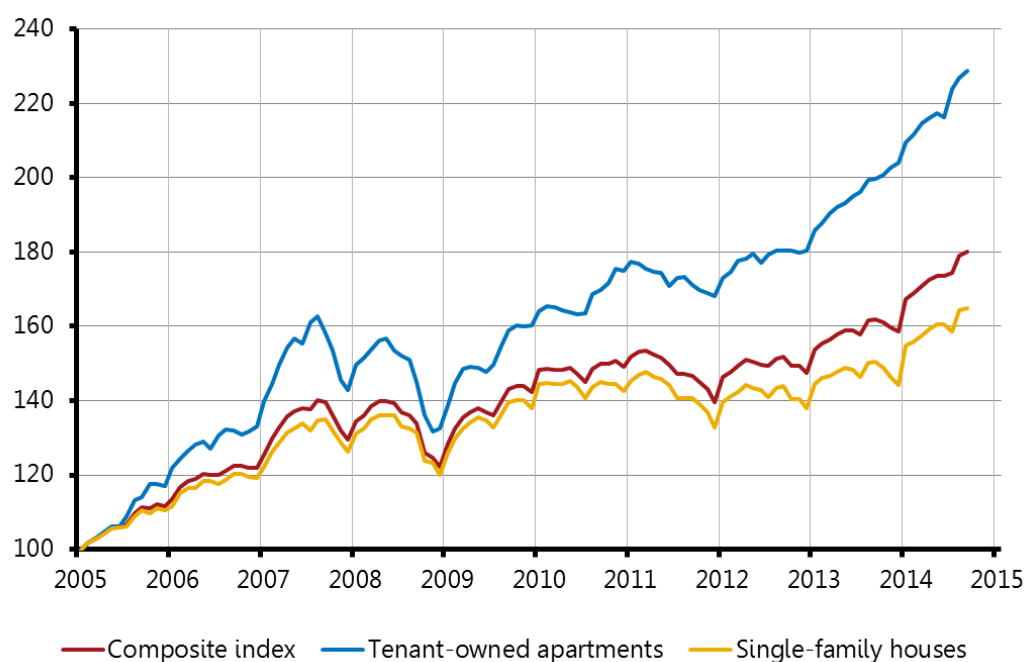
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■ Appendices to the memorandum *Amortisation requirements – a step towards more sustainable debt development*

Appendix 1: Household debt from a historical and international perspective

Chart B1. Swedish house prices

Index, 100 = January 2005



Sources: Valueguard and the Riksbank

■ **Chart B2. Annual growth in household mortgages**

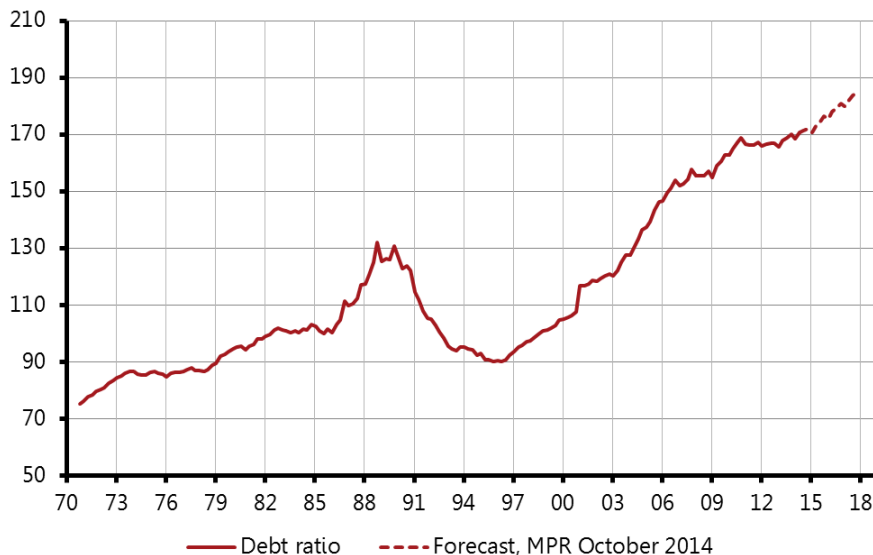
Per cent



Sources: Statistics Sweden and the Riksbank

Chart B3. Household debt as a percentage of disposable income

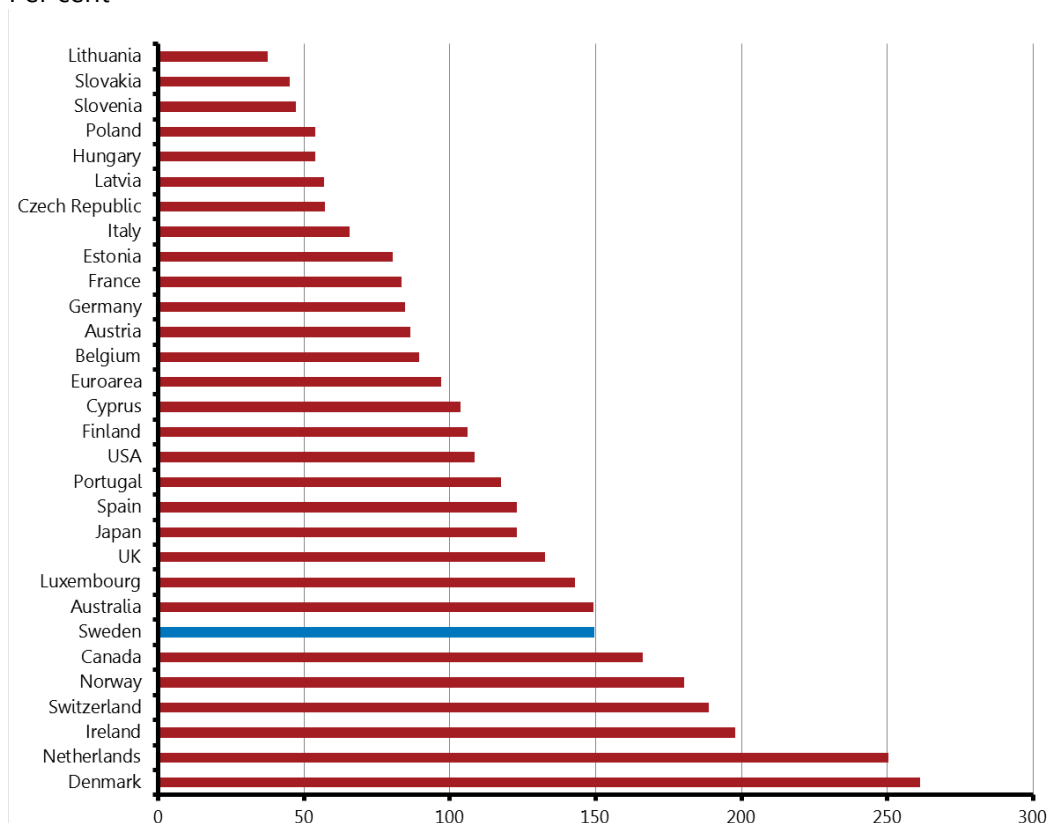
Per cent



Sources: Statistics Sweden and the Riksbank

Chart B4: Household debt ratio in various countries

Per cent



Note. For Australia, Canada, Japan, Switzerland and USA, the data is derived from either the OECD or the national statistics authorities. For other countries, the data is derived from Eurostat. Since Eurostat defines the debt ratio differently compared with the Riksbank, the figure for Sweden differs from the figure that is normally reported. The difference is that Eurostat uses a gross measure for disposable income and makes adjustments for household net receivables from pension funds. The difference between the net measure for disposable income, which the Riksbank normally uses, is that the gross measure for disposable income includes capital wear.

Sources: Eurostat, the OECD, Macrobond and the Riksbank

Table B1. Typical mortgage borrowers in the loan stock, 2013

	Stock (individuals)		
	Lowly indebted	Average indebted	Highly indebted
Disposable income (SEK per month)	19,717	19,508	18,442
Total debt (SEK)	271,650	581,899	1,035,000
Debt ratio (%)	115	249	468
Amortisation (years)	26	45	75
Amortisation (SEK/month)	886	1,076	1,148
Amortisation/disposable income (%)	4,5	5,5	6,2
Age (years)	55	47	43

Note. Lowly indebted individuals are represented by the median for individuals between the 20th and 25th percentile; average indebted by the median for individual households between the 45th and 55th percentile and highly indebted for individuals between the 75th and 80th percentile.

Source: The Riksbank

■ Appendix 2: Consequences for various typical mortgage borrowers

In July 2012, the total loan stock was SEK 3,057,667 million and up to July 2013, borrowers in the Riksbank's data set from the eighth largest banks had made amortisation payments of SEK 47,194 million. Mortgages accounted for about 72 per cent of the total loan stock, that is, about 2,201,520 million as of July 2012. This means that about 2.14 per cent of the mortgage stock had been paid down, which may be translated to an amortisation period of 46.7 years.¹ That portion of the loan stock that is not mortgages consists of consumer loans, study loans, car loans, tax debts and so forth. The calculation assumes that these loans are, on average, paid down over 25 years, or 4 per cent annually, which means that amortisations in relation to the total loan stock were $0.72 \cdot 2.14 + 0.28 \cdot 4 = 2.66$ per cent between July 2012 and July 2013, or 37.6 years ($100/2.66$).

If an amortisation requirement over 35 years is introduced for all new mortgages, it will mean that the aggregate amortisation period for new mortgages is 24.4 years, or about 4.1 per cent annually (the reason that the amortisation period among new loans is not 35 years is that there are already new borrowers who make mortgage repayments faster than 35 years and these are assumed to make amortisation payments at the same rate as in the past). For each year, it is assumed that the portion of the entire stock (including loans that are not related to residences) that is affected by amortisation requirements will increase by 5 percentage points so that the entire mortgage stock will be affected after 20 years. After one year, 95 per cent of the total loan stock will be repaid over 37.6 years and the other 5 per cent will be repaid over almost 25 years (72 per cent of the 5 per cent of the new loans in the stock are assumed to be repaid over 24.4 years and 28 per cent are other loans that are assumed to be paid down over 25 years). After two years, amortisation payments will be made on 90 per cent of the total stock and over 37.6 years and 10 per cent based on 24.4 years and so on. After 20 years, amortisation payments will be made on the total stock and over 24.4 years, which entails that the aggregate amortisation on the loan stock will have declined by a little more than 13 years.

To gain an idea of how increased amortisation can affect the individual mortgage borrower, the effects on typical individual mortgage borrowers are studied. Given the fact that mortgage borrowers use current income to make amortisation payments, the effect for individuals depends on how indebted they are vis-à-vis their disposable income. Thus, the calculations below describe how increased amortisations affect mortgage borrowers with a low, average or high debt ratio. The effects are calculated for one period ahead.

Typical borrowers, as described in Tables B2 and B3, are based on random samples of mortgage borrowers from FI's mortgage survey.² Borrowers in this random sample are classified on the basis of how large their new mortgage is in relation to their disposable income. Subsequently, the median values are calculated for three groups: lowly indebted, average indebted and highly indebted. Lowly indebted borrowers are represented by the median for new borrowers between the 20th and the 25th percentile, average indebted borrowers by the median for new borrowers between

¹ This amortisation period is not comparable with the 99 years that serve as the average amortisation period for mortgage borrowers. The amortisation period is calculated here as the total amortisations divided by total debt. Apart from the fact that the calculation methods differ, the major difference is, in part, that the amortisation times for individuals that prepay their mortgages are distributed in a warped manner (the average is 99 years, the 25th percentile is 16 years, the median is 37 years and the 75th percentile is 87 years), and, in part, because the amortisation period applied here is calculated only on the basis of the mortgage.

² Finansinspektionen (2014), The Swedish Mortgage Market in 2014.

the 45th and the 55th percentile and the highly indebted borrowers by the median for new borrowers between the 75th and the 80th percentile.

Since the amortisation proposals are directed towards newly established mortgages, the debts and amortisation payments for typical mortgage borrowers are presented only for the new mortgages (see Table B2) and for the total (see Table B3). The new mortgages are those recently taken by mortgage borrowers, but there are occasions when mortgage borrowers already have loans and, thus, this does not solely describe the new mortgage borrowers' indebtedness. The division into lowly, average and highly indebted is, however, based on new mortgages in relation to disposable income. All values in Table B2 and Table B3 are the median value for mortgage borrowers in the various groups.

If the requirement is shaped so that all new mortgages are to be repaid over 35 years, amortisation on new mortgages for a typical lowly indebted mortgage borrower will increase from SEK 281 to SEK 767. As a portion of disposable income, this corresponds to an increase from 0.9 per cent to 1.8 per cent (see Table B2). The total amortisation payments, meaning the inclusion of amortisation payments on other loans, increases from SEK 954 to SEK 1,190 and as a portion of disposable income from 2.8 per cent to 3.1 per cent (see Table B3). Thus, overall, this is a relatively small change for the lowly indebted mortgage borrower.

Given the same amortisation requirements, amortisation increases for new mortgages from SEK 395 to SEK 1,642 for the average indebted borrower. As a percentage of disposable income, this corresponds to an increase from 1.3 per cent till 4.8 per cent (see Table B2). Total amortisation increases from SEK 830 to SEK 1,969 and the total amortisation, as a percentage of disposable income, rises from 2.7 per cent to 5.1 per cent (see Table B3). The average indebted borrower is thus more affected by this requirement than the lowly indebted borrower. The requirement has the greatest effect on the highly indebted borrower. In this case, amortisation of the new mortgage increases from SEK 948 to SEK 3,685, or from 2.7 per cent of disposable income to 10.1 per cent (see Table B2). Total amortisation rises from SEK 1,195 to SEK 4,048 and as a percentage of disposable income it rises from 3.8 per cent to 10.3 per cent (see Table B3).

The Riksbank's interpretation of the proposal of the **Swedish Bankers' Association** from October 7 entails that mortgage borrowers with a loan-to-value (LTV) ratio of more than 70 per cent amortise 2 per cent of the mortgage annually and mortgage borrowers with an LTV between 50 and 70 per cent make amortisations of 1 per cent of the mortgage per year. Given this interpretation of the proposal, the typical lowly indebted borrower needs to increase amortisations on the new mortgage from SEK 281 to SEK 385, which corresponds to an increase from 0.9 per cent to 1.1 per cent of disposable income. The average indebted borrower needs to raise amortisation payments from SEK 395 to SEK 850, corresponding to an increase from 1.3 per cent to 3.0 per cent of disposable income. In the case of the highly indebted borrower, amortisations on the new mortgage rise from SEK 948 to SEK 2,160, corresponding to an increase from 2.7 per cent to 6.9 per cent of disposable income (see Table B2). Given the interpretation of the Swedish Bankers' Association's proposal, this does not affect the lowly indebted borrower's total amortisation to any great extent. For the average indebted borrower, the total amortisation payments rise from SEK 830 to SEK 1,158, and as a share of disposable income from 2.7 per cent to 3.5 per cent. The highly indebted mortgage borrower must raise the total amortisation from SEK 1,195 to SEK 2,479 and, as a share of disposable income, 3.8 per cent to 7.1 per cent (see Table B3).

Table B2. Typical mortgage borrower (new mortgage), 2013

	Lowly indebted	Average indebted	Highly indebted
Disposable income (SEK/month)	36,879	33,165	36,651
Total debt (SEK)	257,750	637,500	1,530,000
Debt ratio (%)	59	162	352
Amortisation period (years)	25	56	85
Amortisation (SEK/month)	281	395	948
Amortisations/disposable income	0.9	1.3	2.7
LTV (%)	15	54	78
Age (years)	48	44	37
Mortgage amount (SEK/month)			
All new loans over 35 years	767	1,642	3,685
Interpretation of Swedish Bankers' Association's proposal	385	850	2,160
Mortgage amount as a percentage of disposable income (%)			
All new loans over 35 years	1.8	4.8	10.1
Interpretation of Swedish Bankers' Association's proposal	1.1	3.0	6.9

Note. Borrowers are classified on the basis of the ratio between new mortgages and disposable income. Lowly indebted borrowers are represented by the median between the 20th and the 25th percentile, average indebted borrowers by the median for the 45th and the 55th percentile, and highly indebted borrowers by the median between the 75th and the 80th percentile. All values are median values for the various groups, which means that, for example, the amortisations as a share of disposable income in the table are not the same as calculating the share using the amortisation amount and the disposable income reported in the table.

Source: The Riksbank

Table B3. Typical mortgage borrower (total mortgages), 2013

	Lowly indebted	Average indebted	Highly indebted
Disposable income (SEK/month)	36,879	33,165	36,651
Total debt (SEK)	1,089,504	980,000	1,730,000
Debt ratio (%)	260	231	369
Amortisation period (years)	43	50	69
Amortisation (SEK/month)	954	830	1,195
Amortisations/disposable income	2.8	2.7	3.8
LTV (%)	62	74	82
Age (years)	48	44	37
Mortgage amount (SEK/month)			
All new loans over 35 years	1,190	1,969	4,048
Interpretation of Swedish Bankers' Association's proposal	979	1,158	2,479
Mortgage amount as a percentage of disposable income (%)			
All new loans over 35 years	3.1	5.1	10.3
Interpretation of Swedish Bankers' Association's proposal	2.8	3.5	7.1

Note. Borrowers are classified on the basis of the ratio between new mortgages and disposable income. Lowly indebted borrowers are represented by the median between the 20th and the 25th percentile, average indebted borrowers by the median for the 45th and the 55th percentile, and highly indebted borrowers by the median between the 75th and the 80th percentile. All values are median values for the various groups, which means that, for example, the amortisation payments as a share of disposable income in the table are not the same as calculating the share using the amortisation amount and the disposable income reported in the table.

Source: The Riksbank

■ Appendix 3: Consequences for the debt ratio, macro-economy and house prices

A description of the various macro-models used

In the analysis of the macroeconomic effects of amortisation, various methods have been used to gain the maximum broad-based support for the assessment. The effects of an amortisation requirement on the economy have been estimated, inter alia, using the forecast methods used regularly in the policy process.³ In addition to this, simulations have been conducted via two DSGE models. One of these models, as described in Walentin (2013), is estimated using Swedish data and has been previously used by the Riksbank in its analyses of the housing market.⁴ Another DSGE model has been estimated and reworked for use specifically in analysing amortisation requirements. The latter model is a reworking of a model presented in Gerali et al. (2010). This model shares a great deal of the ground structure with Walentin (2013) but also includes a banking sector. The term structure for mortgages in this model has been changed by the monetary policy department at the Riksbank.^{5,6} The change approximates that most of the mortgage stock runs over several terms and that most mortgage borrowers do not need to renegotiate their mortgages in every term. It is emphasised that this model is still under development. Thus, the results from this model may change in the future.

Construction of the scenarios in the models

In the calculations, it has been assumed that the debts will develop as in the monetary policy update in September. The various amortisation requirements require in turn that the debt growth then becomes lower in varying degrees, depending on how the requirement is shaped. This difference in the mortgage trend has then been used in the models as the point of departure to estimate the economic consequences. The figure below shows how the various proposals affect the households' aggregate loan ratio.

Account of what will happen to the economy when the amortisation requirement is enforced

The analysis made with the DSGE models, and with the forecast system, shows that a decisive factor in determining the magnitude of the effects on aggregated consumption involves the size of the share of consumers who are directly impacted by an amortisation requirement. The models show that the aggregated effects on, inter alia, consumption and GDP are determined by the number of households affected by the mortgage limitation, regardless of how it is technically designed in the models.

The aggregate effects conceal the fact that the impact of an amortisation requirement can be very different among the various groups of households. The

³ This encompasses forecast equations and various different identities between mortgage stocks and flows for household balance sheets, savings and consumption.

⁴ Refer to the Riksbank's survey of the Swedish housing market in 2011, the Riksbank.

⁵ Andrea Gerali & Stefano Neri & Luca Sessa & Federico M. Signoretti (2010) "Credit and Banking in a DSGE Model of the Euro Area," *Journal of Money, Credit and Banking*, Blackwell Publishing, Blackwell Publishing, vol. 42(s1), pp 107-141, 09.

⁶ The change in the term structure means that loan contracts are not renewed every quarter but instead can reflect the loan contracts that extend over a number of years. The technique for doing this is described in Alessandro Calza, Tommaso Monacelli, Livio Stracca (2007) "collateral constraint, house prices, monetary policy, mortgage markets" CEPR Working Paper No. 6231 April 2007.

■ impact on consumption for those households that are not affected by the amortisation requirement (or that have no debt) is tiny. On the other hand, negative effects arise for residential investments and consumption for the portion of households that are directly affected by the amortisation requirement. In the housing market, this will lead to downward pressure on house prices. However, there is a counteracting force that will dampen the decline in house prices, since those consumers who are not impacted by the amortisation requirement can now increase their residential investments. This will help to alleviate the decline in house prices.⁷ In the models, it is implied that all those who were previously mortgage borrowers will continue to be so under the new regulations, but that they will borrow smaller amounts.

The analysis also shows that the effects on house prices in relation to debt constitute a key question in assessments of the macroeconomic effects of amortisation requirements. In the DSGE models, and also implicitly in the forecasting tools, it is assumed that total debt will decline considerably but that house prices will not be equally impacted. This assumption turns out to be crucial for the outcomes.

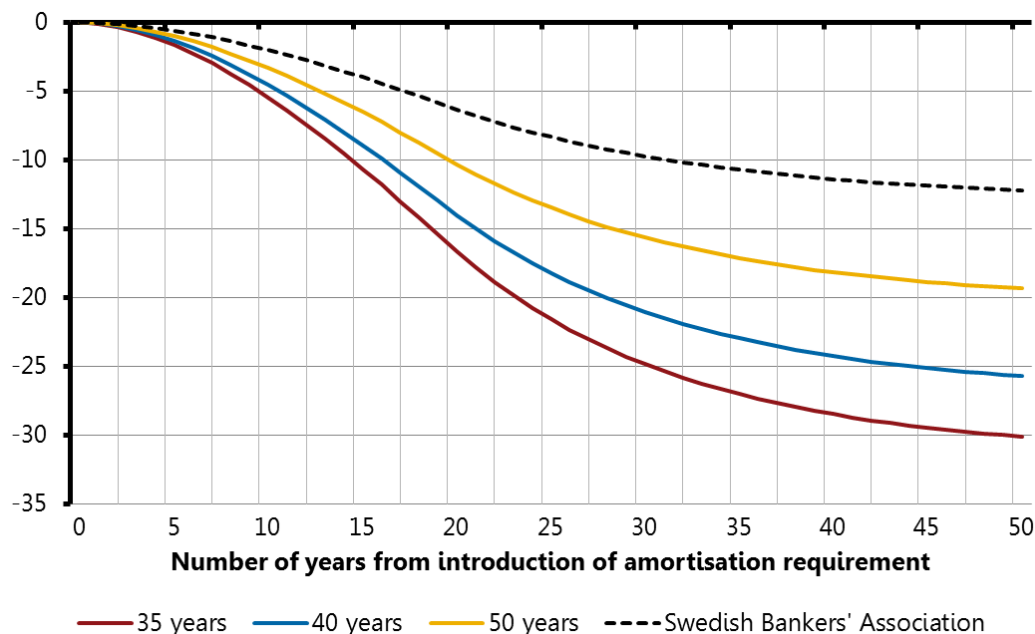
In addition, both the DSGE models and the forecasting tools used in the analysis show that house prices in large are explained by fundamental factors. Since no model used in the analysis is appropriate for analysing effects of an amortisation requirement in a situation where there is a considerable lack of equilibrium in the housing market (bubbles or some form of non-rational behaviour), other, partial methods have been used to analyse the effects of an amortisation requirement on house prices. This is done by converting the increased amortisation cost into an interest rate expense (i.e. interest-rate equivalence) and the effects of such a rise in interest rates can then be analysed in a model. With this purpose in mind, a simulation of an empirical model à la Claussen (2012) has been used.⁸ The model is what is known as an error correction model, whereby the long-term level of house prices depends on a number of variables such as disposable income, financial wealth and the real interest rate after tax. By means of a long-term change in the real interest rate expenses after tax, it is possible to gain an impression of the possible effects on house prices of an amortisation requirement that is not captured in a DSGE model. Equating increased amortisations with a higher interest rate expenses is a strong assumption, since an increase in amortisation is actually a saving. However, the assumption entails that the increasing expenditure for a household, which arises during a period when amortisations occur, can be translated into an economic quantity that can be used in models for a sensitivity analysis.

⁷ In the DSGE models, the number of households affected by mortgage restrictions has been estimated based on historical data and amounts to between 15 and 20 per cent of the total mortgage amount.

⁸ See Claussen Carl Andreas (2012) "Are Swedish Houses Overpriced?", *the Riksbank, Working paper*

Chart B5. Trend in the aggregated debt ratio compared with a base scenario assuming various amortisation requirements

Percentage points



Note. The interpretation of the Swedish Bankers' Association recommendation is that mortgage borrowers with an LTV exceeding 70 per cent will amortise 2 per cent of the mortgage per year and mortgage borrowers with an LTV of between 50 and 70 per cent will only have to amortise 1 per cent of the mortgage per year.
Source: The Riksbank

Table B4. Average macroeconomic effects on new loans prepaid in full over 35 35 years (deviations from a base scenario as a percentage)

	STARTING POINT	CHANGE, LONG TERM (50 YEARS)	
Debt ratio	180 per cent	-31.0 percentage points	
Macroeconomic effects with small effects on house prices		Max effect	Long-term effect
GDP		-0.9%	-0.1%
Consumption		-1.4%	-0.1%
Real house prices		-1.3%	-0.9%
Macroeconomic effects with major effects on house prices		Max effect	Long-term effect
GDP		-1.9%	-0.1%
Consumption		-2.4%	-0.2%
Real house prices		-12.0%	-0.2%

Note. Macroeconomic effects shown in the table are the average of the estimated effects on the basis of the models used in the analysis.
Source: The Riksbank

■ **Table B5. Average macroeconomic effects on new loans prepaid according to the Riksbank's interpretation of the Swedish Banking Association's proposal (deviations from a base scenario as a percentage)**

	STARTING POINT	CHANGE, LONG TERM (50 YEARS)	
Debt ratio	180 per cent	-13.0 percentage points	
Macroeconomic effects with small effects on house prices			
		Max effect	Long-term effect
GDP		-0.3%	-0.1%
Consumption		-0.7%	-0.1%
Real house prices		-0.5%	-0.3%
Macroeconomic effects with major effects on house prices			
		Max effect	Long-term effect
GDP		-0.8%	-0.1%
Consumption		-1.0%	-0.1%
Real house prices		-5.0%	-0.3%

Note. Macroeconomic effects shown in the table are the average of the estimated effects on the basis of the models used in the analysis.
Source: The Riksbank

Table B4 and Table B5 above show the average maximum effect arising in the models due to the amortisation requirement. However, this average conceals the fact that the various models have somewhat different effects, but above all that the effects of the various models occur at different times. In the DSGE models, in which households are looking ahead, the effects occur quickly, even if only a small portion of the households are affected. In the forecast system, the households do not look ahead, which means the effects arise slowly.