



Summary

Has the amortisation requirement had any effects on household behaviour? In this FI Analysis, we investigate whether the amortisation requirement has affected households' new loans and the price of the homes these households are buying. The study uses data on new mortgagors.

We find that new mortgagors take smaller mortgages than what they would have had if FI had not implemented the amortisation requirement. They are also buying less expensive homes. The groups that must increase their amortisation payments the most are also those that are affected the most.

To the contrary of many expectations before FI introduced the amortisation requirement, the analysis shows that the requirement has had more of an effect on older home buyers than on younger home buyers. Older households that are taking out new loans are buying less expensive homes and borrowing significantly smaller amounts. Younger households have not changed their behaviour significantly as a result of the requirement. However, families with children and home buyers in Stockholm and Gothenburg have been clearly affected. These households typically want larger and more expensive homes, and subsequently take larger loans. On average, the amortisation requirement has lowered the size of mortgages in relation to income by almost 9 per cent.

Households affected by the amortisation requirement are now buying less expensive single-family homes and significantly less expensive holiday homes. However, the prices of tenant-owned apartments have thus far stayed the same. An analysis of all new mortgagors in the mortgage survey indicates that, due to the amortisation requirement, households with new mortgages are purchasing homes that on average are just over 3 per cent less expensive.



Introduction

The objective of the amortisation requirement, which Finansinspektionen (FI) introduced on 1 June 2016, is to counteract macroeconomic and financial stability risks associated with high household debt. Under this requirement, households with a mortgage larger than 50 per cent of the value of their home must amortise at least one per cent of the loan every year. If the loan exceeds 70 per cent of the value, the household must amortise at least 2 per cent a year.¹ The amortisation requirement is expected in the long run to reduce the percentage of highly leveraged households and thus slow the growth of household debt. This makes households more resilient to shocks.

Before FI implemented the amortisation requirement, both FI and the Riksbank investigated the potential consequences of the requirement on households and the economy at large (see e.g. Finansinspektionen, 2014 and Sveriges Riksbank, 2014).² It is important to follow up on the consequences on a regular basis to evaluate whether the amortisation requirement has had the intended effect.

Since the amortisation requirement applies to new mortgages, households with new mortgages will be affected first. The stock of loans changes more slowly, and it will take a long time before the amortisation requirement has an effect on all mortgages. We have based this study on FI's household data from the mortgage surveys³ in 2012–2016. This range includes periods before and after FI's implementation of the amortisation requirement. We are thus able to evaluate how the amortisation requirement has affected the behaviour of new mortgagors. The term “behaviour” here refers more specifically to whether the amortisation requirement has affected the size of the loans taken by new mortgagors and the price of the homes they are buying.

It is not enough to merely compare the mortgage surveys conducted before and after 1 June 2016 to determine the effects of the amortisation requirement. Many other factors that affect new mortgagors may also have changed. In order to specifically measure the effect of the amortisation requirement specifically, we must estimate what the development would have been if FI had not implemented the requirement. To do this, we divide new mortgagors into three groups based on their loan-to-value (LTV) ratio:⁴

1. The *first* group has LTV ratios between 50 and 70 per cent. This group must amortise at least one per cent a year.

1 The amortisation requirement is binding and applies to all new mortgages, although some loans are not subject to the requirement and there are occasions when the bank may grant an exception, see Finansinspektionen (2016).

2 A number of other institutions and researchers have also analysed the macroeconomic consequences of an amortisation requirement (for example, Fromlet and Iancu, 2015 and Burgert, D'Souza and Vermeulen, 2016).

3 The mortgage survey contains a sample of all of the households that took out a loan to purchase a home. The survey contains information about, for example, how large the loan the households took to finance the purchase of their home, the loans they had before they purchased the home, what they paid for the home (the purchase price) and the size of their disposable income. The most recent survey was gathered during Q3 2016 and included almost 30,000 households. For a full description of the mortgage survey, see Finansinspektionen (2017).

4 The loan-to-value ratio sets the mortgage in relation to the value of the home.

2. The *second* group has LTV ratios of more than 70 per cent. This group must amortise at least two per cent a year.
3. The *control group* has LTV ratios of less than 50 per cent. These households are not subject to the amortisation requirement.

We assume that the amortisation requirement has not affected the control group's behaviour, i.e. the size of the loans taken by new mortgagors with LTV ratios below 50 per cent and the type of home they are buying. We then use the fact that these groups' behaviour co-varied across the period 2012–2015, during which there was no formal amortisation requirement. This enables us to estimate how households subject to the amortisation requirement would have behaved if FI had not introduced the requirement. By comparing the estimates with the actual data for 2016, we can measure the effects of the amortisation requirement.

The results of this analysis are based on the assumption that the amortisation requirement has not affected the control group. However, it is possible that, as a result of the amortisation requirement, certain households may have adapted their LTV ratio in order to end up below 50 or 70 per cent, for example by using savings or borrowing against their parents' homes. This would mean that the control group is not "unaffected", and the results may both overestimate and underestimate the effects. We have conducted a number of sensitivity tests for different assumptions regarding the group division and find that the results we present in this study are robust.⁵

In the following sections, we first study how mortgagors' amortisation payments have changed since FI introduced the amortisation requirement. We then investigate whether the amortisation requirement has affected the size of the loans taken by new mortgagors as well as the price of the homes these households are buying. Finally, we present our conclusions.

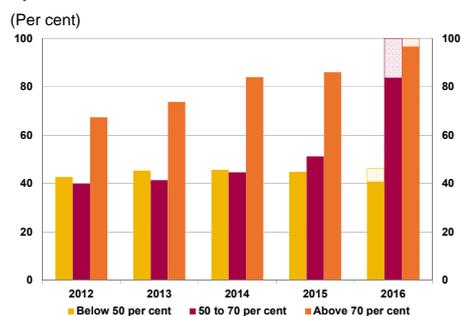
Amortisation payments have increased

The share of new mortgagors who amortise increased from 67 per cent in 2015 to 78 per cent in 2016. The increase was greatest for LTV ratios in the interval 50–70 per cent, but mortgagors with LTV ratios greater than 70 per cent are also amortising more (see Diagram 1).⁶ It may seem strange that not all new mortgagors with LTV ratios above 50 per cent amortise, but some of the loans in the survey refer to households that have switched to a new bank. These loans are not subject to the amortisation requirement, and neither are loans to buy agricultural property. It is also possible for the banks to grant exceptions from the requirement, e.g. if the household is buying a newly built home. The fact that not all new mortgagors with LTV ratios

⁵ We find that the results are the same even if we disregard households that are close to the 50 and 70 per cent thresholds.

⁶ In the Decision Memorandum (2016) "Föreskrifter om krav på amortering av bolån", FI estimated that the share of new mortgagors who amortise would be more than 84 per cent as a result of the amortisation requirement. The largest increase was expected among mortgagors with LTV ratios between 50 and 70 per cent. This is also what happened in practice, even if the total share of households that is now amortising is somewhat lower.

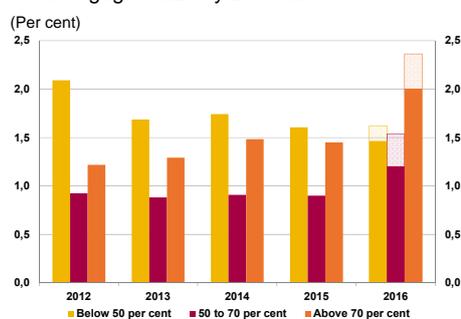
Diagram 1. Share of households that amortise by LTV ratio



Note: The LTV ratio specifies the size of the mortgage in relation to the purchase price or market value of the home. The shaded area marks FI's estimated effects of the implementation of the amortisation requirement (see Finansinspektionen, 2016).

Source: Finansinspektionen.

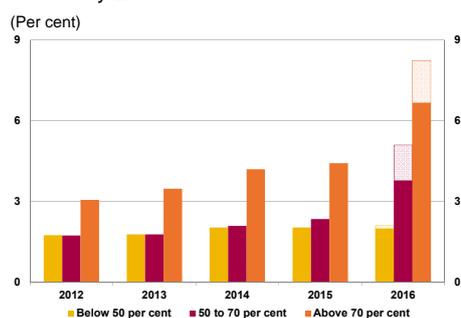
Diagram 2. Average amortisation as a share of the mortgage's size by LTV ratio



Note: The LTV ratio specifies the size of the mortgage in relation to the purchase price or market value of the home. The shaded area marks FI's estimated effects of the implementation of the amortisation requirement (see Finansinspektionen, 2016).

Source: Finansinspektionen.

Diagram 3. Average amortisation as a share of income by LTV ratio



Note: The LTV ratio specifies the size of the mortgage in relation to the purchase price or market value of the home. The shaded area marks FI's estimated effects of the implementation of the amortisation requirement (see Finansinspektionen, 2016).

Source: Finansinspektionen.

greater than 50 per cent amortise, therefore, does not mean that the banks are in violation of the amortisation requirements.

Of those not affected by the amortisation requirement, approximately 40 per cent amortise. This percentage is more or less unchanged compared to previous years. These households amortised more on average during the years 2012–2015 in relation to the size of the mortgage than households with larger LTV ratios (see Diagram 2). Since FI introduced the regulation, this has changed. New mortgagors with an LTV ratio of more than 70 per cent amortise the most now; on average, approximately 2 per cent of the size of their loan. Mortgagors with LTV ratios of 50–70 per cent amortise on average more than 1 per cent of the size of the loan.

In relation to income, amortisation payments rose sharply for new mortgagors subject to the requirement. Households not subject to the amortisation requirement have amortised a constant percentage of their income during the period 2012–2016 (see Diagram 3).

The amortisation payments are lower than what FI previously estimated (see the shaded area for 2016 in Diagrams 2 and 3), most likely due to the fact that fewer households with new mortgages actual amortise (see Diagram 1). The share of households that amortise more than the requirement is about the same in 2016 as in previous years. FI assumed that all new mortgagors with LTV ratios of more than 50 per cent would amortise like before or in accordance with the requirement. The amortisation requirement resulted in more mortgagors with high LTV ratios amortising, and they are amortising more. This should slow the debt growth among new mortgagors, which we now will analyse.

Amortisation reduced new mortgages

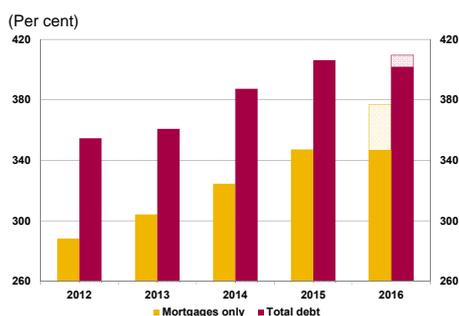
Swedish household debt has risen rapidly in recent years and is at a high level both historically and in international comparison.⁷ The amortisation requirement is expected to slow the growth of household debt. Because the amortisation requirement only applies to mortgages, households will probably borrow less using the home as collateral, but the requirement can also affect household demand for other loans (unsecured loans).⁸ The mortgage report contains information about new loans that households took on in conjunction with buying a home. This information includes total household debt and mortgages.⁹ We

7 See also Winstrand and Ölcer (2014).

8 The amortisation requirement can affect household demand for unsecured loans via both households' cash flow and their balance sheets. Cash flow means that households subject to the amortisation requirement have less room left in their budget to also carry the expenses for other loans, which implies that the number of unsecured loans should decrease. Balance sheet means that households that want to use their home as collateral when borrowing to buy something else (car, holiday home, trips, etc.) have a small surplus value left over to use in the home since a higher LTV ratio may trigger amortisation payments. This implies that household demand for unsecured loans should increase.

9 Total household debt includes paid mortgages, other mortgages, other collateralised loans, unsecured loans, student loans, etc. These loans refer to loans raised in the original institute or other institutes. If the household has credit card or overdraft protection, the utilised amount should be included. Mortgages are the sum of the households' total loans on the collateralised object (including previous loans against the same collateral) and unsecured loans that can be linked to the financing of the home or that was paid at the same time. Bridging loans are not included.

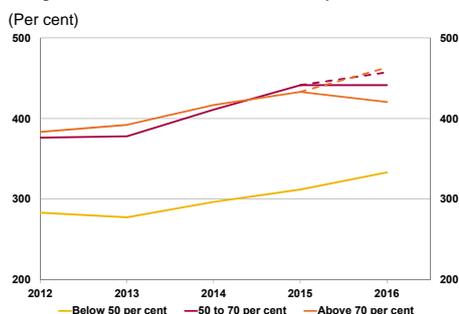
Diagram 4. Average debt ratios



Note: Refers to mortgages and total debt as a share of disposable income. The shaded area for 2016 marks the estimated growth in the debt ratios if FI had not implemented the amortisation requirement. This estimation is an aggregation of the effects for each respective group (including the control group). The groups' effects are presented in Table 1.

Source: Finansinspektionen.

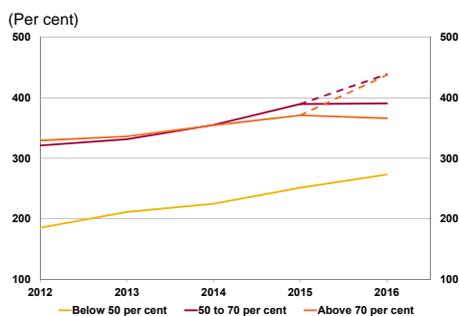
Diagram 5. DTI ratio, total debt, by LTV ratio



Note: Dashed lines are the estimated DTI ratios for the different groups if FI had not implemented the amortisation requirement.

Source: Finansinspektionen.

Diagram 6. LTI ratio, mortgage, by LTV ratio



Note: Dashed lines are the estimated LTI ratios for the different groups if FI had not implemented the amortisation requirement.

Source: Finansinspektionen.

will study the amortisation requirement's effect on both of these measures of household debt.¹⁰

Debt ratios in the mortgage surveys rose during the period 2012–2015 (see Diagram 4). This applies both to total loans (debt-to-income, DTI, ratio) and mortgages (loan-to-income, LTI, ratio). The debt ratios in 2016 were approximately the same as in 2015, which could be a sign that the amortisation requirement has had an effect. However, the slow-down in the debt ratios can also be due to factors other than the amortisation requirement, such as the state of the economy. In order to assess the amortisation requirement's actual effects, we must therefore consider how the debt ratios would have changed if FI had not implemented the amortisation requirement. Since this is not directly observable, we must estimate the change.

One way to do this is to compare the behaviour of the group that is not subject to the requirement (the control group) to the behaviour of groups that are subject to the regulation (Groups 1 and 2). The fundamental assumption behind the method we use is that changes for both the groups that must amortise and the control group would have followed a common trend if FI had not implemented the amortisation requirement.¹¹

This breakdown shows that the average debt ratios for households in the control group in 2016 grew at approximately the same rate as in previous years (see Diagrams 5 and 6). The households subject to the amortisation requirement have lower DTI ratios. This also applies to LTI ratios (mortgages only).¹²

Amortisation requirement has greatest effect on the most indebted. In order to measure the impact of the amortisation requirement, we use the relationship between the debt ratios for the affected new mortgagor groups and the control group. This relationship and the outcome of the control group provides an estimate of what the debt ratios would have been for the other groups if FI had not implemented the requirements (see the dashed lines in Diagrams 5 and 6).¹³

According to this method, the amortisation requirement has lowered the debt ratio among new mortgagors. Households in Group 2, which have LTV ratios of more than 70 per cent, were affected the most.

Amortisation diminished mortgages

Even if this method of measuring the amortisation requirement's effects provides some information, the results can be affected by that the

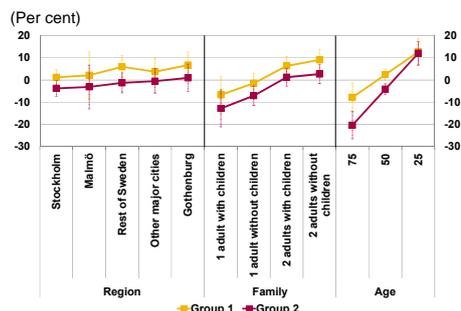
10 It is also possible to derive new unsecured loans taken at the original institute at the time the loan is granted. But these loans only constituted 0.5 per cent of households' new loans in 2016.

11 This method is called *difference-in-difference* and is used to compare the effect of a reform for those affected (the groups subject to the requirement) to a comparable control group. It is important for the selected groups to show a common trend before the reform. This method adjusts for factors that affect both the groups, and the results can then be interpreted as a causal effect of the reform. A normal application of *difference-in-difference* is the evaluation of political reforms (see, for example, Card and Krueger, 1994 and Imbens and Wooldridge, 2009). See the Appendix as well.

12 We do not account for a corresponding analysis of new unsecured loans since the fundamental assumption of common trend before the reform is not met by the data.

13 Average debt ratios in the control group and households subject to the amortisation requirement changed in approximately the same way during the period 2012–2015. If the amortisation requirement had not been implemented, we would expect the debt ratios for the households with high LTV ratios to have increased similarly to those with low LTV ratios in 2016. See the Appendix for a more detailed description.

Diagram 7. Effects of the amortisation requirement on total debt for different types of households



Note: The intervals for show the estimated 95 per cent confidence interval for each household category. Group 1 represents new mortgagors that have an LTV ratio of 50–70 per cent and Group 2 represents new mortgagors with an LTV ratio of more than 70 per cent. The figures in the diagram are relative to households that have an LTV ratio of less than 50 per cent.

Source: Finansinspektionen.

sample of new mortgagors in the mortgage survey differs over the years. For example, the households buying a home may include more households in Stockholm or more families with children in 2016 than in previous years. We therefore estimate a model to separate the effect of the amortisation requirement from other factors.¹⁴ The model is thus also able to analyse if there are any differences in how the amortisation requirement affects different groups of households.

The model results confirm that new mortgagors have taken on smaller loans as a result of the amortisation requirement (see Table 1). The effect is greatest for households with LTV ratios of more than 70 per cent. The amortisation requirement has diminished mortgages more than total debt. As a whole, the mortgagors' DTI ratios (total loans) and LTI ratios (mortgages only) were 2 per cent and 9 per cent, respectively, lower as a consequence of the amortisation requirement. This means that, if FI had not implemented the requirement, the debt ratios would have continued to rise in 2016 to approximately 410 per cent and 377 per cent, respectively, for total loans and mortgages only (see the shaded area in Diagram 4).

Table 1: Effect of amortisation requirement on total debt and mortgages

	Total debt	Mortgages only
LTV ratio 50–70 per cent (Group 1)	-0.001 (0.011)	-0.086*** (0.011)
LTV ratio above 70 per cent (Group 2)	-0.041*** (0.010)	-0.140*** (0.010)
Coefficient of determination (R^2)	0.333	0.390
Number of observations	129,800	129,800

Note: Robust standard errors in parentheses. *** indicates that the estimate is statistically significant at the one per cent level. The table only presents the *difference-in-difference* estimate, which specifies the effect of the amortisation requirement on households with LTV ratios between 50-70 per cent and LTV ratios greater than 70 per cent.

Source: Finansinspektionen.

Since the amortisation requirement only applies to mortgages, the requirement's greater impact on mortgages compared to total debt was expected. Total debt includes other loans that are not directly affected by the amortisation requirement. However, the regulation may also have influenced households with high LTV ratios to choose other consumption loans rather than leveraging their home for consumption (renovation, purchasing a car or boat, etc.) to the same extent as before.¹⁵ An additional potential explanation is that the banks have become better at reporting all of the existing loans that a household has when it receives a new mortgage.

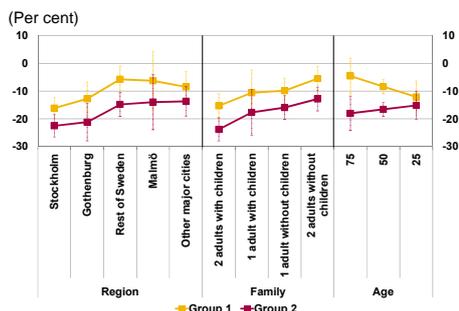
Families with children and older households that take new loans affected most

There is a clear geographic break-down in the households' DTI ratios (Finansinspektionen, 2017). The model enables us to analyse how the amortisation requirement has affected debt in different regions. We find no regional differences in how the amortisation requirement has affected total debt (see Diagram 7). However, it has affected family compositions differently; total debt is lower for households with one

¹⁴ The model is described in an appendix.

¹⁵ This information is not available in our dataset and therefore cannot be analysed in more detail.

Diagram 8. Effects of the amortisation requirement on mortgages for different types of households



Note: The intervals show the estimated 95 per cent confidence interval for each household category. Group 1 represents new mortgagors that have an LTV ratio of 50–70 per cent and Group 2 new mortgagors with an LTV ratio of greater than 70 per cent. The figures in the diagram are relative to households that have an LTV ratio of less than 50 per cent.

Source: Finansinspektionen.

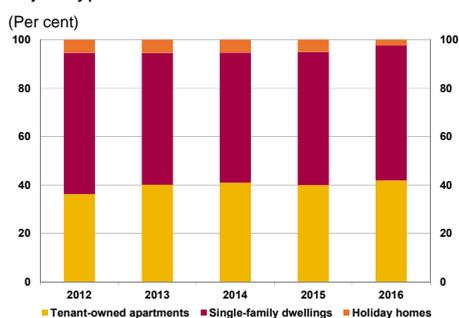
Diagram 9. House prices and turnover



Note: Each index is calculated using a 12-month moving average with December 2005 set at 100. The black, vertical line shows when the amortisation requirement entered into force (June 1, 2016).

Source: Valueguard.

Diagram 10. Percentage of sold homes by object type



Source: Finansinspektionen.

adult and higher for households with multiple adults that have LTV ratios of 50–70 per cent. The requirement has also reduced the total debt of older households, while the effect is positive for younger households.

The amortisation requirement has, though, lowered mortgages for all types of households (see Diagram 8). The effect has been most prominent for new mortgagors in Group 2 and primarily in Stockholm. This is most likely because the amortisation requirement affects households' debt service payments more in Stockholm since prices and debt levels are highest there. The amortisation requirement also affected families with children. This is probably because families with children typically demand larger, more expensive homes and therefore take larger loans. Following the amortisation requirement, these households are now taking smaller loans.

Before FI introduced the amortisation requirement, there was a concern that younger first-time buyers would be particularly hard-hit by the requirement. In this analysis, we find that the regulation has resulted in smaller mortgages among the younger age groups, but also that the oldest age groups were affected the most. The older age groups are taking significantly smaller mortgages and reducing their total debt as well.

Highly leveraged households buy less expensive homes

Debt and house prices often follow similar trends since debt is the main source of financing a home. House prices are still rising at a relatively fast rate, albeit somewhat slower than at the beginning of 2016 (see Diagram 9). Turnover has also clearly slowed. However, it is too early to draw conclusions about the impact the amortisation requirement has had on the housing market with this information. Such an analysis requires more detailed information.

Fewer holiday homes

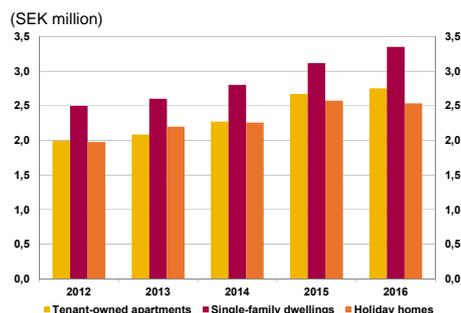
The mortgage survey contains information about the type of home – tenant-owned apartment, single-family home or holiday home – that is purchased when granting the loan. Single-family homes and tenant-owned apartments represent the majority of the purchases (see Diagram 10). Their shares have been relatively constant over time, but the percentage of holiday homes in 2016 fell by half compared to previous years.¹⁶

New mortgagors are buying less expensive holiday homes

The trend for holiday homes was also deviant in terms of the price of homes bought by new mortgagors. In the 2016 mortgage survey, the average price was marginally lower than in 2015 for purchased holiday homes. However, households purchased more expensive single-

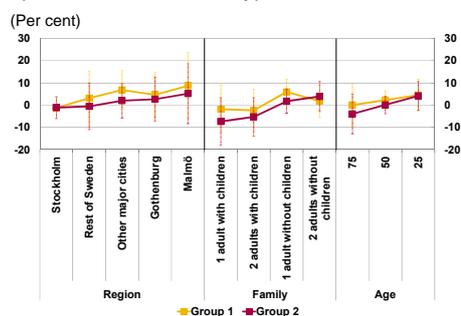
¹⁶ The number of completed housing-related transactions could in itself be an indicator of the effect of the amortisation requirement, but it is difficult to interpret it this way based on the data gathered by Finansinspektionen. The data was taken from 25,756 households in 2016, which is fewer households than in 2015 but in line with the years 2012–2014.

Diagram 11. Average market value by object type



Source: Finansinspektionen.

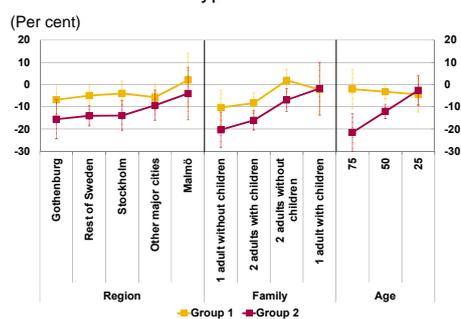
Diagram 12. Effects of the amortisation requirement on the market value of tenant-owned apartments for different types of households



Note: The interval for each group shows the estimated 95 per cent confidence interval for each household category. Group 1 represents new mortgagors that have an LTV ratio of 50–70 per cent and Group 2 represents new mortgagors with an LTV ratio of more than 70 per cent. The figures in the diagram are relative to the households that have an LTV ratio that is less than 50 per cent.

Source: Finansinspektionen.

Diagram 13. Effects of the amortisation requirement on the market value for single-family homes for different types of households



Note: The interval for each group shows the estimated 95 per cent confidence interval for each household category. Group 1 represents new mortgagors that have an LTV ratio of 50–70 per cent and Group 2 represents new mortgagors with an LTV ratio of more than 70 per cent. The figures in the diagram are relative to the households that have an LTV ratio that is less than 50 per cent.

Source: Finansinspektionen.

family homes and tenant-owned apartments than last year (see Diagram 11).

As a next step, we estimate how much households subject to the amortisation requirement would have spent when buying a home if FI had not introduced the requirement. We use the same method as before, i.e. we assume that new mortgagors in the control group have not changed their behaviour since they are not subject to the amortisation requirement.

Households are purchasing tenant-owned apartments that are approximately just as expensive as they would have done if FI had not introduced the amortisation requirement (see Table 2), but it is not possible to rule out whether households purchased smaller tenant-owned apartments or switched to a tenant-owned apartment instead of a single-family home as a result of the regulation. It is not possible to study these types of changes in the home buying process from our available dataset.

Table 2: Amortisation requirement's effect on market value per object type

	Tenant-owned apartments	Single-family dwellings	Holiday homes
LTV ratio 50–70 per cent (Group 1)	0.017 (0.017)	-0.035** (0.013)	-0.142* (0.086)
LTV ratio above 70 per cent (Group 2)	0.017 (0.015)	-0.094*** (0.012)	-0.315*** (0.073)
R²	0.537	0.520	0.281
Number of observations	51,890	70,991	6,039

Note: Robust standard errors in parentheses. *** indicates that the estimate is statistically significant at the one per cent level. The table shows only the *difference-in-difference* estimates, which specifies the effect of the amortisation requirement on households with LTV ratios between 50-70 per cent and LTV ratios above 70 per cent.

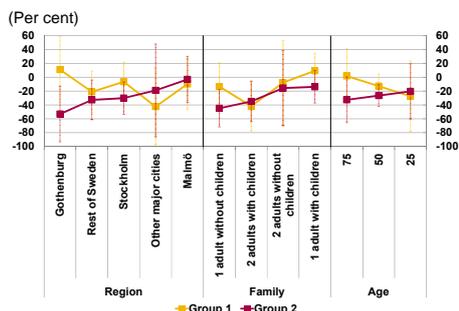
Source: Finansinspektionen.

The amortisation requirement has had an effect, though, on the market for single-family homes and holiday homes. We find the greatest impact on holiday homes, where households with new mortgages bought holiday homes that are 14–31 per cent less expensive than if FI had not implemented the amortisation requirement (see Table 2). As a result of the regulation, households with LTV ratios above 70 per cent also bought single-family homes that are approximately 10 per cent less expensive. The results therefore indicate that the groups that are affected by the amortisation requirement opted to buy less expensive single-family homes and, in particular, less expensive holiday homes. This may be because a holiday home is not something that everyone needs, like a permanent home. Therefore, households that take new mortgages and risk being subject to the regulation may choose less expensive objects or refrain from making a purchase.

Families with children buy less expensive homes

All categories of new mortgagors bought tenant-owned apartments that were approximately at the same price level since the amortisation requirement was implemented (see Diagram 12). In contrast, however, households subject to the requirement purchased single-family homes that were less expensive (see Diagram 13). This shift toward less ex-

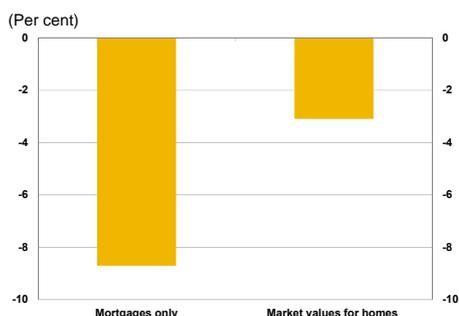
Diagram 14. Effects of the amortisation requirement on the market value for holiday homes for different types of households



Note: The interval for each group shows the estimated 95 per cent confidence interval for each household category. Group 1 represents new mortgagors that have an LTV ratio of 50–70 per cent and Group 2 represents new mortgagors with an LTV ratio of more than 70 per cent. The figures in the diagram are relative to the households that have an LTV ratio that is less than 50 per cent.

Source: Finansinspektionen.

Diagram 15. The amortisation requirement's effect on mortgages and the market values of homes



Note: The diagram shows the change in per cent of the LTI ratios for mortgages and the market values for homes resulting from the amortisation requirement. The estimation of the effects for each group (including the control group) is based on the estimated effects presented in Table 1 and Table 2.

Source: Finansinspektionen.

pensive homes is largest for Group 2 and is found in all regions except Malmö.

Families with children also shifted toward less expensive homes to a greater extent than families without children. One conceivable explanation is that families with children in general tend to buy larger and more expensive homes, and that the amortisation requirement has meant that these families must now purchase smaller and less expensive homes. In addition, these households may be turning to less attractive areas where the prices are lower. We have also found that older households with high LTV ratios were affected more than younger households. The amortisation requirement has resulted in older households that take new mortgages buying less expensive homes. In contrast, younger households with new mortgages have not changed their behaviour. Younger households with new mortgages are buying homes at the same price level, regardless of whether they are subject to the regulation. In general, the market for holiday homes has been affected in the same way as single-family homes, but the estimated effects are larger (see Diagram 14).

Link between purchasing less expensive homes and debt slow-down

In this analysis, we show that the amortisation requirement slowed the debt among new mortgagors. Households subject to the amortisation requirement on average also bought less expensive homes. There is a link between the purchase of less expensive homes and the slowed debt.

Using the mortgage survey, we are only able to evaluate if the amortisation requirement affected the behaviour of new mortgagors, i.e. if these households opted to borrow less and buy less expensive households. In order to comment on the effects on house prices, it is important to also take into account other factors (such as living area), to which we do not have access. If we disregard this and weigh together all new mortgagors in the mortgage survey with the estimated effects of the amortisation requirement, the results show that households with new mortgages are buying homes that on average are more than 3 per cent less expensive as a result of the amortisation requirement (see Diagram 15). The requirement has also dampened households' LTI ratios for mortgages by on average almost 9 per cent.

The difference between the fall in debt and prices could be because the amortisation requirement has resulted in households choosing different types of homes. For example, if smaller tenant-owned apartments in the suburbs become more attractive than larger and more expensive apartments in central areas, the price effect from the amortisation requirement on the tenant-owned apartment market may be neutral.¹⁷ The fact that debt slowed more than prices may also be because households to a greater extent than before are using their savings for the cash payment.

¹⁷ To be able to draw these conclusions with certainty requires a different type of data than the data that is available in the mortgage survey.

Conclusions

This FI analysis presents signs that the amortisation requirement has had an effect. Households with new mortgages have changed their behaviour. New mortgagors are taking smaller mortgages than what they would have taken if FI had not implemented the requirement. They are also buying less expensive homes. The groups that must increase their amortisation payments the most are those that have changed their behaviour the most.

In contrast to what many people expected before FI implemented the amortisation requirement, younger home buyers, who are often first-time home buyers, were not noticeably affected by the requirement. Rather, older home buyers were affected the most. They are buying less expensive homes and borrowing significantly less. Families with children and home buyers in Stockholm and Gothenburg have also been affected by the amortisation requirement. In total, the LTI ratios (mortgages only) fell by almost 9 per cent as a result of the amortisation requirement.

Households affected by the amortisation requirement are now buying less expensive single-family homes, but it is primarily the holiday home market that has been affected. Holiday homes constitute a smaller percentage of housing-related transactions now than before, and households are buying significantly less expensive holiday homes as a result of the amortisation requirement. However, the prices of tenant-owned apartments that households are buying have thus far stayed the same. As a whole, the amortisation requirement slowed house prices by more than 3 per cent.

It is likely that the amortisation requirement over time will have further effects on debt and house prices. It is therefore important for FI to continue to monitor how the amortisation requirement affects individual households and the economy at large.

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Appendix: Calculations

This appendix describes the calculations used in this FI Analysis.

DEBT RATIOS IN THE MORTGAGE DATA

A household's total debt at time t is described by the following equation:

$$(B1) \quad s_{i,t} = b_{i,t}^M + b_{i,t}^B + b_{i,t}^O + l_{i,t}^M + l_{i,t}^B,$$

where s_i is household i 's total debt, and b_i^M , b_i^B and b_i^O are existing mortgages, unsecured loans¹⁸ and other loans, respectively. New mortgages and unsecured loans are designated with l_i^M and l_i^B , respectively. In this FI Analysis, we study two debt ratios. In the first we set a household's total debt against its disposable income ($d_{i,t}$):

$$(B2) \quad dti_{i,t} = \frac{s_{i,t}}{di_{i,t}}.$$

The second is defined in terms of mortgages only:

$$(B3) \quad lti_{i,t} = \frac{b_{i,t}^M + l_{i,t}^M}{di_{i,t}}.$$

CALCULATION OF REGULATED HOUSEHOLDS' DEBT RATIOS AND HOUSE PRICES IF FI HAD NOT IMPLEMENTED THE AMORTISATION REQUIREMENT

We divide the households into three groups. Households with an LTV ratio below 50 per cent constitute the control group since they are not affected by the requirement. Households that must amortise 1 at least per cent are included in Group 1 and households that must amortise at least 2 per cent are included in Group 2. Since we have separated the households into those that are subject to the regulation and those that are not, it is natural to use the performance of the latter group as a reference. We start with a general difference-in-difference (DD) specification:

$$(B4) \quad DD = (\bar{X}^{after} - \bar{X}^{before}) - (\bar{Z}^{after} - \bar{Z}^{before})$$

In this specification, *before* and *after* denote data points before and after a reform took place. In this case the reform is the amortisation requirement. X designates the group that is affected by the reform, and Z is the group that is not affected (the control group). In order for equation (B4) to say anything about the effect of the reform, the groups must have had a common trend before the regulation. Otherwise, the DD_g estimates would be influenced by these differences in the trends.

We now take the general DD specification and adapt it to our analysis of the amortisation requirement. The logarithm of the three groups' – those that do not need to amortise, those that must amortise 1 per cent

¹⁸ Unsecured loans here refer to housing-related unsecured loans.

and those that must amortise 2 per cent – average debt ratios have had similar growth and therefore the assumption of common trends holds. This means that we can use equation (B4) to calculate what the debt ratios would have been in Groups 1 and 2 if the amortisation requirement had not been implemented. Without the amortisation requirement, DD would have been equal to 0 for the groups that must amortise and equation B4 could thus be written as

$$(B5) \quad \begin{aligned} \widehat{\bar{y}}_g^{after} &= \widehat{\bar{y}}_g^{before} + \widehat{\bar{y}}_{control}^{before} - \widehat{\bar{y}}_{control}^{after} \\ y &= \ln(\text{Debt ratio}) \\ g &= \{1,2\} \end{aligned}$$

The estimated debt ratios “without the amortisation requirement” for those subject to the requirement are given as the exponent

$$(B6) \quad \widehat{\bar{y}}_g^{after} = \exp(\widehat{\bar{y}}_g^{after}).$$

The estimates for 2016 are compared to the outcome in Mortgage Survey 2016 in Diagrams 5 and 6.

Similarly, we calculate how the market values for tenant-owned apartments, single-family homes and holiday homes would have changed for households with LTV ratios above 50 per cent if the amortisation requirement had not been implemented. The method for the estimates is the same as in equations (B4) to (B6). The estimates for 2016 are compared again to the outcome in the Mortgage Survey.

A “DIFFERENCE-IN-DIFFERENCE” MODEL TO ESTIMATE THE EFFECTS OF THE AMORTISATION REQUIREMENT

The calculations in equations (B4) to (B6) give an estimate of how the amortisation requirement affects the debt ratios and the prices that households have paid for different types of homes. Different households have different characteristics – some are in big cities and other in rural areas – and the age of the borrowers varies. By specifying an econometric model, we are able to investigate how these characteristics affect debt ratios and house prices. We can also estimate how the amortisation requirement affected different types of households. The approach we use starts with the same principle as the calculations in equation B4. It is also important in this model that analysed debt ratios and house prices grow at the same rate regardless of the LTV category of the household prior to the reform.

We estimate the following difference-in-difference model:

$$(B7) \quad y_{it} = \beta_0 + \beta_1 P_{it} + \beta_2 B_{it} + \beta_3 P_{it} B_{it} + \delta X_{it} + \varepsilon_{it},$$

where y is the dependent variable of interest; P is a dummy variable for the period after the reform (2016 in our case); B indicates whether the household is included in the group that is affected by the reform (LTV ratio between 50–70 per cent or LTV ratio above 70 per cent). The coefficient β_3 in front of the interaction term $P_{it} B_{it}$ gives an estimate of the DD parameter in equation (B4) and states how the regulated households are affected by the amortisation requirement. X is a vector of additional explanatory variables and ε is a random error

term.¹⁹ The difference-in-difference method is described in more detail by Imbens and Wooldridge (2009).

Estimated coefficients from equation (B7) are presented in Tables 1 and 2 and in Diagrams 7, 8, 12, 13 and 14.

¹⁹ Explanatory variables in the model are: volume-weighted interest rate, LTV ratio (total mortgages as a per cent of the value of the pledged collateral), the borrower's age, age squared, dummies indicating if several adults in the household, if children in the household, if the household has a top loan and if the household has an unsecured loan, annual effects, and region-specific effects.