Amortization Requirements, Distortions, and Household Resilience: Problems of Macroprudential Policy II*

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First draft: August 2018
This version: November 2019

Abstract

Mortgage lending standards have tightened in Sweden in recent years, in particular through mandatory amortization requirements introduced by the Swedish FSA. The stated purpose is to increase the resilience of mortgagors to shocks, but it is shown that the resilience actually falls and that the tightening causes or worsens many distortions. Households without high income or wealth face higher barriers to entry into owner-occupancy. The mobility within the market for owner-occupied housing is reduced. First-time buyers without high income or wealth are excluded from the owner-occupancy market in Stockholm Municipality and many outsiders have to resort to a high-rent secondary-rental market. To prevent such exclusions, housing prices may have to fall by almost 40%. Less-than-high-income outsiders have higher housing user cost than high-income insiders. A less wealthy outsider has a higher user cost than a high-wealth insider with similar income. Mortgagors are forced to oversave and underconsume relative to their disposable income, and their consumption becomes more sensitive to income shocks. They have to save in illiquid housing equity instead of more liquid and diversified assets. They become less resilient to shocks for many years, for a very small gain in resilience later. Secondary-rental outsiders are forced to overpay, undersave, and underconsume, and their consumption becomes more sensitive to income shocks. By design the amortization requirements make the amortization countercyclical, which makes consumption more procyclical and sensitive to income shocks. The tightening of lending standards reduces demand for and lowers the prices of housing. This in turn reduces already too-low housing construction and worsens the structural problem of excess demand for housing. The conclusion is that this example of macroprudential policy is counterproductive and harmful to social welfare and equity.

JEL codes: E21, G01, G21, G23, G28, R21

Keywords: Macroprudential policy, housing, mortgages, loan to value ratio, loan to income ratio


*I am grateful to Robert Boije, Robert Emanuelsson, Peter Englund, Harry Flam, Martin Flodén, Sten Hansen, Lars Hörngren, Goran Katinic, Stefan Palmqvist, Erik Thedén, Roine Vestman, Karl Wallentin, Xin Zhang, and participants in a seminar at Sveriges Riksbank for comments or discussions of related issues. Support from the Knut and Alice Wallenberg Research Foundation is gratefully acknowledged. Any views expressed and any errors are my own.
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1 Introduction and summary

The possible risks associated with high housing prices and household debt and a controversial macroprudential policy by Finansinspektionen (FI, the Swedish Financial Supervisory Authority), have been much discussed and debated in Sweden and by international organizations such as the European Commission, the IMF, and the OECD, which monitor and comment on Swedish economic policy. In a previous paper, Svensson (2019), I have answered three questions about current Swedish housing prices and household debt: (1) Are housing prices too high? (2) Is household debt too high? (3) Does household debt pose an “elevated macroeconomic risk”?

The FI has argued that the answers to these questions are all yes and that this has justified a substantial further tightening during the last few years of already rather tight lending standards, achieved through mandatory amortization requirements and in other ways. The previous paper argues that the answers to the questions instead are all no, in the following sense: Regarding questions (1) and (2), there is no evidence that housing prices and household debt are higher than what is consistent with their fundamental determinants.

Regarding questions (2) and (3), first, it is noteworthy that the FI does not see much risk to financial stability from household debt. Indeed, the FI has summarized the situation as follows (FI, 2017d, p. 9; italics added):

*Finansinspektionen’s current assessment is that the risks to financial stability associated with household debt are relatively small.* This is because mortgagors generally have good potential to continue paying the interest and amortisation on their loans, even if interest rates rise or their incomes fall. On average, households have comfortable margins with which to cope with a fall in house prices. Swedish mortgage firms are also deemed to have satisfactory capital buffers should credit losses still arise.

The FI’s view is instead that household debt poses an “elevated macroeconomic risk” (FI, 2017d, p. 1; italics added):

The risks associated with household debt are [instead] primarily related to the possibility that highly indebted households may sharply reduce their consumption in the event of a macroeconomic shock. This development was noted in other countries during the financial crisis in 2008–2009. If many households reduce their consumption at the same time, this can amplify an economic downturn. Because loan-to-income ratios are high and rising among many borrowers, they represent an elevated macroeconomic risk.

Second, regarding question (3)—whether there really is such an elevated macroeconomic risk from Swedish household debt—there is indeed evidence from Denmark, the UK, and the US of a correlation between households’ indebtedness before the crisis 2008–2009 and subsequent negative consumption responses during the crisis. But, as explained in Svensson (2019), there is no evidence in the relevant literature that high household indebtedness caused a subsequent larger negative consumption response. The correlation is instead explained by an underlying common factor—an
omitted variable—that caused both high indebtedness before the crisis and a large negative consumption response during the crisis. For Denmark and the UK, the evidence is that the common factor is debt-financed household overconsumption relative to income, more precisely overconsumption financed by housing equity withdrawals. Importantly, among households that did not indulge in debt-financed overconsumption, highly indebted households did not reduce their consumption more than less indebted households (Andersen et al., 2016; Broadbent, 2019). There is also evidence of debt-financed overconsumption for the US. But there is no evidence of debt-financed overconsumption of any macroeconomic significance in Sweden. Therefore, there is no evidence of Swedish household debt posing an elevated macroeconomic risk. In summary, the FI’s tightening of lending standards lacks scientific support.

1.1 The tightening of lending standards

Disregarding the lack of evidence of an elevated macroeconomic risk, the FI has now for several years tried to gradually tighten lending standards, in order to reduce the growth of household debt and prevent too high indebtedness. According to the FI (FI, 2017d, p. 1):

The aim of the measure[s] is to increase the Swedish households’ resilience to shocks.

That the FI considers that the households’ resilience needs to be improved may at first seem surprising, given the first quotation on page 1 above, which implies that households’ resilience to shocks is considered satisfactory. However, the quotation refers to households’ resilience to continue to fulfill their debt-service commitments when shocks occur. Given the second quotation on page 1, it seems that it is the households’ resilience to maintain their consumption while fulfilling their debt service that is at stake. That is, the FI apparently aims to improve the households’ capacity to smooth their consumption while fulfilling their debt service, when macroeconomic shocks occur.

Through several twists and turns—briefly described in appendix A—the FI has eventually introduced a first mandatory amortization requirement that applies from June 2016 for new mortgages with loan-to-value (LTV) ratios above 50%. For LTV ratios between 50% and 70%, at least 1% of the loan amount at origination should be amortized per year; for LTV ratios above 70%, at least 2% of the loan amount at origination. The FI has then introduced a second, “stricter” mandatory amortization requirement that applies from March 2018. For new mortgages above 4.5 times annual gross income (income before taxes), at least an additional 1% of the loan amount at origination should be amortized per year.

The FI has also encouraged the banks to tighten their lending standards in other ways. In November 2015, the new director general, Erik Thedén, suggested a loan-to-income limit of 6 times annual disposable income (Thedén, 2015). The banks—perhaps perceiving an implicit threat of regulation if not obliging—have introduced new or taken more seriously existing internal loan-to-income limits, now typically 5–6 times annual gross income (Svenska Dagbladet, 2017). The banks
have also converged on a high interest rate in the interest-rate stress tests in their affordability assessments, typically 7% (thus no less than 5.5 percentage points higher than prevailing variable mortgage rates of about 1.5%).\(^1\) There is separate information from bank insiders that the FI has encouraged a general tightening of lending standards, for example, in non-public meetings with bank representatives, what the FI calls “communicative supervision.”\(^2\) As another indication that FI has both encouraged and welcomed the tightening, one might also quote FI (2017b, pp. 2–3):

> [T]he tightening of the requirements and credit assessments in recent years is healthy. It can also be mentioned here that the turnaround in this regard has been fuelled by FI’s actions. The measures themselves have been important, but the open debate FI has fostered about what needs to be done has played an important role in how banks and mortgagors act and think. The current [first] amortisation requirement was questioned before it was introduced. Today, amortisation is a natural element in the banks’ and the customers’ calculations and considerations. The same can be said about the mortgage cap. [An LTV cap of 85% was introduced in 2010.]

By tightening lending standards in this way, the FI has effectively reduced the supply of credit to households with less-than-high incomes and wealth, a category which includes many young households and individuals. European Commission (2018, p. 30) reports that Swedish “[d]emand-side policy action in the housing market has been focused on curbing mortgage lending via macroprudential measures” and notes “increasing difficulties faced by lower-income households to obtain a mortgage at all” (p. 31).

### 1.2 The consequences of the tightening of lending standards

Whereas Svensson (2018, 2019) examined the rationale for the further tightening of already tight lending standards—and found that there was none—the present paper examines the consequences of the tightening, in particular, the consequences of the mandatory amortization requirements.

#### 1.2.1 Higher housing payment, unchanged user cost, and higher involuntary saving

So, what are the consequences? What do mandatory amortization requirements do? Mandatory amortization requirements increase the mandatory housing payment (the sum of the operating and maintenance cost [OMC], the after-tax mortgage interest payment, and the mandatory amortization payment). They do not increase the user cost of housing (the sum of the OMC, the real after-tax mortgage interest, and the real cost of housing equity, minus the real after-tax capital gains on housing).\(^3\) (section 3)

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\(^1\) For example, at the press conference presenting the mortgage market report 2018, it was clear that the director general of the FI welcomed tighter lending standards of the banks in addition to the amortization requirements (FI, 2018c).

\(^2\) Private information to me from several independent bank insiders. I find the use of such informal “soft power” in macroprudential policy problematic, because it is not documented publicly and the macroprudential authority cannot then be held accountable for the results of its actions.

\(^3\) The OMC here includes any property taxes. Sweden has a local property fee (“kommunal fastighetsavgift”) with a nominal tax rate of 0.75% of the tax-assessed value for most houses and 0.3% for apartment. However, the property
Amortization does not increase the user cost because it is not an expense; it is saving, in the particular form of increasing the housing equity by reducing the mortgage. The mandatory housing payment minus the user cost is the involuntary saving associated with the housing. It equals the sum of the mandatory amortization and the reduction due to inflation of the real value of the mortgage minus the real cost of housing equity.

Thus, mandatory amortization increases the housing payment and the involuntary saving associated with the housing but does not affect the user cost of housing. The mortgagor is forced to pay more and to save more each month.

How does mandatory amortization compare to an interest-rate increase? From a housing-payment and cash-flow point of view, a 3% amortization is equivalent to a 3 percentage point increase in the after-tax interest rate on an interest-only loan—that is, a loan without any contracted amortization. With tax-deductible interest and a 30% capital-income tax, this is equivalent to a substantial $3/(1-0.3) = 4.3$ percentage point increase in the mortgage rate. For households that are liquidity-constrained (cash-constrained), it is the housing payment that matters and constrains the household, and then 3% amortization has the same effect as a 4.3 percentage-point mortgage-rate increase, a pretty substantial increase.

From a user-cost point of view, mandatory amortization and an interest-rate increase are different. As mentioned, mandatory amortization does not increase the user cost. But an interest-rate increase increases the user cost, by increasing the real after-tax interest. For households that are not liquidity-constrained, it is the user cost that matters. Then 3% mandatory amortization has little or no effect. For example, households that are not credit-constrained can simply borrow more, deposit the excess borrowing in a savings account, and pay the amortization from the savings account (Svensson, 2016). Alternatively, they may substantially reduce the impact of the mandatory amortization by frequent refinancing (Hull, 2017).

As a concrete example, we may consider the average studio (one-room apartment) in Stockholm (Municipality) in 2017. For an interest-only loan of SEK 2.38 mn (€238,000)—corresponding to an LTV ratio of 85% (equal to the FI’s mandated LTV cap of 85%, introduced in 2010)—the monthly housing payment, user cost, and involuntary saving are about SEK 6,700 (€670), SEK 2,800 (€280), and SEK 3,900 (€390), respectively.

For further concreteness, one may consider a Stockholm 25–29-year-old individual with monthly gross income of SEK 25,000 (€2,500), which happens to be the median income in 2017 for this Stockholm cohort. For brevity, this individual will be referred to as the 25K individual. The fee is capped at a low indexed level (in 2018, SEK 7,812 (€781) and SEK 1,337 (€138) per year for single-family houses and apartments, respectively). For tenant-owned apartments, the property tax is included in the monthly fee to the tenant-ownership association.

4 Throughout the paper, Stockholm refers to Stockholm Municipality, which is substantially larger than the central city of Stockholm.

5 The average price of a Stockholm studio in 2017 was SEK 2.8 mn (€280,000) (the source is Svensk Mäklarstatistik [Swedish Real Estate Agent Statistics]). The interest rate is 3.3% (a 10-year fixation-period mortgage rate in 2017; the 3-month variable rate was about 1.5%). See table 3.1 and figure 3.1 for details.
corresponding net income (income after tax) is about SEK 20,000 (€2,000). Assume that the individual can manage a down payment of 15% of the price of the studio and receives an interest-only loan for the remaining 85%. Then the housing payment, the user cost, and the involuntary saving are 34%, 14%, and 20% of net income, respectively. This makes this average Stockholm studio quite affordable for the median Stockholm 25–29-year-old. In particular, the user cost is quite small, both absolutely and relative to net income.

With amortization requirements, the amortization will be 3% of the loan amount at origination, adding SEK 5,950 (€595) to the monthly housing payment and the involuntary saving. Then the monthly housing payment rises to about SEK 12,600 (€1,260) and the involuntary saving to about SEK 9,800 (€980), whereas the user cost is unchanged.6

As a result, the housing payment, user cost, and involuntary saving is now, respectively, 64%, 14%, and 50%. The mandatory amortization is a full 30% of net income, quite large. Clearly, the housing payment becomes prohibitively high, and the involuntary saving rate of 50% is extremely high, in particular, for a 25–29-year-old from a life-cycle perspective.

Thus, the 25K individual will not be able to afford the average Stockholm studio, and the individual will miss out on the low user cost of the studio. What are the alternative housing options in Stockholm?

Stockholm is infamous for its dysfunctional rental market—dysfunctional because of rent control. The average monthly rent for a rent-controlled Stockholm studio was about SEK 5,300 (€530) in 2017 (Stockholm Housing Agency, 2018, and own calculations). But for such a rent-controlled studio, the median and average queuing time is about 11 years.7 Therefore, aside from those that can live with their parents in Stockholm, the practical alternative for the 25K individual is the secondary rental market, on which the average monthly market rent for a Stockholm studio is about SEK 10,000 (€1,000) (Qasa, 2019). Such a rent makes the housing payment and user cost 51% of the 25K individual’s net income. Because the housing payment and the user cost are both equal to the rent, the involuntary saving is zero. With such high rent, the 25K individual may not be able to save to make a future higher down payment to get out of the secondary-rental market, and may indeed be caught in a poverty trap.8

Thus, aside from those that can live with their parents in Stockholm, the amortization requirements forces a 25K individual to spend 51% of net income on the rent in a secondary studio rental instead of enjoying a user cost of 14% of net income in an owner-occupied studio. The difference between “insiders” (those with owner-occupied housing) and “outsiders” (those without owner-occupied housing and without rent-controlled rental housing) is large in Stockholm, and the cost

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6 See figure 3.2. The LTV ratio is above 75%, so according to the first amortization requirement at least 2% shall be amortized. The loan exceeds 4.5 times gross income, so according to the second amortization requirement at least an additional 1% of the loan shall be amortized.
7 Stockholm Housing Agency (2018, and own calculations).
8 See figure 3.3. NBHBP (2018) provides details on the secondary-rental market.
of being an outsider is large.

Figure 1.1: Monthly housing payment, user cost, and involuntary saving: Without amortization, with 3% amortization requirements, for a rent-controlled rental, and for a secondary rental.

Figure 1.2: Monthly housing payment, user cost, and involuntary saving: Without amortization, with 3% amortization requirements, for rent-controlled rental, and for a secondary rental. Including capital gains.

Source and note: Figure 1.1: Table 3.1, figures 3.1 and 3.2. The average rent and average and median queuing time for a rent-controlled rental is from Stockholm Housing Agency (2018). The average rent for a secondary rental is from Qasa (2019). Figure 1.2: Table 6.1 and figures 6.9 and 6.10. Real after-tax capital gains are 1.12% per year, instead of 0 as in table 3.1. The user cost includes the negative of the real after-tax capital gain. SEK/EUR ≈ 10.

Figure 1.1 summarizes the housing payment, user cost, and involuntary saving for the four alternatives: owner-occupancy, without amortization and with amortization requirements, respectively; a rent-controlled rental with an 11-year queuing time; and a secondary rental. (Note the zero involuntary saving for the rental alternatives.) The difference between the low user cost of owner-occupancy and the rent of the secondary rental is striking. Furthermore, this low user cost is calculated under the assumption of a zero after-tax real capital gain. Figure 1.2 shows the result of the alternative and realistic assumption of an annual nominal housing-price growth of 4%. This results in an annual real after-tax capital gain of 1.12%. When the negative of this capital gain is included in the monthly user cost, it drops to only SEK 210 (€21), making the difference to the rentals even larger, and the difference in user costs between insiders and outsiders extreme.9

The above concerns the fate of this 25K individual, who needs to borrow 85%. Consider another 25K individual that has own wealth or rich helpful parents and therefore only needs to borrow 50%. Then there will be no amortization according to the first amortization requirement and only 1% amortization according to the second requirement (the loan still exceeds exceeds 4.5 times the gross income). The monthly housing payment will be about SEK 5,900 (€590), the involuntary saving about SEK 3,100 (€310), and the user cost is unchanged.10

9 In order to be on the conservative side, most of the calculations in the paper nevertheless assumes a zero real after-tax capital gain.

10 See figure 3.4 for details.
and involuntary saving are, respectively, 30%, 14%, and 16%. Clearly, for a 25K individual that only needs to borrow 50%, the average Stockholm studio is eminently affordable.

Thus, amortization requirements lead to very unequal situations for the 25K individual who needs to borrow 85% and the one who only needs to borrow 50%. More generally, they lead to very different treatment of borrowed capital from owned capital to finance housing purchases.

It follows that the tightening of lending standards increases the barriers to entry into the market for owner-occupied housing for households without high income and wealth.

### 1.2.2 A substantial credit contraction

For households that are liquidity-constrained and constrained by their housing payments, 3% mandatory amortization is equivalent to a 4.3 percentage-point mortgage-rate increase and leads to a corresponding fall in *demand* for mortgages. But amortization requirements also directly influence the *supply* of mortgages and implies a credit-supply contraction (section 4).

In deciding how large mortgages to lend to borrowers, Swedish banks use affordability assessments that include an interest-rate stress test of whether the borrower can afford the mortgage for a given high interest rate—the affordability-test interest rate—that is substantially higher than prevailing rates. More precisely, the borrower’s *cash-flow margin* (CFM) shall be nonnegative for the affordability-test interest rate. The CFM is defined as the borrower’s net income minus the sum of the housing payment and standardized (basic) (non-housing) living expenses. As explained below in section 4.1.1, the lending standards before the tightening—also referred to as “without the tightening”—may be represented by an affordability assessment with an affordability-test interest rate of 6% and an interest-only loan.\(^\text{11}\)

For such an affordability assessment *without the tightening* of lending standards, the required minimum monthly gross income to get the above loan of SEK 2.38 mn is about SEK 25,000 (€2,500), so the 25K individual would just pass the affordability test and get the mortgage.

*After the tightening* of lending standards, banks use a higher affordability-test interest rate of typically 7% and include the higher housing payment due to the mandatory amortization requirements in their affordability assessment. For a given loan amount, this increases the required minimum gross income. For the above loan, the minimum monthly gross income required increases from SEK 25,000 to about SEK 35,000 (€3,500), that is, from the median income to 40% above the median income—which corresponds to the 80th percentile of the income distribution of Stockholm 25–29-year olds. Of this increase of SEK 10,000 (€1,000), about SEK 8,000 (€800) is due to the amortization requirements and about SEK 2,000 (€200) is due to the higher affordability-test interest rate.\(^\text{12}\)

\(^{11}\) Affordability assessments are also known as “discretionary-income calculations” and the CFM is also known as “discretionary income” (FI, 2017e, Glossary, p. 27). In Swedish, affordability assessments are called “Kvar Att Leva På (KALP) [Left To Live On]” calculations.

\(^{12}\) See table 4.1 for details.
1.2.3 Measures of the tightening

One can consider several measures of the tightening of lending standards. A first measure is that amortization of 3\% is from a housing-payment point of view equivalent to a before-tax interest-rate increase of 4.3\% on an interest-only loan. Thus, the tightening is equivalent to an increase in the affordability-test interest rate on an interest-only loan from 6\% to \(7 + 4.3 = 11.3\%\), an increase of 5.3 percentage points.

A second measure is the reduction in the maximum loan for the 25–29-year olds who need to borrow 85\%. The maximum loan falls by 14\% because of the 1 percentage point increase in the affordability-test interest rate and by 33\% because of the two amortization requirements. Thus the total fall in the maximum loan is 47\%.13

A third measure is the above 40\% increase in the minimum required gross income caused by the tightening.

A fourth measure is the share of the Stockholm 25–29-year-olds that are excluded by the tightening. Without the tightening, the top 50\% of the income distribution of such individuals had enough income to get the above loan. After the tightening, only the top 20\% of the income distribution had enough monthly income. This is thus a credit contraction that excludes \((50 - 20)/50 = 60\%\) of those that would have qualified for the loan without the tightening.14

One can also consider a rough measure of the fall in housing demand of 25–29-year-olds caused by the tightening. By adding the down payment of to the maximum loan, one gets the maximum price the individual can pay for the Stockholm studio. The percentage fall in the maximum price can be seen as a rough measure of the fall in housing demand. For the 25K individual, the maximum price has fallen by 37\%.

For this individual to still be able to buy the Stockholm studio after the tightening, prices would thus have had to fall by 37\%. Stockholm housing prices fell by about 10\% from August 2018 to January 2018 and has since then recovered a bit. Thus, the 25K individual unable to buy the Stockholm studio by a wide margin and is in a considerably worse situation after the tightening.15

1.2.4 Large involuntary saving

The large involuntary saving caused by the amortization requirement has several negative consequences.

Households that need to borrow and can afford the large housing payment are forced to save very much. Consider the individual with a monthly gross income of SEK 35,000 (€3,500), who just passes the affordability assessment to borrow 85\% of the price of the average Stockholm studio. For brevity, this individual will be referred to as the 35K individual. This individual will have a

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13 See figures 4.9 and 4.10 for details.
14 See figure 4.11 for details.
15 See figures 4.12 and 4.13 for details.
net income of about SEK 27,000 (€2,700) and will face involuntary saving of 37% of net income (housing payment of 47% minus user cost of 11%, with a correction for rounding errors). For most households, especially young individuals, this large saving will be much higher than they would prefer and what would be optimal for them from, for example, a life-cycle perspective. This implies that their consumption is constrained to be much lower than they would prefer. Thus, insiders are forced to oversave and underconsume.

In particular, these households are prevented from their preferred consumption-smoothing over time. Their marginal propensity to consume out of current net income (MPC) will be very high. They may indeed be hand-to-mouth consumers with an MPC equal to unity (Campbell and Mankiw, 1989; Kaplan et al., 2014; Ampudia et al., 2018). Thus, amortization requirements imply that borrowers’ consumption is more sensitive to their current income.

The oversaving borrowers and housing owners are not only forced to save too much, they are also forced to save by amortizing and thereby save in an illiquid asset, housing equity, with the result that the savings are not easily accessible when needed. If the household has sufficient equity in its housing, the household is normally better off by instead building up a more balanced and diversified portfolio of liquid and illiquid, financial and real assets, including bank deposits, bonds, and stocks. In particular, building up a liquidity buffer increases the resilience of the household to income shocks and helps in smoothing consumption.

1.2.5 The FI and the government understates the effects of the tightening

The FI and the government has given misleading statements about the consequences of the amortization requirements (section 5). The FI has stated, in proposing the second amortization requirement, that “Most borrowers [are] not affected” (by the second amortization requirement) (FI, 2017a). The FI showed a figure according to which the second amortization requirement would only affect single adults without a children with a monthly gross income exceeding SEK 31,000 (€3,100). Of Stockholm 25–29-year-olds, 31% had a monthly gross income exceeding SEK 31,000 in 2017—by itself is still a substantial proportion.

However, the FI used an imperfect approximation of the income tax schedule in its background calculations. When the Swedish Tax Agency’s Tax Table is used, it turns out that the second amortization requirement affects these single adults with a monthly gross income exceeding only SEK 24,000 (€2,400). Of the Stockholm 25–29-year-olds, 53% had a monthly gross income exceeding SEK 24,000 in 2017. Thus, a correct, rather different statement would be “More than half of the borrowers are affected.”

The government, in the form of the minister of financial markets, Per Bolund, has also stated that “Most borrowers [are] not affected,” while showing a similar figure (Bolund, 2017). This

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16 See figures 5.1–5.4 for details.
time the figure referred to a household with two adults and two children. According to the figure, the second amortization requirement would only affect such households with monthly gross income exceeding SEK 72,000 (€ 7,200). This calculation used the same imperfect approximation of the tax schedule. However, when the correct Tax Table is used, it turns out that the second amortization requirement affects such households with a monthly gross income exceeding SEK 60,000 (€ 6,000).

Both the FI and the government were only talking about the second amortization requirement. They did not mention that the first requirement affects even more borrowers, namely everyone that has to borrow more than 50% of the price of the housing.

Another apparently misleading statement by the FI is in an op-ed by the director general, “The young are excluded by ever higher housing prices—not by amortization requirements” (Thedéen, 2018). The director general maintained that the minimum monthly gross income required to buy an average Stockholm studio had increased by SEK 7,400 (€ 740) from 2012 to 2017. Of this increase, only a minuscule SEK 190 (€ 19) was supposed to be due to the amortization requirements, whereas SEK 6,700 (€ 670) was supposed to be due to higher housing prices. How can the effect of the amortization requirements be so small, when 3% amortization on the loan to finance 85% of the average Stockholm studio implied monthly amortization of about SEK 6,000 (€ 600), which in turn required an increase in the monthly gross income of about SEK 8,000 (€ 800).

Scrutiny of the calculation reveals several misleading assumptions. When these are replaced by more reasonable assumptions, a more correct calculation shows that the total increase in the minimum gross income from 2012 to 2017 is about SEK 14,400 (€ 1,440)—almost double that reported by the FI. Of this, the increase due to the amortization requirements is about SEK 8,300 (€ 830), much larger than the FI’s reported SEK 190 (€ 19), and the increase due to higher prices is about SEK 4,500 (€ 450), smaller than the FI’s reported SEK 6,700. Thus, a more correct statement is “The young are excluded mainly by the amortization requirements and to a lesser extent by higher housing prices”.

1.2.6 A strongly frontloaded debt-service-to-income ratio over time

With 4% annual growth of nominal incomes (consistent with 2% real growth and 2% inflation), nominal incomes will double in about 18 years. For a given interest-only loan, the borrower’s debt-service-to-net-income (DSTNI) ratio for a constant interest rate as well as the loan-to-income (LTI) ratio will then fall gradually by about 4% per year and be halved in about 18 years. With also 4% growth of nominal housing prices, nominal housing prices will also double in about 18 years. Then the LTV ratio will also fall by about 4% and be halved in about 18 years. Thus, for a given interest-only loan, 2% real growth and 2% inflation results in an “automatic” amortization

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17 See figures 5.5 and 5.6 for details.
18 See table 5.1 and figure 5.7 for details.
of 4% per year. There is little reason to believe that an optimal amortization rate would be faster (section 6).

For the 25K individual and the above interest-only loan, the initial DSTNI would be 23%, and it would gradually fall to 16% in 10 years. The LTV ratio would fall from the initial 85% to 57% in 10 years, thus corresponding to a substantial housing equity of 43%.

With amortization requirements, the initial DSTNI ratio would be a forbidding 54%. The DSTNI ratio becomes strongly frontloaded. It would fall over time but remain above the DSTNI ratio for an interest-only loan until year 10, when amortization would cease and the DSTNI would drop to 12%, below the 16% for an interest-only loan. Thus, at the cost of a high DSTNI ratio during the first 9 years, there is a gain of a 4 percentage point lower DSTNI ratio from year 10. But the 16% DSTNI ratio in year 10 for the interest-only loan is already quite low, so it is difficult to see that a reduction of a few percentage points would have any significant benefit.19

With amortization requirements, as noted above, the 25K individual will in any case not pass the affordability test and not get the loan, whereas the 35K individual will pass the test and get the loan. For the 35K individual, for an interest-only loan, the DSTNI ratio would have started out at 17% and fallen gradually to 12% in year 10. With amortization requirements, the strongly frontloaded DSTNI ratio starts out at 39% and remains above that of the interest-only loan until year 10, when it drops to 9%, 3 percentage points below the one for the interest-only loan. Again, at the cost of a higher DSTNI ratio during the first 9 years, there is a gain of a 3 percentage point lower DSTNI ratio from year 10. Again, it is difficult to see that a reduction of 3 percentage points from the low DSTNI ratio of 12% would have any significant benefit.20

In summary, amortization requirements lead to a strongly frontloaded DSTNI ratio compared with an interest-only loan. Importantly, the DSTNI ratio remains higher than that of an interest-only loan for several years, and only drops a few percentage points below that of the interest-only loan when amortization ceases in year 10. Because, in year 10, the DSTNI ratio for an interest-only loan is already small, it is difficult to see that there would be much benefit from the reduction of it.

From an informal cost-benefit analysis, it seems rather likely that the cost of a substantially higher DSTNI ratio during the first 9 years are larger than the possible benefits a modest reduction of a relatively small DSTNI ratio from year 10. More generally, the strongly front-loaded DSTNI ratio under amortization requirements makes more borrowers liquidity-constrained for many years, forces more borrowers to oversave and underconsume, and makes it more difficult or even impossible for borrowers to smooth their consumption when shocks to their current income occur.

The borrowers’ consumption becomes more sensitive to current income, and the borrowers become less resilient to income shocks.

19 See figure 6.2 for details.
20 See figure 6.6 for details.
1.2.7 The cash-flow channel of monetary policy increases resilience

High household debt and variable interest rates implies that households’ cash flows become sensitive to interest-rate changes. Interest-rate rises will reduce households’ cash flows. A rise in interest rates at the same time as incomes fall is particularly problematic. This was indeed the case during the 1990s crisis in Sweden. Then there was a fixed exchange rate, the krona was subject to speculative attacks, and the Riksbank was defending the fixed exchange rate with a very high policy rate in the middle of deep recession. However, as discussed in Svensson (2019, section 4.2), this is very unlikely to happen now, with a flexible exchange rate and monetary policy under “flexible inflation targeting” aiming at achieving both the inflation target and full employment.\(^{21}\) Then interest rates are not exogenous but vary with the business cycle. In recessions, the policy rate will be low, and mortgage rates will also be low, because the Swedish authorities have the tools to keep the spread between mortgage rates and the policy rate normal (Svensson, 2019, section 4.2.1). Interest rates thus generally become procyclical, higher in booms and lower in recessions (section 7).

It follows that, in a recession with negative shocks to current incomes, the Riksbank will lower policy rates as far as necessary to stabilize consumption, aggregate demand, and inflation—or at least as far into the negative range as is deemed possible and effective. This will lower mortgage rates and improve the households’ cash flows, thus moderating the effect on the cash flows of the income fall. This is the so-called cash-flow channel of monetary policy (Flodén et al., 2018; Hughson et al., 2016; Gustafsson et al., 2017; Cumming, 2018; Svensson, 2019).\(^{22}\) Importantly, as discussed in Svensson (2019), Swedish authorities have the tools to keep the margin between mortgage rates and the policy rate at a normal level—and used these tools during the crisis 2008–2009. This makes the pass-through from the policy rate to mortgage rates approximately one-to-one.\(^{23}\)

With high household debt and variable mortgage rates, the cash-flow channel is strong in Sweden. Furthermore, it is stronger with higher LTI ratios. High LTI ratios thus makes it easier for the Riksbank to stabilize consumption and aggregate demand and counter the effect of income falls. Households with higher LTI ratios benefit more from a given interest-rate fall and find it easier to maintain their consumption. Thus, this way higher LTI ratios improve rather than deteriorate resilience.

Furthermore, high debt and variable mortgage rates in this way provide borrowers with insurance against bad times. From this point of view, variable interest rates are less risky than interest rates with long fixation periods, counter to conventional wisdom. However, renters do not benefit from this kind of insurance and improvement of their cash flows in recessions. Rents do not fall,\(^{21}\)

\(^{21}\) Each Monetary Policy Report of the Riksbank contains the statement “[I]n addition to stabilising inflation around the inflation target, [the Riksbank] endeavour[s] to stabilise production and employment around paths that are sustainable in the long term. The Riksbank therefore conducts what is generally referred to as flexible inflation targeting.” (Sveriges Riksbank, 2019, p. 3)

\(^{22}\) See also Cloyne et al. (2018).

\(^{23}\) See also Erikson and Vestin (2019) for evidence that the pass-through has been approximately one-to-one also for negative policy rates in Sweden.
and renters’ cash flows do not improve, when interest rates fall in bad times.

1.2.8 Reduced household resilience to income shocks

As mentioned in section 1.1, the FI’s aim of the amortization requirements is to increase households’ resilience to shocks. But a closer look reveals that amortization requirements actually reduce households’ resilience (section 7).

As noted in section 1.1, the resilience in question is mainly the resilience of the households’ consumption, more precisely, the households’ capacity to smooth their consumption while fulfilling their debt service, when negative shocks to current income occur. This resilience can be measured by the households’ CFMs. As mentioned in section 1.2.2, the CFM is defined as the household’s current net income minus the sum of the mandatory housing payment—the OMC plus the mandatory debt service (the after-tax interest plus the mandatory amortization)—and standardized (basic) (non-housing) expenses. The CFM shows the scope for actual non-housing consumption to exceed the standardized basic living expenses and the capacity to maintain a smooth normal non-housing consumption without having to draw on any liquidity buffer, when negative shocks to current income occur.

Amortization requirements increase the housing payment and reduce households’ CFMs and thereby reduce households’ resilience compared with an interest-only loan. A given interest-only loan results—with nominal income growth—in a gradually increasing cash-flow-margin-to-net-income (CFMTNI) ratio; this is the mirror image of the gradually decreasing DSTNI ratio for an interest-only loan noted in section 1.2.6. In contrast, amortization requirements result in a strongly backloaded CFMTNI ratio; the mirror image of the strongly frontloaded DSTNI ratio with amortization requirements. The initial CFMTNI ratio is thus much lower with amortization requirements than for an interest-only loan. The CFMTNI ratio remains lower than that for an interest-only loan until amortization ceases in year 10, when the CFMTNI ratio rise to slightly exceed the that for an interest-only loan; this is again the mirror image of the DSTNI ratio with amortization requirements, which only after about 10 years slightly undershoots the DSTNI ratio for an interest-only loan.\(^\text{24}\)

With amortization requirements, the cost of a substantially lower resilience during the first 9 years are likely to be significantly larger than the possible benefits of a modest increase in resilience from year 10. More generally, the marginal welfare loss from less resilience is likely to increase when resilience falls. The marginal welfare loss from a lower CFM is larger when the CFM is initially low than when it is initially high. This means that it is optimal to smooth the CFM over time, for the same reason why decreasing marginal utility of consumption makes it optimal to smooth consumption over time.\(^\text{25}\)

\(^{24}\) See figures 7.4 and 7.5.

\(^{25}\) It is easy to show that reasonable measures of the welfare loss display increasing marginal loss to less CFM. See
It follows that the FI’s amortization requirements with its frontloaded CFM profile results in less resilience and a welfare loss compared with the smooth CFM profile for an interest-only loan. More intuitively, the more smoothly increasing CFMTNI ratio for an interest-only loan makes borrowers less liquidity-constrained and make it easier for borrowers to smooth their consumption when shocks to their current income occur. Clearly, amortization requirements are a counterproductive way to increase borrowers’ resilience.

Furthermore, the secondary-rental outsiders—the individuals that are excluded from owner-occupied housing because of the tightening of lending standards and have to resort to the secondary-rental market—end up having a lower CFM and a lower resilience to income shocks than if they had received the interest-only loan. This is because the secondary rent is higher than the housing payment for an interest-only loan. In addition, the secondary-rental outsiders’ CFMs do not benefit from lower mortgage rates in recessions.

Amortization requirements reduce the resilience of borrowers in other more indirect ways. The high housing payment and low CFM prevent borrowers from building up a liquidity buffer—or force them run down an existing liquidity buffer. They also prevent the borrowers to invest in a more diversified portfolio. The borrowers are forced to oversave and underconsume, and become liquidity-constrained. More borrowers become hand-to-mouth consumers, with their consumption very sensitive to shocks to current income.

Finally, as discussed in section 7.6, by design the amortization requirements make the amortization and associated involuntary saving inherently countercyclical, because the amortization rate rises when LTV and LTGI ratios fall due to housing-price and income falls. This makes consumption inherently procyclical and increases the macroeconomic risk that FI wanted to reduce.

Thus, amortization requirements make it more difficult for borrowers to smooth their consumption, when negative income shocks occur. Their consumption becomes more sensitive to income shocks, which may reinforce a recession. Amortization requirements may create and increase the macroeconomic risk that FI is trying to reduce.

### 1.2.9 The FI’s exemptions on “special ground” do not solve the problem of reduced resilience

The FI’s is aware of the problem that amortization requirements reduce households’ resilience. Its response to this problem—and contradiction—is to allow mortgage firms to make exemptions from amortization payments for borrowers on “special grounds” (FI, 2017d). However, the special grounds FI mentions refer to situations when individual borrowers face individual problems in fulfilling their debt service for reasons such as “unemployment, long periods of absence from work due to illness and the death of a close relative.” There is no suggestion in the FI’s discus-
sion that mortgage firms might consider borrowers’ consumption or the macroeconomic risk from a reduction in borrowers’ consumption—the FI’s official rationale for having introduced the amortization requirements. It difficult to believe that mortgage firms would exempt borrowers from amortization on the ground that they cannot maintain their normal consumption. The mortgage firms will most certainly be focused on any risk to their individual debt service rather than on any macroeconomic consequences. Thus, the FI has not provided any mechanism through which the exemptions to amortization payments would avoid the reduced resilience caused by the amortization requirements.

1.2.10 A reduction in already too-low construction

As discussed in Svensson (2019), the main problem with the Swedish housing market is a structural excess demand for housing in the major cities. Demand for owner-occupied housing has been growing, due to a downward trend in mortgage rates, a reduction of and low cap on property taxes, increases in disposable income, urbanization and migration to the major cities, the dysfunctional rental market, and other structural factors. For several reasons, the supply of housing has not kept up with the growing demand. The reasons include restrictions on land use, building regulations, lack of regional planning, local special regulations, local permit handling times, limited competition, and so on. Given this, it is not surprising that housing prices and household debt have been rising.

The obvious solution to this problem of a structural excess demand for housing is to increase the supply of housing, through increased construction of new housing and more efficient use of the existing housing stock, including reforms of the rental market. In contrast, the FI’s tightening of lending standards and the resulting credit contraction has served to artificially reduce the demand for housing and thus lowered housing prices. This in turn has led to a substantial fall in the construction of new housing, in a situation when housing construction was already lower than socially optimal. This makes the structural housing problem worse.

1.2.11 Many distortions

It is clear that the tightening of lending standards, especially the mandatory amortization requirements, cause several obvious distortions. These distortions cause efficiency (welfare) losses. They also cause equity (welfare distribution) losses between insiders and outsiders of the owner-occupancy market and between insiders with and without high income and wealth (section 8).

The FI’s mandatory amortization requirements increase the housing payment and cause a large difference between the housing payment and the user cost of housing and thereby a large involuntary saving. The large difference between the housing payment and the user cost of housing as well as the large involuntary saving cause several distortions compared with an interest-only loan. The amortization requirements also cause a strongly frontloaded time profile of the debt-service-to-net-
income ratios as well as a strongly backloaded time profile of the cash-flow-margin-to-net-income. This causes distortions compared with the smoother time profiles resulting from an interest-only loan.

Section 8 further examines the distortions. Table 8.1 (reproduced on page 16) provides a non-exhaustive summary of the distortions. In the table, “outsiders” denote individuals that are excluded from the market for owner-occupied housing by the tightening of lending standards. “Insiders” denote individuals that are still able to buy the average studio after the tightening. “Secondary-rental outsiders” denote outsiders that have to resort to the secondary-rental market.

Table 8.1. A non-exhaustive summary of distortions caused by the tightening of lending standards, especially by the mandatory amortization requirements (reproduced from page 74).

| 1. Households without high income or wealth face higher barriers to entry into owner-occupancy. |
| 2. The mobility within the market for owner-occupied housing is reduced. |
| 3. First-time buyers without high income or wealth are excluded from the owner-occupancy market in Stockholm Municipality and many have to resort to the secondary-rental market. |
| To prevent such exclusions, housing prices may have to fall by almost 40%. |
| 4. Less-than-high-income outsiders have higher housing user cost than high-income insiders. |
| 5. A less wealthy outsider has a higher user cost than a high-wealth insider with similar income. |
| 6. Mortgagors are forced to oversave and underconsume. |
| 7. Mortgagors’ consumption becomes more sensitive to income shocks. |
| 8. Mortgagors have to save in illiquid housing equity instead of more liquid and diversified assets. |
| 9. Mortgagors are less resilient to shocks for many years, for a small gain in resilience later. |
| 10. Secondary-rental outsiders are forced to overpay, undersave, and underconsume. |
| 11. Secondary-rental outsiders’ consumption is more sensitive to income shocks. |
| 12. Secondary-rental outsiders are less resilient to shocks, without any gain in resilience later. |
| 13. By design the amortization requirements make amortization and involuntary saving countercyclical, which makes consumption more procyclical and sensitive to income shocks. |
| 14. Reduced demand for and lower prices of housing reduce already too-low housing construction and worsen the structural problem of excess demand for housing. |

Note: “Outsiders” refer to households excluded from the market for owner-occupied housing because of the tightening of lending standards. “Insiders” refer to households still being able to enter the market for owner-occupied housing after the tightening of lending standards. “Secondary-rental outsiders” refers to outsiders that have to resort to the secondary rental market, with very high rents.

The paper is organized as follows: Section 2 notes some good things about Swedish macroprudential policy. Section 3 examines the consequences of amortization requirements on the housing payment, the user cost of housing, and the involuntary saving (the housing payment minus the user cost) associated with owner-occupied housing. Section 4 examines the consequences of the tighten-
ing of lending standards on the affordability assessments that banks do before granting mortgages to customers, including what share of households are excluded because of the tightening. Section 5 scrutinizes whether the FI has presented the consequences correctly. Section 6 examines the time profile of debt-service, loan-to-value, and loan-to-income ratios without amortization and with mandatory amortization requirements. Section 7 examines the effect of amortization requirements on household resilience. Section 8 summarizes the several and considerable distortions caused by the tightening of lending standards, especially the mandatory amortization requirements. Section 9 presents some conclusions. An appendix contains additional figures and details.

2 Good things about Swedish macroprudential policy

There are many good things about Swedish macroprudential policy. The government has introduced a framework for financial stability with a clear separation of monetary policy and macroprudential policy and with the FI in charge of and accountable for macroprudential policy. Furthermore, the FI has been quite active in strengthening the resilience of the Swedish financial system. It has also thoroughly monitored bank’s lending standards for mortgages and the households’ debt-service capacity and resilience to disturbances.

The FI has taken a series of actions to strengthen the resilience of the financial system. It introduced an LTV cap of 85% in October 2010. It raised the risk-weight floor for mortgages first in May 2013 to 15% and then in September 2014 to 25%, which is quite high given historical credit losses and the fact that mortgages are full recourse. It introduced the Basel 3 LCR regulation in January 2014. It introduced a Basel Pillar 2 add-on of 2% in September 2014 and a systemic buffer of 3% in January 2015 for the four largest banks. The Countercyclical Buffer was activated at level 1% in September 2015, raised to 1.5% in June 2016 and 2% in March 2017, and will be further raised to 2.5% in September 2019. The capital requirements in 2017 for the four largest and systemically important banks stood at 24% of risk-weighted assets. Their actual capital was 28% of risk-weighted assets (22% of risk-weighted assets for common equity tier 1 capital). Swedish banks are among the best capitalized in Europe and are very resilient in severe stress tests (FI, 2017c).26

Regarding households and household debt, the FI introduced an LTV cap of 85% for mortgages in October 2010. Before that, it had introduced a special annual mortgage market report in February 2010. The report uses microdata on a large sample of new borrowers collected from the banks and provides an extensive and detailed report of the volume and distribution of household debt. In particular, it reports the results of stress tests of the households, to assess their debt-servicing capacity and resilience to disturbances. This way, the FI is able to thoroughly monitor


26 The Riksbank has over the years regularly accused the FI of having an “inaction bias,” but there is clearly no ground for such an accusation.
the development of households’ debt-service capacity and resilience. Already in 2010, the debt-service capacity was good, as was the resilience to disturbances in the form of housing-price falls, interest-rate increases, and income losses from unemployment increases. Since then, the debt-service capacity and resilience to disturbances have improved steadily even further (FI, 2018d).

Furthermore, the average LTV in 2017 was only 63% for new mortgages and only 55% for the total stock of mortgages.

As noted from the first quotation on page 1, the FI’s current judgment is that the risks to financial stability associated with household debt are small. The FI’s judgment is consistent with its heatmap of vulnerability indicators for the household sector, shown in figure 2.1. The considerable resilience of new borrowers is further illustrated in figure 2.2 (FI, 2016c, diagram 24): Consider a stress test in which housing prices fall by a full 40%. Also, whereas new mortgagors can be assumed to be employed at the origination of their loans, assume that a full 10% of them thereafter become unemployed because of negative shocks to the economy. Because new mortgagors on average have better-than-average-education and safer-than-average jobs, for 10% of them to become unemployed, the unemployment in the economy has to increase by more than 10 percentage points. So the shocks to housing prices and to unemployment are quite large.27

The question then is, after these negative shocks, what share of the new mortgagors fail the

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27 During the 2008–2009 crisis, Swedish housing prices fell by 13% from a peak in May 2008 to a trough in December 2008 (figure B.1b). The seasonally adjusted unemployment rate rose by 3.5 percentage point from a trough of 5.6% in May 2008 to a peak of 9.1% in January 2010 (figure B.1c).
stress test in the sense of suffering from the classical “double trigger” of distress: having negative housing equity and a negative cash-flow margin. According to figure 2.2, the answer is only 2.5%. That so surprisingly few of the new mortgagors fail a stress test with such large negative shocks is strong evidence of their substantial resilience. Furthermore, this stress test refers to data from 2015, before the amortization requirements were introduced.

3 Housing payment, user cost, and involuntary saving

This section considers the effects of amortization requirements on the monthly housing payment, user cost, and involuntary saving associated with owner-occupied housing. The housing payment is the cash outflow associated with the housing. It equals the operating and maintenance cost (OMC) plus the after-tax interest payment plus any amortization. The user cost of housing is the actual cost of the housing services provided by the housing. It consists of the OMC plus the real after-tax interest payment plus the real cost of housing equity minus the real after-tax capital gains on the housing. The involuntary saving equals the housing payment minus the user cost.

For rented housing, under the assumption that the full OMC is included in the rent, the renter’s housing payment and user cost are both equal to the rent. Thus, the involuntary saving is zero. For owner-occupied housing, the difference between the housing payment and the user cost may be large. Thus, the involuntary saving may be large.

To be concrete, let me consider an average Stockholm tenant-owned studio (a one-room apartment) that is financed by a 15% down payment and an 85% mortgage. Benchmarks are given in table 3.1. (The SEK/EUR and SEK/USD rates were approximately 10 and 9, respectively, in December 2018.)

Figure 3.1 shows the related monthly housing payment, user cost, and involuntary saving under the assumptions of table 3.1 and an interest-only mortgage, that is, without any amortization. The monthly housing payment is about SEK 6,700. It equals the OMC of SEK 2,100 plus the after-tax interest payment on the mortgage of SEK 4,582 (= (1 − 0.3)×0.033×2.38 mn/12). The monthly user cost is only about SEK 2,800. It equals the OMC plus the real after-tax interest payment of SEK 615 (= [(1−0.3)×0.033−0.02]×2.38 mn/12) plus the real cost of the 15% equity (approximated by the real after-tax interest rate) of SEK 109 (= [(1−0.3)×0.033−0.02]×0.42 mn/12) minus the real after-tax capital gains (the real after-tax capital gains are here set to zero). The involuntary saving,

28 There is a fine distinction between the simple user cost discussed here and the shadow price of housing services. The latter include the Lagrange multipliers/shadow prices of the various borrowing constraints facing the household (Díaz and Luengo-Prado, 2008; Blow and Nesheim, 2009).
29 Throughout this paper, Stockholm refers to Stockholm Municipality, which is considerably larger than the central city.
30 The term tenant-owned apartment (“bostadsrätt” in Swedish) refers to a cooperative property-ownership structure for an apartment building, where each resident is a member of the tenant-owner association and owns a share in the overall building together with a legal right to occupy a specific housing unit. This is the most common owner-occupancy model for apartments in Sweden. The tenant-ownership can be sold, but the buyer has to be approved by the tenant-owner association.
Table 3.1: Benchmark assumptions for an average studio in Stockholm Municipality 2017.

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<table>
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<tbody>
<tr>
<td>Price</td>
<td>SEK 2.8 mn</td>
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<tr>
<td>Size</td>
<td>31 m²</td>
</tr>
<tr>
<td>Price/m²</td>
<td>SEK 90,323</td>
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<tr>
<td>Monthly operating and maintenance cost (OMC)</td>
<td>SEK 2,100</td>
</tr>
<tr>
<td>Down payment, 15%</td>
<td>SEK 0.42 mn</td>
</tr>
<tr>
<td>Mortgage, LTV ratio 85%</td>
<td>SEK 2.38 mn</td>
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<tr>
<td>Interest rate</td>
<td>3.3%</td>
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<tr>
<td>Nominal capital-income tax rate</td>
<td>30%</td>
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<tr>
<td>Nominal capital-gains tax rate</td>
<td>22%</td>
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<tr>
<td>Expected inflation rate</td>
<td>2%</td>
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<tr>
<td>Real after-tax capital gains</td>
<td>0%</td>
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<tr>
<td>Monthly standardized (basic) (non-housing) living expenses</td>
<td>SEK 9,300</td>
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<tr>
<td>Monthly rent on secondary rental</td>
<td>SEK 10,000</td>
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</tbody>
</table>

Source and note: The source for price, size, and monthly fee to the tenant-owner association is Svensk Mäklarstatistik. They refer to the mean of the studio transactions during 2017. The operating and maintenance cost is approximated by the monthly fee to the tenant-owner association of SEK 1,900 plus an additional monthly operating and maintenance cost of SEK 200. The interest rate is approximately equal to a December 2018 mortgage rate with a 10-year fixation period (figure B.1a). The standardized (non-housing) living expenses refer to a single adult without children and are from FI (2017e, appendix 1). They exceed by SEK 2,950 the corresponding estimates of “reasonable” living expenses by the Swedish Consumer Agency (Swedish Consumer Agency, 2018, pp. 22–23). The rent on a secondary rental is from Qasa (2019). SEK/EUR ≈ 10.

the difference between the housing payment and the user cost, is about SEK 3,850 and equals the reduction in the real value of the mortgage due to inflation of SEK 3,967 (= 0.02 * 2.38 mn/12) minus the real cost of equity.

For further concreteness, I will consider a 25–29-year-old individual in Stockholm with a monthly gross (earned) income equal to SEK 25,000 as a potential buyer of this average Stockholm studio. For brevity, I will refer to this individual as the 25K individual. The individual’s net (after-tax) income is about SEK 19,700 (figure B.2). Without amortization, the housing payment, user cost, and involuntary saving are, respectively, 34%, 14%, and 20% of the individual’s net income. Although the housing payment is a substantial share of net income, and the involuntary saving is high for a young individual, given that the user cost is only 14% of net income, this Stockholm studio seems quite affordable for the individual. Furthermore, these items are calculated for a mortgage rate with a 10-year fixation period, so it is possible to lock in the interest payment—the main part of the housing payment—for the next 10 years. If net income grows by 4% (2% real growth and 2% inflation), in 10 years it will have grown by 48%. For many young individuals with a good education and good career ahead, their income is likely to grow faster. This would over time substantially reduce the initially rather modest ratios of the housing payment, user cost, and involuntary saving to income.

The relative affordability of this housing is even more apparent when the alternatives to an

\[ ^{31} \text{ The median monthly gross (earned) income for 25–29-year-olds in Stockholm was about SEK 24,000 in 2016 (Statistics Sweden, 2019b). (Earned income excludes capital income.)} \]

\[ ^{32} 1.04^{10} = 1.48. \]
owner-occupied Stockholm studio is considered. The average monthly rent in 2017 for a rent-controlled Stockholm studio was about SEK 5,300 (Stockholm Housing Agency, 2018, and own calculations). But for such a rent-controlled studio, the median and average queuing time is about 11 years.  

Therefore, aside from those that can live with their parents in Stockholm, the practical alternative for the individual is the secondary rental market, where the average monthly market rent for a Stockholm studio is about SEK 10,000 (Qasa, 2019). Such a rent makes the housing payment and user cost equal to 51% of the individual’s net income, and the involuntary saving is zero (figure 3.3).  

However, according to the FI’s first amortization requirements, with an LTV ratio of 85% and thus over the limit of 70%, the mandatory amortization on the mortgage in question is 2% of the

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33 The Stockholm Housing Agency (Bostadsförmedlingen) is the main agent for allocating vacant rental apartments in the Stockholm region. The apartments are allocated on the basis of the time spent in the housing queue. To apply for an apartment, people must first register in the housing queue. The time spent in the queue before being allocated an apartment can be seen as an indicator of the shortage of rented apartments. For Stockholm, the median and average time until being allocated and a rented apartment in 2017 was about 11 and 12 years, respectively. For a studio, the median and average time was about 11 years (Stockholm Housing Agency, 2018, and own calculations). Donner, Englund, and Persson (2017) provide details on the structure of and interplay between the rent-controlled rental market and the market for owner-occupied apartments in Stockholm, as well as estimates of market rents if the rental market would be deregulated.

34 According to the National Board of Housing, Building and Planning (Boverket) (NBHBP, 2018, table 3.8), the monthly secondary-rental market rent may be even higher: SEK 10,500 for a rental apartment and SEK 13,200 for a tenant-owned apartment in the greater Stockholm area 2017.

35 Being excluded from the market for owner-occupied housing means that renters miss the many benefits from home ownership, as explained in Sodini et al. (2017).
Figure 3.3: Monthly housing payment, user cost, and involuntary saving in SEK for an average studio secondary rental in Stockholm.

Figure 3.4: Housing payment, user cost, and involuntary saving for a studio, for an LTV ratio of 50% and 1% amortization according to the second amortization requirement.

Source and note: Figure 3.3, Qasa (2019). For a rental, the housing payment and the user cost is simply equal the rent. The involuntary saving is zero. Figure 3.4, see note to figures 3.1 and 3.2. SEK/EUR ≈ 10.

loan at origination. Furthermore, according the second amortization requirement, with an annual gross income of SEK 300,000 and a loan-to-gross-income (LTGI) of about 8—thus way over the limit of 4.5—there is a mandated additional amortization of 1%. Thus, the amortization is 3% of the loan at origination.36

Figure 3.2 shows the housing payment, user cost, and involuntary saving with 3% amortization is imposed. The monthly amortization is SEK 5,950. The housing payment then increases by the amortization to about SEK 12,600. The user cost is unchanged. The involuntary saving also increases by the amortization to about SEK 9,800. with the main part of the involuntary saving consisting of amortization. As a share of net income, the housing payment, user cost, and involuntary saving are, respectively, 64%, 14%, and 50%. The housing payment mainly consists of an extremely high involuntary saving and becomes prohibitively high.

Clearly, the FI’s amortization requirements cause a large distortion in the form of a big difference between the housing payment and the user cost. The amortization requirements imply a most distortive and large—indeed prohibitive—involuntary saving for an individual who—without amortization requirements—can easily afford the studio.

Figure 1.1 summarizes the housing payment, user cost, and involuntary saving for the four alternatives: owner-occupancy, without amortization and with amortization requirements, respectively; a rent-controlled rental with an 11-year queuing time; and a secondary rental. (Note the zero involuntary saving for the rental alternatives.) The difference between the low user cost of

36 LTI ratios sometimes refer to net income, sometimes to gross income. In order to avoid ambiguity, I will therefore use the abbreviation LTGI for loan to gross income.
owner-occupancy and the rent of the secondary rental is striking. Furthermore, as mentioned this low user cost is calculated under the assumption of a zero after-tax real capital gain. Figure 1.2 shows the result of the alternative and realistic assumption of an annual nominal housing price growth of 4%. This results in an annual real after-tax capital gain of 1.12%. When the negative of this capital gain is included in the monthly user cost, it drops to only SEK 210, making the difference to the rentals even larger, and the difference in user costs between insiders and outsiders extreme. The case with a positive real after-tax capital gain is further examined in section 6.5.\(^{37}\)

The above calculation uses a mortgage rate with a 10-year fixation period of 3.3%. Most mortgages in Sweden have variable rates. The current variable rates are about 1.5%. The calculation for a mortgage rate of 1.5% is shown in figures B.4 and B.5. Then the real after-tax interest rate is \(-0.95\)% and the user cost becomes negative, SEK \(-117\). Again, the difference in user costs between insiders and outsiders becomes extreme.\(^{38}\)

The above benchmark calculation shown in figures 3.1 and 3.2 assumes that the buyer has the savings to make the substantial down payment of SEK 420,000, 15% of the price of the studio and consistent with the FI’s LTV limit of 85%. For buyers who has less savings than that, one option is to finance the down payment partly with an unsecured loan, with a higher interest rate and relatively short amortization period. The calculation for an unsecured loan of 2/3 of the down payment—thus with the equity reduced to SEK 280,000—is presented in appendix C. It results in an even higher housing payment, user cost, and involuntary saving.

3.1 Effect on mobility: A lock-in effect

Note that figures 3.1 and 3.2 also illustrate the rather dramatic effect of the amortization requirements on the incentives of mobility. The amortization requirements apply to new mortgages, not to old mortgages that were originated before the amortization requirements were introduced. Figure 3.1 then shows the housing payment for an individual who has a studio with an old mortgage without amortization. If this individual would sell his or her old studio and move to a new studio with the same price, figure 3.2 shows the housing payment for the new studio, with amortization requirements. Clearly, the individual has strong incentives not to move. The individual may not even be able to move to a new studio, because the individual may not get a new mortgage, given the tighter lending standards and the fact that the amortization requirements are included in the banks’ affordability assessments (section 4).

Furthermore, we can consider two individuals living in separate studios with old mortgages without amortization requirements. They may want to move and live together in a larger apartment.

\[^{37}\] In order to be on the conservative side, most of the calculations in the paper nevertheless assumes a zero real after-tax capital gain.

\[^{38}\] This is even more the case, if also nominal capital gains of 4% per year are assumed, with resulting real after-tax capital gains of 1.12% per year. Then the user cost becomes strongly negative, SEK 2,730, as shown in figures B.6, B.7, and F.1.
But then they will have to get a new mortgage on that apartment, with amortization requirements, and may face a similar prohibitive housing payment and involuntary saving relative to their joint income.

### 3.2 An individual who only needs to borrow 50%

As another example of the distortion caused by the amortization requirement, consider instead the situation of an individual with a monthly gross income of SEK 25,000 that has sufficient wealth—or rich parents—to make a 50% down payment of SEK 1.4 mn instead of the benchmark 15% down payment of SEK 420,000. This individual thus needs to borrow only SEK 1.4 mn, resulting in an LTV ratio of 50%. This in turn means that the first amortization requirement does not apply, only the second, for an individual with an income such that the LTGI exceeds 4.5.

Figure 3.4 shows the housing payment for the studio with an LTV ratio of 50% and only 1% amortization, to be compared with figure 3.2 for an LTV ratio of 85%. Whereas the user cost is the same, the housing payment and involuntary saving are very different and much smaller for an LTV of 50%. The housing payment is only about SEK 6,000 and the involuntary saving only about SEK 3,100, even smaller than for an LTV ratio of 85% and no amortization in figure 3.1.

Clearly, the difference in circumstances between insiders and outsider in the market for owner-occupied housing is much affected by the amortization requirements.

Figure 3.5: Monthly housing payment, user cost, and involuntary saving, 2006–2018, and Stockholm disposable income.

Figure 3.6: Monthly housing payment and its components, 2006–2018, and Stockholm disposable income.

Source and note: Own calculations. Assumptions as in table 3.1. The studio price follows Stockholm apartment prices (figure B.1b) and is set equal to SEK 2.8 mn for December 2017. 10-year interest rate (figure B.1a). The user cost is calculated under the assumption of 2% expected inflation, not historical inflation, which has been less. 12-month moving averages. SEK/EUR $\approx$ 10.
3.3 Over time

Figure 3.5 shows a time series of the housing payment, user cost, and involuntary saving for the average Stockholm studio since 2006, including the introduction of the first and second amortization requirements in, respectively, June 2016 and March 2018. Figures 3.6–3.8 show separately the components of the housing payment, the user cost, and the involuntary saving. In particular, we see a substantial increase in the housing payment and involuntary saving implied by the first amortization requirement from June 2016 and the second requirement from March 2018.

Figures 3.5 and 3.6 allow a comparison of the user cost and the after-tax interest to disposable income. Both the user cost and the after-tax interest have fallen substantially relative to disposable income. As explained in Svensson (2019), this is one of several indications that Swedish housing is not overvalued.

4 Tighter lending standards and the resulting credit contraction

In this section, we look at how the tightening of lending standards has affected the availability of mortgages through its effect on banks’ affordability assessments. We also provide measures of the degree of tightening.

4.1 Affordability assessments without and after the tightening of lending standards

In deciding how large mortgages to lend to borrowers, Swedish banks use affordability assessments that include an interest-rate stress test of whether the borrower can afford the mortgage for a given
high interest rate—the affordability-test interest rate—that is substantially above prevailing rates. More precisely, the borrower’s \( \text{cash-flow margin} \) (CFM) shall be nonnegative for the affordability-test interest rate. The CFM is defined as the borrower’s net income minus the sum of the housing payment and standardized (basic) (non-housing) living expenses. This results in a monthly payment constraint, which can be solved for a minimum gross income as a function of a given loan amount or, equivalently, a maximum loan amount as a function of a given gross income.

The monthly payment constraint can be expressed as

\[
\text{CFM} = \text{GI} - T(\text{GI}) - \text{OMC} - \left[(1 - \tau^c)(\bar{i} + a)\frac{L}{12} - \text{SLE}\right] \geq 0, \tag{4.1}
\]

where \( \text{GI} \) denotes the monthly gross income, \( T(\text{GI}) \) the tax on the gross income, \( \text{OMC} \) the monthly operating and maintenance cost, \( \tau^c \) the capital-income tax rate, \( \bar{i} \) the affordability-test interest rate, \( a \) any amortization rate, \( L \) the loan amount, and \( \text{SLE} \) the monthly standardized living expenses. The monthly net income equals \( \text{GI} - T(\text{GI}) \), and the housing payment for the affordability-test interest rate equals \( \text{OMC} + \left[(1 - \tau^c)(\bar{i} + a)\frac{L}{12} \right] \).

For a given gross income, the maximum loan amount, \( \bar{L} \), is then equal to the loan amount that corresponds to equality in \( (4.1) \). The payment constraint can then be rewritten as

\[
L \leq \bar{L} \equiv \frac{12 \left[ \text{GI} - T(\text{GI}) - \text{OMC} - \text{SLE} \right]}{(1 - \tau^c)\bar{i} + a}. \tag{4.2}
\]

### 4.1.1 Lending standards without the tightening

It is clear from \( (4.2) \) that the affordability-test interest rate, \( \bar{i} \), and any amortization rate, \( a \), has a big impact on the maximum loan level. I will simplify the tightening of lending standards by representing the situation without the tightening by an affordability-test interest rate of 6% and no amortization. The situation after the tightening will be represented by an affordability-test interest rate of 7% and the two amortization requirements, implying 3% amortization for a loan and borrower with an LTV ratio above 70% and an LTGI ratio above 4.5.

This representation of the lending standards without the tightening is justified as follows. FI (2013b, p. 12) reports that the affordability-test interest rates in 2012 varied from 5.7% to 8.0%. Among new loans with a 76–85% LTV range, 21% in 2011 and 8% in 2012 were interest-only loans (FI, 2013b, diagram 9). FI (2013b, pp. 12–13) reports that some banks offered “bottom” loans up to an 85% LTV ratio and that at least one bank did not have any requirement of amortization on the bottom loan in the affordability assessment. Sveriges Riksbank (2012, chart 3:7) reports that almost 60% of new mortgage holders did not amortize in 2011. In particular, according to SBAB (2010):

Before the [85%] LTV cap was introduced [in October 2010], [the bank] SBAB required amortization of the loan amount exceeding 85%—the loan amount in the range of 85–95% should be amortized in at most 10 years. [In November 2010,] after the introduction

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\(^{39}\)Affordability assessments are called “Kvar Att Leva På (KALP) [Left To Live On]” calculations in Swedish.
of the LTV cap, [the bank] offers a supplementary loan product (Private Loan), that requires amortization.

This implies that at least one bank in late 2010 was offering interest-only mortgages up to an LTV ratio of 85%. Altogether, the above is consistent with the availability of loans with an affordability-test interest rate of 6% interest rate and no amortization before the tightening.\(^{40}\)

Figure 4.1: Maximum and required loan for an affordability-test interest rate of 6% and no amortization. User-cost- and housing-payment-to-income ratios for a 3.3% interest rate.

Figure 4.2: Monthly housing payment, user cost, and involuntary saving for a 6% interest rate and no amortization.

Source and note: Own calculations. Calculations for interest-only loan, LTV ratio 85%, average studio in Stockholm municipality, and single adult. SEK/EUR ≈ 10.

Figure 4.1 shows the result of an affordability assessment without the tightening, for the average Stockholm studio. The horizontal dashed black line shows the required loan of SEK 2.38 mn. The solid red line shows the maximum loan, \(\hat{L}\) in (4.2), for an affordability-test interest rate of 6% and an interest-only loan. The minimum monthly gross income to receive this loan is about SEK 25,000. Thus, the 25K individual we have focused on has just enough income to receive the loan and purchase the studio.

Table 4.1, column “Without” (the tightening), provides details of the interest-rate stress test, resulting in a minimum net income of SEK 19,730 (row 13, column “Without”) and a minimum gross income of about SEK 25,000 (row 14, column “Without”). The relation between net income and gross income is shown in figure B.2.

Figure 4.2 shows the resulting housing payment, user cost, and involuntary saving for the 6% interest rate and no amortization.

The solid blue line in figure 4.1 shows the user-cost-to-net-income ratio, calculated for a 3.3%

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\(^{40}\) Among anecdotal evidence, according to *Dagens Industri* (2013), the then minister of financial markets, Peter Norman, reported that his mother was required to manage a 6% interest rate on her new mortgage in 2013. There are reports that Danske Bank used an affordability-test interest rate of 6% as late as October 2018, for example, *Expressen* (2018). However, in January 2019, *Danske Bank* (2019) reports that mortgagors should be able to manage an interest rate of 7%.
Table 4.1: Affordability calculations for an average Stockholm studio and a single individual, without and after the tightening of lending standards.

<table>
<thead>
<tr>
<th></th>
<th>Without</th>
<th>After</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Price, SEK</td>
<td>2,800,000</td>
<td>2,800,000</td>
<td></td>
</tr>
<tr>
<td>2. LTV ratio</td>
<td>85%</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>3. Down payment, SEK</td>
<td>420,000</td>
<td>420,000</td>
<td></td>
</tr>
<tr>
<td>4. Loan, SEK</td>
<td>2,380,000</td>
<td>2,380,000</td>
<td></td>
</tr>
<tr>
<td>5. Standardized living expenses, SEK/month (1)</td>
<td>9,300</td>
<td>9,300</td>
<td></td>
</tr>
<tr>
<td>6. Operating and maintenance cost, SEK/month (2)</td>
<td>2,100</td>
<td>2,100</td>
<td></td>
</tr>
<tr>
<td>7. Affordability-test interest rate</td>
<td>6%</td>
<td>7%</td>
<td>1 pp</td>
</tr>
<tr>
<td>8. After-tax interest in stress test, SEK/month (3)</td>
<td>8,330</td>
<td>9,718</td>
<td>1,388</td>
</tr>
<tr>
<td>9. <strong>Required gross income increase</strong>, SEK/month</td>
<td></td>
<td></td>
<td><strong>1,945</strong></td>
</tr>
<tr>
<td>10. Amortization rate</td>
<td>0%</td>
<td>3%</td>
<td>3 pp</td>
</tr>
<tr>
<td>11. Amortization, SEK/month (4)</td>
<td>0</td>
<td>5,950</td>
<td>5,950</td>
</tr>
<tr>
<td>12. <strong>Required gross income increase</strong>, SEK/month</td>
<td></td>
<td></td>
<td><strong>8,337</strong></td>
</tr>
<tr>
<td>13. Minimum net income, SEK/month = (1+2+3+4)</td>
<td>19,730</td>
<td>27,068</td>
<td>7,338</td>
</tr>
<tr>
<td>14. <strong>Minimum gross income</strong>, SEK/month</td>
<td><strong>25,081</strong></td>
<td><strong>35,363</strong></td>
<td><strong>10,282</strong></td>
</tr>
</tbody>
</table>

Source and note: Assumptions as in table 3.1. “Without” (the tightening) is represented by an interest-rate stress tests with a 6% interest rate and no amortization. “After” (the tightening) is represented by a stress test with a 7% interest rate and 3% amortization rate (the amortization rate for an LTV ratio above 70% and an LTGI ratio above 4.5). Gross (before tax) and net (after tax) income is related as in figure B.2, taking into account the increase in the marginal tax rate from 27% to 30% at the breakpoint SEK 30,200. Gross (before tax) and net (after tax) income increases are calculated using a constant average marginal tax rate of 28.633%, which equals the average marginal tax rate according to the 2017 Tax Table 30 for the interval between the monthly gross incomes of SEK 25,081 and SEK 35,363. SEK/EUR $\approx 10$.

interest rate, and measured along the right axis. At the minimum gross income of SEK 25,000, this ratio is 14%. The dashed blue line shows the housing-payment-to-net-income ratio, which is 34% at the gross income of SEK 25,000. The difference between the two ratios, 20%, is the resulting involuntary-saving rate.

### 4.1.2 Lending standards after the tightening

What is the minimum gross income required to obtain the mortgage of SEK 2.38 mn after the tightening of lending standards? Then the affordability-test interest rate, $\bar{i}$, is 7% and the two amortization requirements apply. The mandated amortization rate, $a$, is somewhat complicated function of the LTV and LTGI ratios but can be compactly expressed as

$$a = 0.01 [1(\text{LTV} > 0.5) + 1(\text{LTV} > 0.7) + 1(\text{LTGI} > 4.5)],$$  \hspace{1cm} (4.3)

where $1(\cdot)$ denotes an indicator function for which $1(\text{True}) = 1$, $1(\text{False}) = 0$ and $\text{LTV} \equiv L/P^h$ and $\text{LTGI} = L/(12 \text{GI})$ denote the LTV and LTGI ratios (where $P^h$ denotes the price of the housing). The first two terms in the square bracket on the right-hand side represent the first amortization requirement; the third term represents the second amortization requirement. Because of the nonlinearity of the mandated amortization rate, we realize that $\bar{L}$ in (4.2) is a somewhat complicated function of gross income.
Figure 4.3: Maximum and required loan for an affordability-test interest rate of 7% and amortization requirements. User-cost- and housing-payment-to-income ratios for 3.3% interest rate.

Figure 4.4: Monthly housing payment, user cost, and involuntary saving for a 7% interest rate and amortization requirements.

Source and note: Own calculations. Calculations for 1st and 2nd amortization requirements, LTV ratio 85%, average studio in Stockholm, and single adult. SEK/EUR ≈ 10.

Figure 4.3 shows the result of an affordability assessment with the tightening, when $\bar{i}$ in (4.2) equals 7% and $a$ is given by (4.3). The solid yellow line shows the maximum loan as a function of monthly gross income when only the first amortization requirement is imposed (here 2% because the LTV ratio is above 70%). The solid red line shows the maximum loan when both the first and the second amortization requirements are imposed. The second requirement is an additional 1% amortization for loans with an LTGI ratio exceeding the value 4.5, corresponding to the dashed orange line. We see that, when both requirements are imposed, the single individual must have a monthly minimum gross income of about SEK 35,000, a full SEK 10,000 above the SEK 25,000 income. For brevity, this individual will be referred to as the 35K individual.

Table 4.1, column “After” (the tightening), shows the details of the calculation. Column “Increase” shows the decomposition of the total increase in the required gross income of SEK 10,281 into SEK 1,945, due to a 1 percentage point higher interest rate, and SEK 8,336, due to 3% amortization.

Figure 4.4 shows the corresponding housing payment, user cost, and involuntary saving at the affordability-test interest rate of 7% and 3% amortization.

Figure 4.3 shows that at the minimum gross income of SEK 35,000, for a 3.3% interest rate, the user-cost-to-net-income ratio is 11%. The housing-payment-to-net-income ratio, is 47%. The resulting involuntary-saving rate is 36%.

The FI for a while was considering introducing a loan-to-income cap of 6 times annual net income (Thedéen, 2015). Apparently, after some consideration, the FI found that this was too restrictive and instead introduced the second amortization requirement instead (FI, 2017d, sec-

41 Amortization requirements of 3% correspond to a before-tax interest-rate increase of $3/0.7 = 4.3$ percentage points.
tion 1.3). Meanwhile, the banks either introduced their own new loan-to-income restrictions (or started applying existing relatively soft loan-to-income caps more strictly). Typical loan-to-income limits now imply that loan is restricted by a cap of 5–6 times gross income (Svenska Dagbladet, 2017).

In figure 4.3, the dashed-dotted blue line shows the maximum loan for a loan-to-income cap of 5.5. By coincidence, in this case it implies about the same minimum monthly income of SEK 35,000 as the two amortization requirements (and the affordability-test interest rate of 7%). Thus, the two kind of constraints are in this case about equally restrictive.

In summary, for this average Stockholm studio, with the new stricter lending standards, the minimum income to get a loan corresponding to an LTV of 85% is SEK 35,000. For an interest-only loan and a somewhat lower interest rate, 6%, the affordability assessment results in a minimum monthly gross income of SEK 25,000.

**Figure 4.5:** Maximum and required loan for 76% LTV ratio, an affordability-test interest rate of 7%, and amortization requirements. User-cost-and housing-payment-to-income ratios for 3.3% interest rate.

**Figure 4.6:** Monthly housing payment, user cost, and involuntary saving for a price of SEK 1.77 mn, a loan of SEK 1.35 mn, a 3.3% interest rate, and amortization 2%.

**4.1.3 How much can the individual with a monthly gross income of SEK 25,000 borrow?**

How much would the 25K individual, who by assumption can make a down payment of SEK 420,000, be allowed to borrow after the tightening? This is seen in figure 4.5. At this gross income, the individual is restricted to effectively be on the LTGI ratio of 4.5, thus below the LTGI ratio of 5.5. Then, the maximum loan is $4.5 \times 12 \times 25,000 = \text{SEK } 1.35 \text{ mn}$, shown as the horizontal dashed black line. Under the assumption that the individual can make a down payment of SEK 0.42 mn (15% of
2.8 mn), the maximum price the individual can pay is $1.35 + 0.42 = \text{SEK 1.77 mn}$. This is 63% of the SEK 2.8 mn of the average Stockholm studio. For this individual to be able to buy the average Stockholm studio, its price would thus have to fall by about 37%. Alternatively, we can say that the tightening of lending conditions has reduced the individual’s housing demand by 37% (see also section 4.3).

Figure 4.7: Maximum and required loan for 50% LTV ratio, 7% discretionary-income interest rate and amortization requirements. User-cost- and housing-payment-to-income ratios for 3.3% interest rate.

Figure 4.8: Monthly housing payment, user cost, and involuntary saving for 50% LTV ratio, 7% discretionary-income interest rate, and amortization requirements.

Source and note: Own calculations. Calculations for 2nd amortization requirement, LTV ratio 50%, average studio in Stockholm, and single adult. For the monthly gross income of SEK 24,000, the LTGI ratio is 5.1, so the second amortization requirement of 1% applies. SEK/EUR $\approx$ 10.

In this case, the LTV ratio is 76%, still above 70%, so the first amortization requirement implies an amortization rate of 2%. However, with an LTGI ratio at 4.5, the second amortization requirement just does not apply. The total amortization rate is thus 2%. Figure 4.6 shows the corresponding housing payment, user cost, and involuntary saving for a 3.3% mortgage rate. It can be compared with figure 3.1, corresponding to the situation without amortization requirements. We see that the user cost has fallen a bit, by about SEK 250. The housing payment has increased by about SEK 250, and the involuntary saving has increased by about SEK 500. The individual is arguably in a marginally better situation, but this is due to a large and unrealistic fall in prices by 37%. If (1) the only demand for Stockholm studios came from identical individuals with this income and capacity to make down payment, and (2) supply would be completely inelastic and all apartments would be on the market, the price would need to fall by 37% to equilibrate the market, but these are clearly extreme assumptions.\footnote{Not to speak of the balance-sheet (and possible amortization) consequences for previous buyers at the original price.}

The FI has suggested that new buyers would benefit from the housing price fall caused by the
fall in credit supply due to the tighter lending standards. However, it is unlikely that the very new buyers that are directly affected by the lower availability of credit following from the tighter lending standards would benefit. The 25K individual discussed here is very likely severely hurt by the credit contraction.

4.1.4 An individual who only needs to borrow 50%

Above in section 3, we noted the distortions created by the amortization requirements and the resulting difference in the housing payment and the involuntary saving between individuals who need to borrow 85% (figure 3.2) and those who only need to borrow 50% (figure 3.4). For the latter, only the second amortization requirement applies and the housing payment and involuntary saving is much lower. We can illustrate the distortion also by how the latter fares in the affordability assessment with tightening. The result of the affordability assessment is shown in figure 4.7. The dashed horizontal black line shows the required loan for an LTV ratio equal to 50%, that is, SEK 1.4 mn. Because the LTV ratio is only 50%, the solid yellow line, corresponding to the first amortization requirement, now shows the maximum loan as a function of monthly gross income with zero amortization, that is, for an affordability assessment without any amortization. The solid red line shows the maximum loan when only the second amortization requirements is imposed, 1% amortization for loans with an LTGI ratio exceeding 4.5, the dashed orange line. The dashed-dotted blue line shows the maximum loan when an LTGI cap of 5.5 times annual gross income is imposed. We see that the minimum monthly gross income to obtain the loan is SEK 23,000. For this gross income, the user-cost-to-net-income ratio is 16%. The housing-payment-to-net-income ratio is 33%. The resulting involuntary-saving rate is 17%.

Thus, a less wealthy outsider has higher user cost than a high-wealth insider with similar income.

4.2 Measures of the FI’s tightening of lending standards

We can consider several relevant measures of lending standards and the tightening of lending standards that FI’s policy has achieved.

A first measure of the tightening is the size of the equivalent affordability-test interest rate on an interest-only loan, that is, translating the combined effect of the affordability-test interest-rate and the amortization requirements to an equivalent affordability-test interest rate on an interest-only loan. Here I have used an affordability-test interest rate of 6% on an interest-only loan as representing the lending standards without the tightening. After the tightening, I have used an affordability-test interest rate of 7% and mandatory amortization requirements of 3%—on a loan with an LTV ratio of 85% and an LTGI ratio of above 4.5—as representing the lending standards. From a cash-flow and housing-payment perspective—with interest tax deductibility and a 30% capital-income tax—3% amortization is equivalent to an increase of $3/(1 - 0.3) = 4.3$ percentage
points in the before-tax interest rate on an interest-only loan. Given this, the lending standards after the tightening can be represented by an affordability-test interest rate of \( 7 + 4.3 = 11.3\% \) on an interest-only loan. Thus, the tightening is equivalent to raising the affordability-test interest rate by 5.3 percentage points—from 6\% to 11.3\%—on an interest-only loan. This is a substantial tightening.

Figure 4.9: Maximum loan without amortization and with amortization requirements.  

Figure 4.10: Percentage loan reduction from an increase in the affordability-test interest rate and from the amortization requirements.

A second measure of the tightening is the percentage reduction of the maximum loan from the tightening first in the affordability-test interest rate from 6\% to 7\% and then to amortization requirements for a 7\% interest rate. The maximum loans are shown in figure 4.9 and the percentage reduction in figure 4.10. The reduction from the increase in the affordability-test interest rate is 14\% and the total reduction including the amortization requirements is 39\% when only the first amortization requirement applies and 47\% when both requirements apply. This substantial reduction can also be interpreted as a rough measure of the fall in housing demand of the individual.

A third measure of the tightening is the increase in the minimum monthly gross income required for a single adult to borrow 85\% of the price of the average Stockholm studio in 2017, namely an increase of about SEK 10,000 (table 4.1, row 14, column “Increase”) from about SEK 25,000 to about SEK 35,000. This increase of 40\% also indicates a pretty substantial tightening. Of the increase, about SEK 8,000 (row 12, column “Increase”) is due to the amortization requirements and about SEK 2,000 (row 9, column “Increase”) to the 1 percentage point increase in the assessment-test interest rate.

A fourth measure of the tightening is the change in the share of 25–29-year-old individuals in Stockholm that have enough income to borrow 85\% of the price of the average Stockholm studio. Thus, let as assume that these individuals have the down-payment of 15\% of the studio price,
that is SEK 420,000 (not an insignificant sum), but need to borrow 85%, in line with the above calculations.

Figure 4.11: Cumulative income distribution 2017 for individuals of age 25–29 years in Stockholm Municipality.

![Cumulative income distribution graph](image)

Source and note: Statistics Sweden (2019b). The curve is a fitted cubic spline. The vertical axis shows the percentage of individuals that have less gross income than the gross income on the horizontal axes. Individuals with zero gross income are excluded. The sample refers to individuals who lived in Sweden the whole year of 2017. The mean and median monthly gross income for individuals with positive income are, respectively, SEK 24,340 and SEK 25,120. SEK/EUR $\approx 10$.

Figure 4.11 shows the cumulative income distribution of 25–29-year-old individuals in Stockholm in 2017.\(^{43}\) We see that about 50% of the individuals have a monthly gross income at least as large as the required SEK 25,000 to qualify for a loan without the tightening. Furthermore, we see that about 20% of the 25–29-year-olds have a monthly gross income at least as large as the required SEK 35,000 to qualify for a loan after the tightening.

Thus, a fourth measure of the tightening is the share \((50 - 30)/50 = 30/50 = 60\%) of the 25–29-year-olds that qualified for a loan without the tightening but have been excluded by the tightening. That measure also indicates a pretty substantial tightening.\(^{44}\)

### 4.3 A rough measure of the fall in housing demand

In this context we can also show a rough measure of the fall in the housing demand from 25–29-year-olds that is caused by the tightening of lending standards. The measure is the fall in the maximum price that 25–29-year-olds can pay for the Stockholm studio. The maximum price is the

\(^{43}\) We are implicitly assuming that the income distribution for those that somehow have access to a down payment of SEK 420,000 is the same as the income distribution for the total population of Stockholm 25–29-year-olds.

\(^{44}\) Evidens (2018) examines the effects of the tightening on young first-time buyers in the Swedish cities Stockholm, Göteborg and Örebro and get similar results. They find that 80% of 25–34-year-olds are excluded from the possibility of buying a studio of 30 m\(^2\) in central Stockholm. Corresponding percentages are for Göteborg 88% and for Örebro 50%, all under the assumption that the buyers have the required down payment of 15%. About 20% more young adults would be able to buy housing if the second amortization requirement was abolished and the affordability-stress interest rate was lowered from 7% to 5%.
The sum of the maximum loan and a fixed down payment, set to SEK 420,000 and corresponding to 15% of the price of the studio (table 3.1).

The maximum loans under amortization requirements in figure 4.9 are calculated under the assumption that the LTV ratio is above 70%, so the amortization according the first amortization requirement is 2% for all loan amounts. This means that the down payment is implicitly assumed to be smaller for smaller loans. But for a fixed down payment and a varying loan amount, the LTV ratio will vary with the loan amount. Then the amortization rate varies with the loan amount. The resulting maximum loans under amortization requirements will therefore be somewhat different from the solid red line in figure 4.9.

Figure 4.12 shows the resulting maximum price that the individuals can pay for the Stockholm studio, as a function of their gross income. The dashed-dotted red line shows the maximum price that the individuals can pay without amortization and an affordability-test interest rate of 6%, corresponding to a situation without the tightening. It is given by the corresponding maximum loan in figure 4.9 plus the down payment. The maximum price increases with the gross income, but it is capped at the price SEK 2.8 mn, because the loan cannot exceed the LTV cap of 85%. We see that the 25K individual can pay for the studio, but individuals with less income cannot.

Figure 4.12: Maximum price without amortization and with amortization requirements.

The dashed red line shows the corresponding maximum price without amortization when the affordability-test interest rate has increased to 7%, representing the tightening of lending standards in other ways than by the amortization requirements. It is also given by the corresponding maximum loan in figure 4.9 plus the down payment.

The solid red line shows the maximum price under the amortization requirements (and the affordability-test interest rate of 7%). The somewhat jagged form is due to the LTV and LTGI
ratios passing their thresholds for higher amortization and corresponding lower loan amounts. We see that the 35K individual can buy the studio, but not individuals with less income.

Figure 4.13 shows the percentage change in the maximum price because of the tightening. The dashed red line shows the percentage change in the maximum price without amortization from an increase in the affordability-test interest rate from 6% to 7% (the shift from the dashed-dotted line to the dashed red line in figure 4.12). The solid line shows the total percentage change in the maximum price when the amortization requirements are included (the shift from the dashed-dotted line to the solid red line in figure 4.12). We see that for the 25K individual to still be able to buy the studio after the tightening, the price has to fall by 37%—the number we also arrived at in section 4.1.3. Of this fall, 25 percentage points are due to the amortization requirements and 12 percentage points are due to the increase in the affordability-test interest rate.

Because Stockholm housing prices have fallen by much less—about 10% from August 2017 to January 2018, after which they have recovered a bit—it is clear that the 25K individual is in a substantially worse situation after the tightening.

5 The FI and the government understates the effects of the tightening

This section scrutinizes two statements of the FI on the consequences of the tightening. The first is “Most borrowers [are] not affected” (by the second amortization requirement) and the second is “The young are excluded by ever higher housing prices—not by amortization requirements.” The scrutiny reveals that the statements are quite misleading. The correct first statement is “More than half of the people are affected” by the second amortization requirement (and all the people that have to borrow more than 50% are affected by the first amortization requirement). The correct second statement is “The young are excluded mainly because of amortization requirements and to a lesser extent by higher housing prices.”

5.1 Are really “most borrowers not affected” by the second amortization requirement?

At the press conference about the second amortization requirement (FI, 2017a), the FI argued that the second (“stricter”) amortization requirement only affected some borrowers with relatively high incomes, with the help of a slide with the heading “Most borrowers not affected,” reproduced as figure 5.1. Under the assumptions made, the slide showed that, given the first requirement, the second amortization requirement only binds for an individual with a monthly gross income of at least SEK 31,000. Because this is considered a relatively high income, FI concluded that most people were not affected by the second amortization requirement. However, even if the income of
SEK 31,000 would be correct, figure 5.3 shows that 31% of the 25–29-year-olds are affected, so it is still a relatively large share of this group that is affected.

Figure 5.1: “Most borrowers not affected.”

Figure 5.2: Maximum loan without amortization and with amortization requirements; own calculations vs. FI calculations.

Source and note: Figure 5.1: FI (2017a, staff background calculations), Swedish title “Flertalet omfattas inte,” translation by me. Operating and maintenance cost (OMC) SEK 3,000, standardized living expenses SEK 9,000, and net income from FI tax approximation. LTV ratio above 70%. Figure 5.2: Assumptions as in table 3.1 and net income from Tax Table 30, figure 5.4 (Swedish Tax Agency, 2017). LTV ratio above 75%. SEK/EUR \( \approx 10. \)

There are two issues here. First, there is reason to believe that the FI:s estimate of the minimum monthly income SEK 31,000 is too high. Second, it is arguably more relevant what share of potential new borrowers are affected by the total of both amortization requirements, thus including the first amortization requirements. Furthermore, for a complete assessment, it is also relevant what the effects of other aspects of the tightening of lending standards, namely the increase in affordability-test interest rate and stricter internal bank LTI limits. Sections 4.2 and 4.3 provide a more complete assessment.

As shown in figure 5.1, the minimum monthly income beyond which the second amortization requirement binds is determined by the intersection of the solid yellow line representing the maximum loan for the first amortization requirement and the dashed orange line representing an LTGI ratio of 4.5, because the second amortization requirement of an additional 1% amortization starts applying when the LTGI ratio exceeds 4.5. This intersection occurs at the income SEK 31,000 in the figure.\(^{45}\)

Figure 5.2 shows the same solid yellow line and dashed orange line representing the same two

\[ \frac{12[GI - T(GI) - OMC - SLE]}{(1 - \tau)c} + a = 4.5 \cdot 12 GI, \]

where \( a \) is a function of the LTV and LTGI ratios given by (4.3). Here the left-hand side of the equation is the maximum loan according to the first amortization requirement as a function of gross income (the solid yellow line), and the right-hand side is the loan that equals 4.5 times the annual gross income (the dashed orange line).

\(^{45}\) It follows from (4.2) that this monthly gross income, GI, is the solution to the equation
things, but constructed under the assumptions of table 3.1 and the use of the relation between net and gross income that follow from figure B.2. Importantly, the intersection between the lines occurs for the monthly gross income of SEK 24,000, not SEK 31,000. Furthermore, in figure 5.3, we see that 53% of the 25–29-year-olds in Stockholm at least an income of SEK 24,000. Thus, more than half of these individuals are affected, not just 31%.

Figure 5.3: Cumulative income distribution 2017 for individuals of age 25–29 years in Stockholm Municipality.

How can the two results be so different? In figure 5.2, the solid black line reproduces the yellow line in figure 5.1, and it indeed intersects the dashed orange line at SEK 31,000, as in figure 5.1. Thus, the difference has to do with how the maximum loan according to the first amortization requirement is calculated. The formula for that is given by the identity in expression (4.2).

The FI’s calculation assumes standardized living expenses of SEK 9,000 and an OMC of SEK 3,000. Only the sum, SEK 12,000, matter for the calculation. Table 3.1 assumes standardized living expenses and an OMC that sum to SEK 11,400. If one reduces FI’s sum by SEK 600, so the two sums are equal, the solid black line in figure 5.2 shifts a bit to the left, and the intersection occurs at SEK 29,500. Thus, the difference in the sums explain only a small part of the difference in the incomes.

5.1.1 An oversimplified FI tax schedule

The difference instead has to with how taxes are calculated and what difference in net incomes this results in. In figure 5.4, the solid blue line shows net income calculated with Swedish Tax Agency (2017, Tax Table 30), the tax table that applies to Stockholm. The table takes into account a number of deductions and fees and other specifics of the Swedish tax system. The dashed-dotted
black line shows net income calculated with the simple approximation to the tax schedule that the FI used in figure 5.1. For a given gross income, this approximation overestimates taxes and underestimates net income. In the affordability assessment, a given loan requires a particular minimum level of net income in the affordability assessment for the first amortization requirement. With higher taxes, a larger gross income is required. This shifts the yellow line to the right and to the black line in figure 5.2.

Because the minimum income of SEK 24,000 is calculated with the actual tax schedule and not a biased approximation to the schedule, it is a better estimate than the high minimum income of SEK 31,000. From these calculations, it is clear that the FI's statement of “Most borrowers not affected” is misleading, and a more correct statement is “More than half of the people affected.”

5.1.2 A similar mistake by the minister of financial markets

Figure 5.5 displays a slide shown by the minister of financial markets, Per Bolund, at a press conference on November 30, 2017, announcing the government’s decision to support FI’s proposal and introduce the second amortization requirement. The content of the slide is identical to that translated in figure 5.6, except that it refers not to a single adult but to a household with two adults and two children, with higher standardized living expenses and OMC. The minister’s point was that most such households would not be affected by the second amortization requirement because it would only apply for such households with relatively high total monthly gross incomes, namely above SEK 72,000. Net income is calculated with the FI’s tax approximation.

Figure 5.6 is analogous to figure 5.2 except that it refers to this larger household with higher standardized living expenses and OMC. It shows that, when the net income is calculated according to the more accurate Tax Table 30, the second amortization requirement applies to monthly incomes above SEK 60,000, substantially below SEK 72,000 level.

For the FI’s final decision on the proposed second amortization requirement, the government was required to provide its consent, in accordance with the Banking and Finaning Business Ordinance (Sveriges Riksdag, 2018, chapter 5, section 2a). This consent was announced by the minister on November 30, 2017 (Bolund, 2017).

The public expectation had been that the government would provide an independent evaluation of the FI’s proposal before consenting or not. The minister was asked by the opposition in the Riksdag to make public any material that would show that an independent evaluation had taken place, but did not supply any. Consequently, the minister was criticized for having rubber-stamped the FI’s proposal (Svenska Dagbladet, 2018). The scrutiny here of the minister’s slide at the press conference and the observation that it contains the same error regarding the tax schedule as that in the FI’s press conference (FI, 2017a) is consistent with such rubber-stamping. This
5.2 Is it really true that “the young are excluded by ever higher housing prices—not by amortization requirements”?!

A relevant question is whether it is mainly high housing prices or amortization requirements that exclude young individuals from the market for owner-occupied housing. This question was posed in an op-ed by the FI’s director general (Thedéen, 2018), with the definitive answer, “the young are excluded by ever higher housing prices—not by amortization requirement.” In support of this answer, the director general reported some surprising numbers. For Stockholm, he stated that, from 2012 to 2017, the minimum monthly gross income required to borrow and buy an average Stockholm studio had increased by SEK 7,400. Of this increase, only a surprisingly small amount, SEK 6,700 was reportedly due to the amortization requirements, whereas SEK 6,700 was reportedly due to higher housing prices.

How could the FI report such a low amount due to the amortization requirements? In contrast, in table 4.1, an amortization rate of 3% implies monthly amortization payments of SEK 5,950 and a corresponding increase in the monthly gross income of SEK 8,337. It turns out that FI’s result depend on some special—and indeed misleading—assumptions made in its calculation.
5.2.1 The benchmark calculation

To see this, first, consider panel a of table 5.1. It reports benchmark results using the benchmark assumptions in table 3.1. Column 5 is identical to column “After” in table 4.1, which shows the calculation of the minimum required monthly gross income after the tightening of lending standards for the average Stockholm studio in 2017, with a price equal to SEK 2.8 mn (row 1, column 5). The tightening takes into account both the two amortization requirements and an increase in the affordability-test interest rate from 6% to 7%.

Column 1 shows the calculation of the minimum monthly gross income in 2012, in 2012 (consumer) prices. The price of the studio in 2012, in 2012 prices (row 1, column 1), is calculated from the average price in 2017 of SEK 2.8 mn and the average price index of Stockholm apartments in 2012 and 2017. With an LTV ratio of 85% and a 6% affordability-test interest rate, a minimum monthly net income of SEK 15,877 is required (row 13, column 1). Under the assumption that the tax schedule is adjusted for inflation, so there is no bracket creep, the minimum monthly gross income is then SEK 19,820 (row 14, column 1).

Column 2 shows the same calculation for 2012 in 2017 (consumer) prices. It is simply the numbers in column 1 scaled up by the CPIF price level in 2017 relative to that in 2012. Then, in 2017 prices, the minimum monthly gross income in 2012 is SEK 20,950 (row 14, column 2). The increase in the minimum monthly gross income from 2012 to 2017 is then SEK (20,950 minus 19,820) = SEK 1,130 (row 14, column 2 minus column 1), the increase in minimum gross income due to cumulative CPIF inflation of 5.7% from 2012 to 2017.

Column 3 shows the affordability assessment in 2017, without the tightening of lending standards—“Without” meaning without the amortization requirements and the increase from a 6% to a 7% affordability-test interest rate. The FI assumes that prices would have been 3% higher in 2017 without the amortization requirements, so the (hypothetical) price in 2017 without amortization requirements (row 1, column 3) is set to 3% above the SEK 2.8 mn (row 1, column 5). Assuming an affordability-test interest rate of 6% and no amortization in the affordability stress test then results in a minimum gross income of SEK 25,431 (row 14, column 3).

Column 4 reports the increase from 2012 to 2017, in 2017 prices, without the tightening (column 3 minus column 2). The increase in the price and resulting increase in the loan imply that the interest payments in the affordability stress increase by SEK 3,198 (row 9, column 2), which results in an increase in the minimum gross income of SEK 4,481 due to higher housing prices (rows 9

47 It is set to SEK 2.8 mn times \( \frac{P_{h2012}}{P_{h2017}} \), where \( P_{h2012} = 176.38 \), \( P_{h2017} = 288.56 \), and \( P_{h}^{t} \) denotes the average Stockholm apartment price index for year \( t \) (figure B.1b).

48 The numbers in 2017 equal the numbers in 2012 times CPIF_{2017}/CPIF_{2012}, where CPIF_{2012} = 199.15, CPIF_{2017} = 210.50, and CPIF_{t} denotes the average CPIF consumer price index during year \( t \). The CPIF price index is chosen because it is the CPI price index for constant mortgage rates and is therefore closer to an index for non-housing consumption than the CPI. For simplicity I choose the CPIF index instead of the less available CPI index excluding housing consumption.

49 It is higher than the minimum gross income in table 4.1 (row 14, column “Without”), because the price is 3% higher.
Table 5.1: Affordability calculations for an average Stockholm studio and a single individual: The effects on the minimum monthly gross income from 2012 to 2017; benchmark and Finansinspektionen.

<table>
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<tr>
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**b. FI**

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<td>1. Price</td>
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<td>6. Operating and maint. cost (2)</td>
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<td>7. Affordability-test interest rate</td>
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<td>30,328</td>
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Source and note: Own calculations and Thedéen (2018, staff background calculations). Column 1 in 2012 (consumer) prices; columns 2–7 in 2017 prices. The 2012 price in 2017 prices is set to SEK 2.8 mn times ($P_{2012}^{h}$/$P_{2017}^{h}$)(CPIF$_{2017}$/CPIF$_{2012}$), where $P_{t}^{h}$ and CPIF$_{t}$ denote the annual average of the Stockholm apartment price index and the CPIF price index, respectively, in year $t$. The (hypothetical) price in 2017 without amortization requirements is assumed to be 3% higher than SEK 2.8 mn. In 2017 prices, gross (before tax) and net (after tax) incomes in 2017 prices are calculated according to 2017 Tax Table 30 (figure B.2). In 2012 prices, the tax table is adjusted to avoid bracket creep. Changes in gross incomes from changes in net incomes are calculated with a constant average marginal tax rate of 28.63%, which equals the average marginal tax rate according to the 2017 Tax Table 30 for the interval between the monthly gross incomes of SEK 25,081 and SEK 35,363. SEK/EUR $\approx$ 10.

and 14, column 4).

Column 5 reports the affordability calculation after the tightening, that is, with a 7% interest rate and an amortization of 3%, resulting in a minimum gross income of SEK 35,363 (row 14, column 5)—identical to that of table 5.1, row 14, column “After.”

Column 6 reports the increase due to the tightening (column 5 minus column 3). The higher affordability-test interest rate of 7%, somewhat moderated by the reduced loan (because of the assumed fall in the price by about 3% because of the amortization requirements), results in an increase in the interest payments of SEK 1,138, in turn resulting in an increase in the minimum
The amortization payments of SEK 5,950 results in an increase in the minimum gross income of SEK 8,337 (row 12, column 6). The resulting total increase, due to the tightening of lending standards, is SEK 9,932 (row 14, column 6).

Column 7 reports the grand total increase from 2012 without the tightening to 2017 after the tightening, in 2017 prices (column 5 minus column 2). We see that the grand total increase in the minimum gross income is no less than SEK 14,413 (row 14, column 7), consisting of SEK 4,481 due to the increase in housing prices (row 14, column 4), SEK 1,595 due to a higher interest rate in the affordability stress test (row 9, column 6), and SEK 8,337 due to the amortization requirements (row 12, column 6).

In summary, the total increase in the minimum gross income from 2012 to 2017 is SEK 14,413 (in 2017 prices), of which the increase due to the amortization requirements is SEK 8,337, much larger than the FI’s reported SEK 190, and the increase due to higher prices is SEK 4,481, smaller than FI’s reported SEK 6,700. How can this be?

5.2.2 The FI’s calculation

To see this, let me redo the calculation using the FI’s assumptions, inferred from background FI staff calculations for Thedéen (2018). First, the FI assumes that prices in 2017 would have been 3% higher without amortization requirements. This assumption is already included in panel a. Second, the FI assumes an affordability-test interest rate of 7% in all years. Third, the FI assumes that the LTV ratio is 75%, not 85%. Fourth, the FI assumes an amortization rate of 1.75% without the amortization requirements, and that this amortization is included in the affordability assessment. Fifth, with amortization requirements, the FI assumes amortization requirements of 2%, disregarding the second amortization requirement of an additional 1% amortization. The fourth and fifth assumptions together imply that the effect of the amortization requirements is an increase of only 0.25 percentage points, not 3 percentage points, which obviously should have a large impact on the result.50

Panel b of table 5.1 shows the calculation with the FI assumptions. We see in columns 1–3 that, even though the loan is smaller, with a higher interest rate and—in particular—amortization of 1.75% included in the affordability assessment, the minimum gross income is higher in 2012 and 2017 without the amortization requirements (row 14, columns 1–3) than in panel a. In particular, the minimum gross income in 2017 without the amortization requirements is a full SEK 30,205 (row 14, column 3), with an increase from 2012 due to higher housing prices of SEK 6,260 (in 2017 prices) (row 14, column 4). Furthermore, in column 5, with a lower price and amortization

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50 The FI also assumes monthly standardized monthly living expenses and an operating and maintenance cost that in 2017 prices sum to about SEK 11,500 in 2012 and SEK 11,700 in 2017, somewhat larger than the corresponding sum for the benchmark of SEK 11,400 for both years (the same for both years in order to focus on the changes caused by prices, amortization requirements, and the affordability-test interest rate). The FI also uses a 30% marginal tax rate instead of the 28.63% that follows from Tax Table 30. These difference have only small effects here but large effects in section 5.1.
increasing by only 0.25 percentage points, the minimum gross income in 2017 after the amortization requirement is just SEK 30,328 (row 14, column 5), an increase by only SEK 124 (row 14, column 6)! This minuscule effect of the amortization requirements differs dramatically from the large effect of SEK 8,337 in panel a (row 12, column 6).

In summary, using the FI’s assumptions, the total increase in the minimum gross income from 2012 to 2017 is SEK 6,384, of which the increase due to the amortization requirements is SEK 124, somewhat smaller than the FI’s reported SEK 190, and the increase due to higher prices is SEK 6,260, somewhat smaller than FI’s reported SEK 6,700. The benchmark (panel a) and FI (panel b) calculations of the increase in the minimum gross income are shown in figure 5.7.

Figure 5.7: The effect 2012–2017 on the required minimum monthly gross income from higher housing prices, amortization requirements, and a higher affordability-test interest rate: Benchmark and Finansinspektionsen.

![Figure 5.7](image)

Source and note: Own calculations. Figure 5.7: See table 5.1. SEK/EUR ≈ 10.

5.2.3 Misleading assumptions

However, the 1.75% amortization assumed by the FI should arguably not be part of the affordability assessment and not contribute to the minimum gross income in 2012 and 2017 without the amortization requirements. Given that interest-only loans were available in 2012, amortization in 2012 should be considered voluntary and not be included in the affordability assessment (section 4.1.1). As Boije (2019) notes, given the higher prices and loans in 2017, borrowers might prefer not to do any voluntary amortization.

The FI’s assumptions about amortization rates and LTV ratios have been chosen to correspond to the means of young borrowers’ amortization rates and LTV ratios during 2011–2016 from the FI’s annual Mortgage Market Survey, which are reported in the annual report, *The Swedish Mortgage*
However, it is misleading to use the historical mean of amortization rates to infer which young borrowers are excluded by a higher mandatory minimum amortization requirement.

To understand why this is so, a simple stylized thought experiment is sufficient. Consider new borrowers that previously have passed the affordability assessments at a zero amortization requirement (section 4.1.1). Assume that they nevertheless voluntarily have chosen to amortize. In particular, assume that the borrowers have chosen to voluntarily amortize at as much as to make their individual amortization-inclusive CFM equal to zero for the affordability-test interest rate. Assume for simplicity that this has resulted in a uniform distribution of borrowers amortizing between 0% and 3.5%, with a mean of 1.75%, as in figure 5.8 (the conclusion does not depend on this simple shape of the distribution). There, the amortization rate, $a$, is plotted along the horizontal axis and the number of borrowers along the vertical axis. The rectangular shape with the bottom from 0 to 3.5% along the horizontal axis shows the uniform distribution of borrowers amortizing between a minimum of 0% amortization and a maximum of 3.5% amortization. The area of the rectangle represents the total number of borrowers that have passed the affordability assessment. The mean of the amortization rate is shown by the vertical dashed line at the amortization rate 1.75%.

Assume now that a mandatory minimum amortization rate of 2% is introduced, shown by the vertical dashed-dotted line in figure 5.8. According to the FI's apparent way of thinking, the borrowers that are excluded would be the ones amortizing between the mean, 1.75%, and the new minimum, 2%. In order to pay the additional 0.25% amortization, the minimum gross income has to increase by SEK 484 (row 12, column 6 in table 5.1, panel b). Less the reduction in after-tax interest of SEK 360 (row 9, column 6) due to the 3% fall in housing prices, the net increase is only SEK 124 (row 14, column 6).

But this is clearly wrong. Instead, all the borrowers amortizing below 2% are excluded, also those amortizing below the mean. That is—under the assumption of a uniform distribution—a share of $(2 - 0)/3.5 = 57\%$ of the borrowers are excluded. The share of $(2 - 1.75)/3.5 = 7\%$ of the borrowers between the mean and the new minimum is not a correct measure.

The correct measure of those affected by the amortization requirement is the share of those that fall between those that can just pass the affordability assessment at the minimum of 0% amortization and those that just pass the assessment at the new mandatory minimum (2% in figure 5.8). And the correct measure of the increase in the required minimum income is then the increase for the individual who is amortizing 0%. This is the principle underlying the comparison without amortization and with amortization requirements in sections 4.1 and 4.2 and figure 4.11.\textsuperscript{52}

\textsuperscript{51} Source: Private communication from FI staff.

\textsuperscript{52} A similar argument can be applied to the question of what borrowers are excluded by the introduction of a maximum LTV ratio. They are obviously not the borrowers with LTV ratios between the previous mean LTV ratio and the new maximum LTV ratio. Assume that the loans are the difference between a given common housing price and the borrowers' individual maximum-possible down payment. Then, those excluded are simply the ones with higher LTV ratios than the maximum, regardless of the previous mean LTV ratio—indeed, regardless of whether the
If the amortization rate accordingly is set to zero in 2012 and 2017 without amortization requirements instead of 1.75% (and the LTV ratio remains at 75%), one can show that the total increase in the minimum gross income from 2012 to 2017 is SEK 9,157, of which SEK 4,544 is due to amortization requirements—very different from the SEK 124 in panel b (row 14, column 5) and from the FI’s reported SEK 140—and SEK 4,613 is due to higher prices (not shown in panel b). However, the minimum mandatory amortization rate after the amortization requirement should arguably be 3% instead of 2%, taking into account the effect of both amortization requirements. One can show that then the total increase in the minimum gross income is SEK 11,609, with SEK 6,996 due to amortization requirements.

Furthermore, an LTV ratio of 85% is arguably more relevant for the comparison than 75% for young borrowers. An LTV ratio of 75% reduces the loan and the effects of housing prices and amortization requirements because it implies that the borrower can make a quite large down payment of SEK 700,000 in 2017, substantially larger than the already considerable benchmark of SEK 420,000. Under the assumption of an LTV ratio of 85%, one can show that the total increase in the minimum gross income and the part due to amortization requirements are SEK 13,157 and SEK 7,929, respectively, with an even larger increase in the minimum gross income due to the amortization requirements.

Finally, the FI has encouraged tightening lending standards in other ways, which can be represented by an increase in the affordability-test interest rate from 6% to 7%. Then we are back at the numbers in panel a, with a total increase in the minimum gross income and amount due to amortization requirements of SEK 14,413 (row 14, column 7) and SEK 8,337 (row 12, column 7).

5.2.4 Summary

In summary, in order to answer the question of who is excluded with tighter lending standards, the natural comparison is between the borrower who just passes the bar of the affordability assessment and the LTV limit under the previous lending standards and the borrower who just passes the same bar under the new tighter lending standards. Then those excluded by the change in lending standards are the ones that just passed the former bar but do not pass the latter one. This is the method used in the present paper.

In conclusion, the FI’s statement, “the young are excluded by ever higher housing prices—not by amortization requirements” is quite misleading. Instead, the young are excluded mainly because of amortization requirements and to a lesser extent by higher housing prices.
6 Loan-to-value and debt-service-to-income ratios over time

This section examines how the debt-service-to-net-income (DSTNI), LTV, and loan-to-gross-income (LTGI) ratios develop over time for a given loan without amortization and with amortization requirements. In this context, it is easy to overlook an “automatic” amortization of an interest-only loan that follows from real growth and inflation.

Suppose, preliminarily, that there is about 2% real growth and 2% inflation, and suppose that as a result both nominal income and nominal housing prices grow by 4% per year. Then nominal income and housing prices will double in about 18 years. This means that, for any given interest-only loan, the LTV and LTGI ratios will fall by (approximately) 4% per year and be halved in about 18 years. This is a substantial automatic amortization rate. Is there any reason why an optimal amortization rate would be larger than this?

Furthermore, for an interest-only loan—and for constant interest rates—the debt service will be constant over time, and the DSTNI ratio will gradually fall by about 4% per year and also be halved in about 18 years. In contrast, with amortization requirements, the DSTNI ratio will be strongly frontloaded and cause large oversaving and underconsumption for many borrowers, especially young individuals. The amortization requirements will make these borrowers very liquidity-constrained for several years, prevent consumption-smoothing, and make their consumption very sensitive to income. The borrowers may even become hand-to-mouth consumers, with a marginal propensity to consume out of income equal to unity (Campbell and Mankiw, 1989; Kaplan et al., 2014; Ampudia et al., 2018). The amortization requirements will reduce their resilience to shocks substantially.

In addition, individuals that are excluded from borrowing because of the tightening of lending standards may have to turn to the secondary rental market. Then they get rent-to-income ratios that are not only very high to start with, they do not automatically fall over time. Furthermore, the user-cost-to-income ratio is much higher, and the individuals are in a much worse position than if they would get a loan. They also become very liquidity-constrained, with all the negative consequences mentioned in the previous paragraph above, but not only for a few years but possibly for very long.

6.1 Assumptions

To see this, start from the benchmark assumptions of table 3.1, that is, a loan of SEK 2.38 mn—corresponding to 85% of the price of the average Stockholm studio—with an interest rate of 3.3%. We will examine the development of the DSTNI, LTV, and LTGI ratios without amortization and with the two amortization requirements. This will be done for the two 25–29-year-old individuals, the 25K and the 35K ones. As noted in section 4.1, after the tightening of lending standards with the amortization requirements, the 25K individual will not get this loan. It is nevertheless instructive to see what the DSTNI and LTV ratios would look like for this individual in the absence
of the tightening and (hypothetically) after the tightening, as well as what the rent-to-net-income ratio looks like for those that have to go to the secondary rental market.

The additional assumptions are summarized in table 6.1. We assume that there is general real income growth of 2% per year. For a young individual in the beginning of the individual’s career, income growth is likely to be higher than the general income growth. Let us nevertheless be conservative and assume that real gross and net income for the two individuals grow by (about) 2%. Assume also that inflation is 2%, and take nominal gross and net income for the two individuals to grow by 4%. Furthermore, assume that real housing prices and the operating and maintenance cost grow by 2% per year, so nominal housing prices and the nominal OMC will grow by 4% per year. This will keep both the housing-price-to-income ratio and—for constant interest rates—the user-cost-to-net-income ratio constant. We will assume that the nominal standardized living expenses grow by 3%, corresponding to 1% in real terms.

With a 4% nominal price increase, the real after-tax capital gain will not be zero—as in table 3.1—but 1.12%. This is further discussed in section 6.5.

Table 6.1: Additional benchmark assumptions.

| Annual growth rate of nominal price, gross and net income, and OMC | 4% |
| Annual growth rate of nominal standardized living expenses | 3% |
| Annual growth rate of nominal rent on secondary rental | 4% |
| Expected and actual inflation rate | 2% |
| Real capital-gains after tax | 1.12% |

Source and note: OMC denotes the operating and maintenance cost. Expected inflation and nominal capital-gains tax as in table 3.1. With 4% nominal capital gains and 2% real capital gains, the real after-tax capital gains are 1.12%.

6.2 The individual with an initial monthly gross income of SEK 25,000

In figure 6.1, the solid blue line shows the LTV ratio over time for an interest-only loan starting at the LTV ratio of 85%. The loan is constant but the housing price grows by 4% per year. Therefore, the LTV ratio falls by about 4% per year. The horizontal dashed black line shows the LTV of 42.5%, half of the initial LTV. It is reached in about 18 years.

In figure 6.2, the solid blue line shows the DSTNI ratio for the interest-only loan for the 25K individual, with an initial monthly gross income of SEK 25,000, resulting in an initial net income of about SEK 20,000 (figure B.2). The debt service consists of the constant interest payment.

This assumes that the tax breakpoints (reported in the note to figure B.2) are adjusted with inflation, so there is no bracket creep due to inflation. The reason "(about)" is inserted before 2% for real growth—and understood elsewhere when appropriate—is that for it and 2% inflation to result in 4% nominal growth, real growth has to be somewhat less than 2%, because 

\[
(1.04/1.02) - 1 = 1.96%.
\]

The LTV ratio falls by "about" 4% because 1/1.04 – 1 = -3.85%.

The halftime of the LTV ratio is log 2/log 1.04 = 17.67 years.
Figure 6.1: LTV ratios for mortgages, without amortization and with amortization requirements. Initial monthly gross income SEK 25,000.

<table>
<thead>
<tr>
<th>Year</th>
<th>LTV, w/o amortization</th>
<th>LTV, w/ amortization req'ts</th>
<th>LTV, w/ amortization req't 1 only</th>
<th>LTV = 70%</th>
<th>LTV = 50%</th>
<th>LTV = 1/2 of initial</th>
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<td>60</td>
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<td>30</td>
<td>20</td>
<td>10</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Source and note: Own calculations. Year-0 values as in table 3.1. Additional assumptions as in table 6.1. Initial monthly net income of about SEK 20,000. Amortization requirement 1: 1% of initial loan for LTV ratio > 50%; 2% for LTV ratio > 70%. Amortization requirement 2: Additional 1% of initial loan for loan-to-gross-income ratio > 4.5. SEK/EUR ≈ 10.

Figure 6.2: Debt-service-to-net-income ratios, without amortization and with amortization requirements, and rent-less-OMC-to-net-income ratio. Initial monthly gross income SEK 25,000.

<table>
<thead>
<tr>
<th>Year</th>
<th>DSTNI, w/o amortization</th>
<th>DSTNI, w/ amortization req'ts</th>
<th>DSTNI, w/ amort. req't 1 only</th>
<th>(Rent - OMC)/Net income</th>
<th>Max DSTNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
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<tr>
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</tbody>
</table>

SEK 4,582 in figure 3.1, making the initial DSTNI ratio equal to 23%. Because net income grows by 4% per year, the DSTNI falls by about 4% per year.

The upward-sloping black dashed-dotted line in figure 6.2 shows the maximum DSTNI ratio. The maximum debt service is defined as the difference between net income and the sum of the OMC and the standardized living expenses used in the affordability assessment. Thus, the maximum DSTI ratio shows the largest DSTI ratio consistent with consumption not falling below the standardized living expenses (the CFM not becoming negative).56

The 25K individual can easily afford the interest-only loan, with an initial DSTNI ratio of only 23% and falling over time.57 As noted in section 4.1, the individual furthermore passes the affordability test without the tightening of lending standards, with an affordability-test interest rate of 6% for an interest-only loan. In figure 6.4, the solid blue line shows the DSTNI ratio for a 6% interest rate, which equals the maximum DSTI ratio for year 0, 42%.

If the individual would get the interest-only loan and be able to buy the studio, after 10 years, the by then 35–39-year-old may want to move to a larger apartment and no longer to stay in a studio. In year 10, with the interest-only loan, the LTV ratio would have fallen to 57%. This is by coincidence close to the average LTV ratio in 2017 of 55% for the total stock of mortgages (FI,

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56 The maximum DSTNI ratio is given by \( \frac{\text{NI}_t - (\text{OMC}_t + \text{SLE}_t)}{\text{NI}_t} = 1 - \frac{(\text{OMC}_t + \text{SLE}_t)}{\text{NI}_t} \). Here \( \text{NI}_t \), \( \text{OMC}_t \), and \( \text{SLE}_t \) denote, respectively, the nominal net income, the operating and maintenance cost, and the standardized living expenses used in the affordability assessments, all in year \( t \). As in table 6.1, the nominal net income and nominal operating and maintenance cost are assumed to grow by 4%; the standardized living expenses are assumed to grow by 1% in real terms so the nominal living expenses grow by 3%.

57 Furthermore, the interest rate used, 3.3%, is the rate for a 10-year fixation period, so it is possible to lock in a constant interest payment of SEK 4,582 for 10 years.
Figure 6.3: Loan-to-gross-income ratios for loans without amortization and with amortization requirements. Initial monthly gross income SEK 25,000.

Figure 6.4: DSTNI ratios, without amortization and with amortization requirements, and rent-less-OMC-to-net-income ratio. Initial monthly gross income SEK 25,000. affordability-test interest rate 6%.

Source and note: Own calculations. See note to figures 6.1 and 6.2. SEK/EUR ≈ 10.

Thus, the equity would have increased from 15% to 43% of the value of the housing. In real terms, the equity would have increased by about 250%.\(^58\)

Furthermore, the 43% equity in the old housing would allow the individual to put up a substantial equity in a larger new apartment and thus take a substantial step up on the property ladder. However, without getting a loan, the individual misses out on this opportunity of automatic saving from the automatic amortization with an interest-only loan and rising housing prices.

However, after the tightening, with a 7% affordability-test interest rate and the two amortization requirements, the individual no longer passes the affordability test. Even without the amortization requirements, with a 7% interest rate on the interest-only loan, the DSTNI ratio in figure 6.4 would shift up and equal 49% in year 0, and thus exceed the maximum DSTNI ratio for that year. Given the lack of a functioning rental market, the individual may have to turn to the secondary rental market, with a monthly rent of about SEK 10,000 (figure 3.3). In figure 6.2, the horizontal dashed black line shows the ratio of the rent minus the OMC to net income (the OMC is deducted in order to allow a comparison with the debt service, which excludes the OMC). Thus, instead of having a DSTNI ratio given by the solid blue line for an interest-only loan, the individual gets a rent-minus-OMC-to-net-income ratio that is much higher, at 40%, and does not fall over time (under the assumption that the rent and OMC grow by 4% per year). Clearly, the individual is in a much worse situation in the secondary rental market.\(^59\)

The dashed-dotted red line in figures 6.1 and 6.2 show the LTV and DSTNI ratios under both

\(^{58}\) \((0.43 \cdot 1.04^{10})/(0.15 \cdot 1.02^{10}) - 1 = 2.48.\)

\(^{59}\) In particular, the individual is much less resilient, has higher fixed housing payments and user cost, and no involuntary saving. The individual is very liquidity-constrained, and the individual is likely to be a (poor) hand-to-mouth consumer, with a marginal propensity to consume out of income close to one.

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amortization requirements. The dashed red lines show the ratios under the first amortization requirement only. We see that the LTV ratio falls faster with the amortization requirements; and is halved in about 11 years rather than 18. However, the DSTNI ratio is much higher in the beginning, starting at a very high 54% (the debt service is initially SEK 10,532, the sum of interest payments SEK 4,582 and amortization SEK 5,950 in figure 3.1). The DSTNI ratio becomes strongly frontloaded compared with that for an interest-only loan.

We also see in figure 6.4 that for a 6% affordability-test interest rate, with the amortization requirements the DSTNI ratios by a large margin exceed the maximum DSTI ratio in year 0, and would even more so for a 7% interest rate. This illustrates how the tightening of lending standards excludes the 25K individual from borrowing. We may recall that a 3% amortization rate is from a debt-service perspective equal to a 3/0.7 = 4.3 percentage point higher interest rate before tax.

In figure 6.1, the dashed-dotted red line shows that, with amortization requirements, the LTV ratio falls below 70% already in year 3. We might therefore expect the first amortization requirement to drop from 2% to 1% in year 3. But the dashed red line in figure 6.2 shows that the amortization requirement drops 1 percentage point only in year 5, when the LTV ratio has fallen to 59%. The reason is that under the first amortization requirement, “a revaluation of the residential property that could lead to a recalculation of the loan-to-value ratio may only take place every fifth year” FI (2016a, italics added). Thus the borrower has to continue to pay the extra 1% for two years, even though the LTV ratio has fallen below the 70% trigger. This is extra involuntary saving of close to 9% of the borrowers’ net income for years 3 and 4.

Figure 6.1 shows that the LTV ratio falls below 50% in year 8, but again the amortization rate according the first amortization requirement can only be reduced after another 5-year period from the previous reevaluation, that is, in year 10, as shown in figure 6.2.

6.2.1 The loan-to-gross-income ratio

Figure 6.3 shows the development of the LTGI ratio for an interest-only loan and under amortization requirements. It starts out an LTGI ratio of about 8, which may seem high. But it is the households’ debt-service capacity and resilience to disturbances that matter for the financial-stability and macroeconomic risks, not the LTGI ratio itself. The households’ debt-service capacity and resilience to risks is best measured by stress tests, such as affordability stress tests and the stress test on new mortgagors done in the annual mortgage market report by the FI (see, for example, FI, 2018d). For example, the 25–29-year-old 25K individual passes the affordability stress test with an affordability-test interest rate of 6% for an interest-only loan and has initially 15% housing equity, which demonstrates considerable debt-service capacity and resilience, even though

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60 There is an exception for a substantial change in the value of the residential property for other reasons than the general housing-price trend: “Revaluation may also occur if there has been a substantial change in the value of the residential property for any reason other than the general house price trend—for instance following comprehensive remodelling or extension” FI (2016a).
the initial LTGI ratio is about 8.

As for macroeconomic risk, as discussed in section 1 and Svensson (2019), there is a correlation— noted in several papers—between pre-crisis household LTI ratios and the spending fall during the crisis for Denmark, the U.K., and the U.S., but there is no evidence of a causal relation between household LTI ratios and later spending falls. The correlation is instead caused by a common factor, and the evidence is that this common factor is debt-financed overconsumption through the “housing collateral channel,” more precisely an overconsumption (and undersaving) of macroeconomic significance by existing homeowners financed by housing equity withdrawal (HEW). Rising pre-crisis housing prices and the housing collateral channel allowed substantial HEW which both explains both the high pre-crisis LTI ratios and the crisis spending falls. When the crisis came, housing prices stopped rising and started to fall, the HEW and the overconsumption could not be maintained, and consumption of highly indebted households that had overconsumed reverted to normal. Importantly, among households that did not indulge in debt-financed overconsumption, highly indebted households did not reduce their consumption more than less indebted households (Andersen et al., 2016; Broadbent, 2019). Thus, if high LTI ratios are caused by HEW that finances overconsumption, they indicate a macroeconomic risk. But the 25–29-year-old new mortgagor considered here is not taking out a mortgage for the purpose of overconsuming but for the purpose of investing in owner-occupied housing.

The solid blue line in figure 6.3 shows the development of the LTGI ratio for an interest-only loan. It falls below 4.5 in year 15 and is halved in about 18 years. The dashed-dotted red line shows that, under the two amortization requirements, the LTGI ratio falls below 4.5 in year 9, in which year amortization according to the second requirement drops to zero, as shown in figure 6.2. The second amortization requirement does not restrict the reconsideration of the amortization to every fifth year but allows reconsideration if the borrower can document a change in the borrowers income across the LTGI limit of 4.5 (FI, 2017d).

6.2.2 Summary

It is apparent that, with amortization requirements, the DSTNI ratio becomes strongly frontloaded compared with that for an interest-only loan. For a monthly gross income of SEK 25,000, the borrower could easily afford the interest-only loan, but with amortization requirements the amortization payments make the housing payment prohibitive. Furthermore, the borrower would have to amortize and deal with higher debt service than for an interest-only loan through year 9. Amortization would cease only in year 10 and the DTSNI ratio would shift down to 12% versus 16% for the interest-only loan.

Comparing the time path of the DSTNI ratio under amortization requirements to that for an interest-only loan, it is difficult to see that the former would be preferable to the latter. One can
say that by very high DSTNI ratios (and very high involuntary saving) during the first nine years, one gains somewhat lower DSTNI ratios (and lower involuntary saving) from the 10th year. But the “gain” seems rather small, about 4 percentage points in year 10, whereas the “cost” before that seems large. It is about 30 percentage points in year 1, falling to 11 percentage points in year 8 and 3 percentage points in year 9. The “cost” here is really excessive involuntary oversaving and underconsumption in years 1–9.

6.3 The individual with an initial monthly gross income of SEK 35,000

Figure 6.5: LTV ratios for mortgages, without amortization and with amortization requirements. Initial monthly gross income SEK 35,000.

Figure 6.6: Debt-service- and user-cost-to-net-income ratios, without amortization and with amortization requirements. Initial monthly gross income SEK 35,000.

Source and note: Own calculations. See note to figures 6.1 and 6.2. Initial monthly net income about SEK 27,000. SEK/EUR $\approx 10$.

Figures 6.5–6.8 are the analogues of figures 6.1–6.4 for the 35K individual, with an initial monthly gross income of SEK 35,000 and an initial net income of about SEK 27,000. As noted in section 4.1, this individual just has the gross income required to get the loan after the tightening. This is also shown in figure 6.8 where the DSTNI ratio with a 7% interest rate and amortization requirements equals the maximum DSTNI ratio in year 0.\(^{61}\) Because the net income of the 25K individual is about 73% of that of the 35K individual, the initial DSTNI ratios of the latter is about 3/4 of the former.

For an interest-only loan, the DSTNI ratio starts out at 17% (figure 6.6). Under amortization requirements, the DSTNI ratio remains strongly frontloaded, starting at 39%. Under amortization requirements, the LTGI ratio falls below 4.5 in year 4, and amortization according to second amortization requirement ceases (figure 6.3). The LTV ratio falls below 70% already in year 3, but

\(^{61}\) The DSTNI ratio slightly exceeds the maximum DSTI ratio because the monthly gross income of SEK 35,000 is rounded down from the exact minimum gross income of SEK 35,363 in table 4.1.
amortization according to the first amortization requirement is not reduced until year 5 because—as noted above—revaluation and recalculation of the LTV ratio can only occur every 5th year (figure 6.5). The LTV ratio falls below 50% in year 9 but the remaining amortization does not cease until the 10th year. Again, the DSTNI ratio under amortization requirements is strongly frontloaded, and there is no “gain” in the DSTNI ratio until year 10, but only about 2 percentage points relative to an interest-only loan. This individual will also be liquidity-constrained, oversaving and underconsuming, and most likely be a hand-to-mouth consumer.

After 10 years, the now 35–39-year-old individual may want to move to a larger apartment and no longer to stay in a studio, and not be able to enjoy the lower DSTNI ratio. As noted above, with the interest-only loan, the LTV ratio would have been 57% after 10 years, and the housing equity would have increased from 15% to 43% of the value of the housing. This would allow the individual to put up a substantial equity in a larger apartment. With the additional involuntary saving under amortization requirements, the LTV ratio will be 47% and the equity 53%.

Figure 6.7: Loan-to-gross-income ratios for loans without amortization and with amortization requirements. Initial monthly gross income SEK 35,000.

Figure 6.8: DSTNI ratios, without amortization and with amortization requirements, and rentless-OMC-to-net-income ratio. Initial monthly gross income SEK 35,000. affordability-test interest rate 7%.

Source and note: Own calculations. Figure 6.7, see note to figures 6.1 and 6.2. Initial monthly net income about SEK 27,000. SEK/EUR ≈ 10.

6.4 Summary

In summary, for a given interest-only loan, the realistic assumption of 4% annual growth of nominal incomes and housing prices results in an automatic amortization of about 4% per year. For an interest-only loan, this means that LTV and DSTNI ratios fall gradually to about 2/3 of their initial values in 10 years and to a half of their initial values in less than 18 years. It is not clear by what optimality criterion an optimal amortization rate would need to be faster than that. There

\[ \frac{1}{1.04^{10}} = 0.68, \text{ and } \frac{1}{1.04^{17.67}} = 0.5 \]
is considerable smoothing of the debt service and housing payment over time.

In contrast, the two amortization requirements make the DSTNI ratio very frontloaded, both in an absolute sense and in comparison with the interest-only loan. The DSTNI ratio becomes very high during the first 5–10 years and in the examples here falls below the DSTNI ratio for an interest-only loan only after 10 years. The LTV-ratio falls quicker than under an interest-only loan, but the DSTNI ratio under amortization requirements is initially more than twice the DSTI ratio under an interest-only loan. This front-loading excludes many borrowers, as shown in section 4.1. It also makes the included borrowers severely liquidity-constrained and force them to oversave and underconsume. This leads to welfare losses for the individuals concerned. It also makes their consumption very sensitive to income disturbances and in many cases make them hand-to-mouth consumers (Campbell and Mankiw, 1989; Kaplan et al., 2014; Ampudia et al., 2018). It simply makes them less resilient, as discussed further in section 7.

It is not clear what optimality criterion would make this very frontloaded DSTNI ratio better than that for an interest-only loan.

### 6.5 Positive real after-tax capital gains

The assumption of 4% nominal housing price growth implies a real after-tax capital gains of 1.12% per year, not zero as is conservatively assumed in table 3.1. This implies a monthly after-tax capital gain of SEK 2,613, which reduces the user cost by the same amount, making the monthly user cost a minuscule SEK 210. The resulting housing payments, user cost, and involuntary saving without amortization and with amortization requirements are shown in, respectively, figures 6.9 and 6.10. With a user cost close to zero, the involuntary saving is close to the housing payment.

Thus, if nominal housing prices grow by 4%, the borrower and buyer of this average Stockholm studio will live for free. Furthermore, the 3.3% interest rate is the current (December 2018) rate for a 10-year fixation period, so it is possible to lock in this interest rate for 10 the next years. In contrast, the excluded borrower that has to go to the secondary rental market will be facing a monthly user cost of about SEK 10,000. The difference between insiders and outsiders in the market for owner-occupied housing in Stockholm is indeed huge.

### 7 Amortization requirements and household resilience

According to the FI, the objective of the amortization requirements is to increase households’ resilience (FI, 2017d, p. 1):

The aim of the measure[s] is to increase the Swedish households’ resilience to shocks.

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63 (3.3% + 3/0.7)/3.3 = 2.30.

64 With a capital-gains tax rate of 22% and 2% inflation, 4% nominal housing price growth implies \((1 - 0.22) 4 - 2 = 1.12\%\) real after-tax capital gains per year.
Before examining the effects of the amortization requirements on households’ resilience, let us first consider what concept of household resilience is relevant in this context and how it can be measured. Here, it turns out that it is helpful to distinguish between risks to financial stability and risks to macroeconomic stability.

7.1 Household resilience

In the context of risks to financial stability, it is natural to consider household resilience in the sense of households’ capacity to continue to service their debt, when shocks occur. The shocks discussed by the FI are a fall in housing prices, a rise in interest rates, and a fall in current income due to unemployment. If a significant share of households would be unable to service their debt, this would imply non-performing loans and credit losses for lenders, which—depending on the loss-absorption capacity of lenders—might threaten financial stability.\footnote{Non-performing loans and credit losses could in principle also arise because households are able but unwilling to service their debt and therefore choose to default—so-called strategic default. However, this is not an issue in Sweden, because debt is full recourse, personal bankruptcy is rare, and unpaid debt remains after bankruptcy for individuals.}

This particular kind of household resilience and risk to financial stability is continuously and thoroughly monitored by the FI in its annual report \textit{The Swedish Mortgage Market} and its biannual report \textit{Stability in the Financial System}. For several years, the FI has concluded that the risk to financial stability from household debt is small. Indeed, the FI has summarized the situation as follows (FI, 2017d, p. 9; italics added):

\textit{Finansinspektions\textquotesingle s current assessment is that the risks to financial stability associated...}
with household debt are relatively small. This is because mortgagors generally have good potential to continue paying the interest and amortisation on their loans, even if interest rates rise or their incomes fall. On average, households have comfortable margins with which to cope with a fall in house prices. Swedish mortgage firms are also deemed to have satisfactory capital buffers should credit losses still arise.

The FI’s assessment is consistent with the heatmap in figure 2.1, the stress test in figure 2.2, and the many other stress tests of household borrowers presented in the annual report The Swedish Mortgage Market.

The risk associated with household debt that the FI has emphasized is instead the risk that highly indebted households may have to reduce their consumption in order to continue to service their debt when negative shocks occur. According to FI, this may reinforce a future economic downturn and can be seen as a macroeconomic risk (FI, 2017d, p. 9; numbers and italics added):

The risks currently associated with household debt thus primarily relate to the fact that highly indebted households may end up reducing their consumption if (1) interest rates rise, if (2) household income falls or if (3) both of these happen at the same time, and that this, in turn, may intensify a future economic downturn.

... Despite the risks to financial stability being assessed as low at present, the trend of high and rising loan-to-income ratios among many borrowers thus means that there is an elevated macroeconomic risk.

The FI thus suggests that higher LTI ratios imply that household consumption is more sensitive to income, that is, that the marginal propensity to consume out of current income (MPC)—or the elasticity of consumption with respect to income—would be higher. That is the reason the FI suggests that high LTI ratios in Sweden imply an elevated macroeconomic risk.

As noted above and in Svensson (2019), the literature cited by the FI in support of its suggestion refutes the suggestion. This literature includes Baker (2018, p. 28; italics added), who concludes from a detailed study of US microdata that:

\[ \text{Debt has little or no independent relationship with the [income] elasticity of spending when controlling for liquidity and the ability of households to access credit. . . . Overall, these results indicate that the primary reasons consumption responses are higher among highly indebted households are credit and liquidity constraints.} \]

Baker’s result and conclusion make eminent sense. Households that are not credit- and liquidity-constrained but have liquid financial assets or have access to credit can smooth their consumption, which makes their consumption less sensitive to current income. In contrast, households that lack liquid financial assets, have no access to additional credit, and whose only asset is illiquid equity in their housing have to adjust their consumption downward if their incomes fall. For an income fall, their consumption may adjust one-to-one with their consumption, whereas for a temporary income rise, they may not immediately increase their consumption but keep some of the income increase in
cash or other liquid assets. In particular, if they are in a situation with a large involuntary saving, so they are involuntary oversaving and underconsuming relative to what they would prefer, they will most likely be so-called hand-to-mouth households. That is, they consume all their net income after deduction of their large involuntary saving, with a marginal propensity to consume out of income equal to one (Campbell and Mankiw, 1989; Kaplan et al., 2014; Ampudia et al., 2018).

It is pretty obvious that amortization requirements, by increasing the households’ housing payments and implying a large involuntary saving, will increase the number of households that are liquidity-constrained. Households without access to further credit will be oversaving and underconsuming and thus tend to be hand-to-mouth households. However, as explained in Svensson (2016), households that have access to credit can neutralize the effect of the amortization requirements on their cash flow by just borrowing more, deposit the excess borrowing in a savings account, and then finance the amortization payments from the savings account. But the 25–29-year-olds that borrow at the maxium LTV ratio of 85% cannot do this.

Let us look more closely at household resilience and liquidity constraints.

7.2 Resilience to income shocks depends negatively on liquidity constraints

In the context of macroeconomic stability and, more precisely, the stability of household non-housing consumption, it is then natural to consider household resilience in the sense of households’ capacity to maintain stable non-housing consumption, if shocks to interest rates or income, or both, would occur—under the maintained assumption that the households fulfill their debt service.

Let us first hold interest rates constant and only consider shocks in the form of a temporary fall in current income. The response of non-housing consumption to current income—the marginal propensity to consume (non-housing consumption) out of current income (MPC)—concerns well-researched areas of consumption smoothing and the life-cycle and permanent-income hypotheses. Consumption smoothing refers to the standard household preference to maintain a stable path of consumption when income fluctuates. According to the permanent-income hypothesis, if the household is not liquidity-constrained, consumption depends mainly on permanent income and little on current income, which makes consumption more stable than current income and the MPC relatively small.

The condition that the household is not liquidity-constrained is crucial. Stabilizing consumption at the preferred level when current income is temporarily high is trivial; it is just a matter of saving the excess of current income over the preferred consumption level in cash or in other liquid assets, or repaying debt. But it is not trivial to stabilize consumption at the preferred level when current

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66 Hull (2017) shows that frequent refinancing can also weaken the effect of the amortization requirements.
67 The focus is on the stability of non-housing consumption, because the housing consumption—the consumption of housing services—is taken to be fixed.
68 In the simplest case of perfect foresight, permanent income is the constant income whose present value is the same as the present value of current and expected future income.
income is temporarily low and below that level; this requires access to cash or other liquid assets or to credit. Not being liquidity constrained when current income is below the preferred consumption level means having access to liquid assets or to credit.

Thus, in the context of the stability of non-housing consumption, resilience is closely related to access to liquid assets and credit, and one measure of the degree of a household’s resilience is the size of its liquidity buffer. The liquidity buffer can be defined as the sum of the value of the household’s liquid assets (cash and bank savings, bonds, stocks, and funds) and of the size of its available credit, such as a credit line on a bank account.

The liquidity buffer is a stock measure of resilience. We can also think of a flow measure of resilience, the cash-flow margin (CFM) introduced above. The CFM is defined as the households’ current net income minus mandatory housing payments (interest plus mandatory amortization plus operating and maintenance cost for owner-occupied housing; rent for rental housing) and standardized (basic) (non-housing) expenses. The CFM shows the scope for actual non-housing consumption to exceed the standardized living expenses without having to draw on any liquidity buffer. We may consider the preferred normal level of non-housing consumption to exceed the standardized (basic) living expenses, so some positive CFM is required for achieving the preferred non-housing consumption level.69

The CFM minus the excess of actual non-housing consumption over the standardized living expenses is the household’s voluntary saving out of its net income. This voluntary saving may be used to increase the liquidity buffer (saving in liquid assets or repaying any credit from a permanent credit line) or for voluntary amortization (saving in an illiquid asset, housing equity, by reducing the mortgage).70 Mandatory amortization requirements are a part of the involuntary saving.71 A large cash-flow margin allows the household to add to its liquidity buffer and this way increase its resilience.

The households’ resilience to negative income shocks is negatively related to the degree to which the household is liquidity-constrained. The degree to which the household is liquidity-constrained is negatively related to the cash-flow margin and the liquidity buffer. Thus, the household’s resilience to income shocks is increasing in the cash-flow margin and the liquidity buffer, which can be used as measures of the household’s resilience. We will mainly use the cash-flow margin as a measure of resilience, while keeping in mind that a large cash-flow margin also allows the household to add to the liquidity buffer while maintaining its preferred consumption level.

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69 One could alternatively define the CFM relative to the preferred normal non-housing consumption level, but it is simpler to define it relative to the standardized (basic) (non-housing) living expenses, for example those in table 3.1.
70 For home-equity loan, housing-equity may be considered a liquid asset.
71 Involuntary saving is defined as the difference between the housing payment and the user cost of housing and consists of the sum of mandatory amortization and the change in the real value of nominal debt due to inflation minus the cost of housing equity (section 3 and figures 3.1 and 3.2).
7.3 The cash-flow channel of monetary policy increases resilience

So far in this discussion of resilience, interest rates have been held constant. From the quote above on page 57, it is clear that the FI considers interest rises (1) and income falls (2) as independent shocks, including that both could occur at the same time (3). The latter was indeed the case during the 1990s crisis in Sweden. Then there was a fixed exchange rate, the krona was subject to speculative attacks, and the Riksbank was defending the fixed exchange rate with a very high policy rate in the middle of deep recession. But, as discussed in Svensson (2019, section 4.2), this is very unlikely to happen now, with a flexible exchange rate and monetary policy under “flexible inflation targeting” aiming at achieving both the inflation target and full employment. Then interest rates are not exogenous but vary with the business cycle. In recessions, the policy rate will be low, and mortgage rates will also be low, because the Swedish authorities have the tools to keep the spread between mortgage rates and the policy rate normal (Svensson, 2019, section 4.2.1). Interest rates thus become procyclical, higher in booms and lower in recessions.

It follows that, in a recession with negative shocks to current incomes, the Riksbank will lower policy rates as far as necessary to stabilize consumption, aggregate demand, and inflation—or at least as far into the negative range as is deemed possible and effective. This will lower mortgage rates and improve the households’ cash flows, thus moderating the effect on the cash flows of the income fall. This is the cash-flow channel of monetary policy (Flodén et al., 2018; Hughson et al., 2016; Gustafsson et al., 2017; Cumming, 2018; Svensson, 2019).

With high household debt and variable mortgage rates, the cash-flow channel is strong in Sweden. Furthermore, it is stronger with higher LTI ratios. High LTI ratios thus makes it easier for the Riksbank to stabilize consumption and aggregate demand and counter the effect of income falls. Thus, this way higher LTI ratios improve rather than deteriorate resilience.

At a constant interest rate, a higher LTI ratio increases the debt service and decreases the cash-flow margin and the resilience. On the other hand, a higher LTI ratio means that a given reduction in the interest rate decreases the debt service and increases the cash-flow margin more, and thus increases the resilience more. The net effect on the resilience depends on the net effect on the debt service.

Furthermore, high debt and variable mortgage rates in this way provide borrowers with insurance against bad times. From this point of view, variable interest rates are less risky than interest rates with long fixation periods, counter to conventional wisdom. However, renters do not benefit

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72 Each Monetary Policy Report contains the statement “[I]n addition to stabilising inflation around the inflation target, [the Riksbank] endeavour[s] to stabilise production and employment around paths that are sustainable in the long term. The Riksbank therefore conducts what is generally referred to as flexible inflation targeting.” (Sveriges Riksbank, 2019, p. 3)

73 However, the recovery after the 2008–2009 crisis has not lead to inflation being too high and not yet justified any policy-rate increases in Sweden, indicating that the neutral interest is quite low in Sweden.

74 See also Cloyne et al. (2018).

75 Under the assumptions of table 3.1, one can show that the debt service falls by more for a 1 percentage point lower interest rate than for a 10% lower debt level.
from this kind of insurance and improvement of their resilience to income falls recessions. Rents do not fall, and renters’ cash flows do not improve, when interest rates fall in bad times.

7.4 Interest-only loans increase resilience

What mortgage contract results in higher resilience? For a given loan amount and interest rate, an interest-only mortgage has the smallest debt service and leads to the largest cash-flow margin. A large positive cash-flow allows a large voluntary saving. This allows the mortgagor to increase its liquidity buffer or reduce its mortgage by a voluntary amortization or do both, while maintaining normal non-housing consumption. For example, the household may choose to build up an adequate liquidity buffer and thereafter use positive cash flows to reduce its mortgage by voluntary amortization. The liquidity buffer can then be drawn upon to maintain normal non-housing consumption when net income falls short of normal non-housing consumption. In general, the interest-only loan allows the household the best opportunity to create its optimal portfolio of liquid and illiquid assets and of debt.

Furthermore, if the mortgage has a credit line—which may come with a somewhat higher interest rate—this credit line adds to the liquidity buffer. Clearly, for a given loan amount and interest rate, an interest-only mortgage with a credit line results in the highest resilience of the borrower and gives the borrower the best possibility to smooth non-housing consumption when negative income shocks occur.76

Interestingly, Piskorski and Tchistyi (2010) show that, for a household with volatile and for the lender unobservable income in a setting with costly foreclosure and a stochastic market interest rate, the optimal mortgage contract for both borrower and lender is an interest-only mortgage with a housing equity line of credit.77

Intuitively, the smoothing of the (mandatory) debt-service over time that results from an interest-only loan is good and helps to smooth non-housing consumption.

7.5 Mandatory amortization requirements reduce resilience

What mortgage contract decreases the resilience below the resilience associated with an interest-only loan with a credit line? Obviously a loan without a credit line decreases the resilience by reducing the liquidity buffer by the size of the credit line. Furthermore, a loan with mandatory amortization requirements reduces the cash-flow margin by the mandatory amortization and thus decreases the resilience.

For a given loan amount, mandatory amortization requirements trivially decrease the resilience of the borrower. The reduction of the resilience may be substantial. An amortization rate is from

76 [Numerical example to be added.]
77 Cocco (2013) provides further discussion of alternative mortgage contracts. Bäckman and Khorunzhina (2019) provide a thorough discussion of the benefits and consequences of interest-only mortgages.
a cash-flow point of view equivalent to an increase of the before-tax interest rate by \(3/0.7 = 4.3\%\)
(at a capital-income tax rate of 30%).

Mandatory amortization is involuntary saving. By reducing the cash-flow margin, they replace voluntary saving controlled by the household by involuntary saving not controlled by the household. With large involuntary saving, they may be larger than the voluntary saving the household prefers to do. This means that they reduce non-housing consumption below the level that the household would prefer. In this sense, amortization requirements lead to involuntary oversaving and involuntary underconsumption. Involuntary underconsumption implies that the household is liquidity constrained, and non-housing consumption is constrained to equal the difference between current income and the housing payment. Non-housing consumption will respond positively one-to-one to current income and negatively one-to-one to the debt service. The household will be a hand-to-mouth household, with non-housing consumption maximally sensitive to current income and no smoothing of non-housing consumption. Furthermore, the cash-flow channel of monetary policy will have its maximal effect on non-housing consumption (Flodén et al., 2018).

Figure 7.1 shows the cash-flow-margin-to-net-income (CFMTNI) ratio for the average Stockholm studio as a function of the monthly gross income, without amortization, with amortization requirements, and for a secondary rental. We see that, for the 25K individual, the CFMTNI ratio is 20% for an interest-only loan and −11% with amortization requirements. For the 35K individual, the two ratios are 40% and 18% respectively. For this individual, the amortization requirements reduce the CFMIT by 22 percentage points, a substantial reduction in the resilience.

Figure 7.1: The cash-flow-margin-to-net-income ratio without amortization, with amortization requirements, and for a rental.

Figure 7.2: The involuntary saving rate without amortization, with amortization requirements, and for a rental.

Source and note: Own calculations. Assumptions as in table 3.1. The cash-flow margin is net income minus the sum of the housing payment and standardized (non-housing) living expenses. The housing payment equals the sum of the interest, amortization, and operating and maintenance cost for owner-occupied housing and equals to the rent for rental housing. The involuntary saving is the amortization requirement plus the reduction in the real value of the loan because of inflation. SEK/EUR ≈ 10.
As noted in section 4.1.2, with amortization requirements, the 25K individual will not get the loan. If the individual has to go to the secondary rental market, the housing payment equals the rent, and the cash-flow margin equals the net income minus the sum of the rent and standardized living expenses. Figure 7.1 shows that the CFTMI ratio is then substantially smaller than for an interest-only loan. Thus, the 25K individual becomes less resilient to income shocks in a secondary rental than in owner-occupied housing with an interest-only loan.

Thus, amortization requirements not only reduce the resilience for the individuals that get the loan. They may also reduce the resilience for the individuals that are excluded from getting a loan because of the amortization requirements. This is because some of these will go to the secondary rental market and be less resilient there than they would have been with an interest-only loan.

Figure 7.2 shows the corresponding involuntary saving rate—the involuntary-saving-to-net income ratio—as a function of monthly gross income, without amortization, with amortization requirements, and for a secondary rental. For an interest-only loan, the involuntary saving rate is 20% for the 25K individual and 14% for the 35K individual, not small, but not unmanageable. With amortization requirements, the involuntary saving rate would be a forbidding 50% for the 25K individual and a large 37% for the 35K individual. The latter is an extreme saving rate for a 25–29-year-old and would most likely turn the 35K individual into a liquidity constrained hand-to-mouth individual, with the individual’s non-housing consumption maximally sensitive to income shocks.

For a secondary rental, the involuntary saving rate equals zero (figure 3.3). Thus, the amortization requirements also has the consequence of drastically reducing the total saving of those excluded from a loan that go to the secondary market.

7.6 The design of the amortization requirements makes amortization countercyclical and consumption inherently procyclical

The design of the amortization requirements makes consumption inherently more procyclical and this way reduces households’ resilience to maintain their consumption when shocks occur.

By design, the FI’s amortization requirements make amortization and the related involuntary saving countercyclical. In a recession, amortization and involuntary saving increase, and consumption falls. This reinforces the recession and increases the macroeconomic risk that the FI is worried about.

The reason for this is that, in a recession, households’ incomes fall, and LTGI ratios rise. For some mortgagors, their LTGI ratio will rise from below to above 4.5. Then, by the second amortization requirements, the mortgage firms have the right to impose 1% amortization of the loan amount at origination. If the mortgage firms do, the mortgagors have to involuntary save more and to reduce their consumption more, in spite of having less incomes.
Furthermore, in a recession, housing prices may fall. Then, for some mortgagors, their LTV ratio will rise from below to above 70%, or from below to above 50%. In the former case, the mortgage firm has the right to increase the amortization from 1% to 2% of the loan amount at origination, in the latter from 0% to 1%. However, FI (2018a, section 4) restricts somewhat the frequency of revaluations for general price changes in the housing market:

A revaluation [of the market value of the property in order to calculate a new LTV ratio] may be performed at the earliest five years after the residential property was acquired or following the last revaluation that resulted in a change in the amortisation amount. However, a revaluation may be performed earlier than this if there has been a material change in the residential property’s market value for reasons other than the general development on the market for residential properties.

This restriction was imposed in order to prevent frequent revaluations and rapid reductions in amortization if prices would rise. But they also reduce the frequency of revaluations when prices fall. However, if it was more than 5 years since the amortization amount was changed because of a revaluation, there is no restriction.

Furthermore, the fact that new mortgages tend to bunch just below the thresholds for higher amortization mean that even a modest fall in housing prices or incomes will push many new mortgagors from below to above the thresholds. Figure 7.3 shows the LTV and LTGI ratio for each household in the FI (2019) survey of new mortgages in 2018. Each dot represents one household. We see a clear pattern of bunching below the 50% and 70% LTV thresholds and also below the 450% LTGI threshold—in addition to the strong bunching below the 85% LTV cap.

Figure 7.3: Loan-to-value and loan-to-gross-income ratios for individual households in FI:s survey of new mortgages in 2018.

Source and note. FI (2019, figure B2.1). Each dot represents one household. The sample includes all new mortgage contracts entered into during the periods August 28–September 4, 2018, and September 27–October 4, 2018, and contains 24,156 households (FI, 2019, p. 6).

In particular, even if mortgage firms would not immediately use their right to increase the
amortization after a fall in incomes and housing prices, the risk perceived by households that the firms might use the right would be enough to cause some precautionary saving and corresponding reduction of consumption.

### 7.7 Resilience over time

What happens to resilience over time, without amortization, with amortization requirements, and for a secondary rental? Mandatory amortization requirements are an involuntary saving in the form of a mandatory repayment of the debt. They imply that LTV and LTI ratios for a given loan will fall more rapidly over time. This will gradually reduce interest payments and this way improve the CFMTNI ratio. Furthermore, the mandatory amortization rates will fall and eventually cease when the LTV and LTI ratios fall below their trigger levels. Eventually, the CFMTNI ratio will be higher than for an interest-only loan.

The crucial question is: Over time, will resilience on average be lower or higher with amortization requirements compared with an interest-only loan?

Figures 7.4 and 7.5 show the CFMTNI ratio over time for the 25K and 35K individuals. The figures are constructed under the additional assumptions of table 6.1—that housing prices, gross and net income, and the rent grow at 4% per year, corresponding to 2% real growth and 2% inflation. The standardized living expenses are assumed to grow at 3%, corresponding to a real growth rate that is 1 percentage point lower than for that of net income. These are the same assumptions that underlie figures 6.2 and 6.6. Thus, the CFMTNI ratio is also the difference between the maximum and actual DSTNI ratios in these figures. In particular, the profile of the CFMTNI ratios under amortization requirements in figures 7.4 and 7.5, with initially low and then rapidly rising CTMI ratios reflects the strongly frontloaded profile of the DSTNI ratios in figures 6.2 and 6.6.

We see that, for the 25K individual, the CFMTNI ratio starts out at a substantial 20% (corresponding to figure 7.1 at the monthly gross income of SEK 25,000) and increases over time (because the loan and debt service is constant in nominal terms and the standardized living expenses are constant in real terms). With amortization requirements, the CFMTNI ratio would be negative to start with and would exceed that without amortization from year 10, mirroring figure 6.2.

If the individual, excluded from getting a loan to buy the average studio, has to go to the secondary rental market, the CFMTNI ratio would be very small to start with and then rise somewhat (because the standardized living expenses are assumed to grow slower than nominal income). The CFMTNI ratio is much smaller than it would be for owner-occupied housing without amortization. This shows how much less resilient the 25K individual is when excluded from owner-occupied housing. Neither does the renter benefit for the cash-flow channel of monetary policy with low interest rates and debt service in recessions.

For the 35K individual, the CFMTNI ratio starts at 40% without amortization requirements
and at about 20% with amortization requirements (corresponding to figure 7.1 at the monthly gross income of SEK 35,000). With amortization requirements, the ratio rises rapidly, but it does not exceed that for no amortization until year 10, when the LTV ratio has fallen below 50% and amortization requirements no longer apply has ceased (figure 6.5). This illustrates that the 35K individual is also less resilient during the first 10 years with amortization requirements than without amortization.

Using the CFMTNI ratio as a measure of resilience, it is clear from figure 7.5 that the average resilience during the first 20 years is much lower with amortization requirements than without. This reflects the strongly frontloaded debt-service profile resulting from the amortization requirements (figure 6.6).

Why is the difference between the CFMTNI ratios from year 10 so small, only about 2 percentage points? In year 10, the monthly net income has grown from about SEK 26,800 to about SEK 39,700. For the interest-only loan, the loan is still SEK 2.38 mn. The price of the average Stockholm studio has risen to about SEK 4.14 mn, so the LTV ratio has fallen to 57%. With amortization requirements, the LTV ratio has fallen to 46.5%, below 50%. The loan is then SEK 1.928 mn. Thus, the difference between the loans is SEK 0.452 mn. The monthly after-tax interest on that difference is \((1 - 0.3) \cdot 0.033 \cdot 452,000 / 12 = \text{SEK 870}\), which as a share of net income is only 2.2%.

By a large decrease in resilience the first several years, amortization requirements achieve a small gain in resilience from year 10. The average gain over 20 years is significantly negative.

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78 The LTV ratio falls below 50% in year 9, but because the amortization requirement specifies that the LTV ratio can only be calculated every 5th year, amortization continues and does not stop until into year 10.
Furthermore, this is when resilience is taken to be a linear function of the CFMTNI ratio. It seems reasonable that resilience would rather be a concave function of the CFMTNI ratio, as discussed in appendix E. Then a decrease of the CFMTNI below the interest-only benchmark reduces resilience more than an equal increase of the CFMTNI ratio improves it. This results in the intuitive and convincing result that a smooth CFMTNI ratio is better than a variable, that is, cash-flow smoothing is desirable.

Furthermore, the initially 25–29-year-old individual may not stay 10 years in the studio before moving to a new apartment. This means that, with amortization requirements, the individual will not benefit from the improved resilience from year 10, only suffer from the less resilience before then. For an interest-only loan, after 10 years, the housing equity has risen to 43% of the value of the studio. With amortization requirements, the housing equity has risen to 53%.

With an interest-only loan, voluntary amortization is normally possible. Therefore, the individual could voluntarily choose to amortize as much as under amortization requirements. Or the individual could smooth amortization better over time. In any case, because the amortizations would be voluntary and under control by the individual, they would not reduce the resilience compared with an interest-only loan.

### 7.8 The FI on reduced resilience and exemptions from amortization requirements

The FI is aware of the fact that amortization requirements reduce household resilience. The FI’s own stress tests trivially show that amortization requirements, by reducing households’ cash-flow margin, reduce their resilience, as shown for example in FI (2018d, diagram 31), reproduced in figure 7.6. The percentage of new borrowers with a deficit, that is, a negative cash-flow margin, at an affordability-test interest rate of 7% is distinctly higher with than without amortization.

The FI’s comment on this result is (FI, 2018d, p. 20; italics added):

*During periods of extreme financial stress, a household can receive a temporary reprieve from the amortisation requirement. This means that their monthly payment may decrease temporarily.* Such a reprieve would mean that the percentage of households with new mortgages that show a deficit at an interest rate of 7 per cent decreases by almost three percentage points (Diagram 31).

Thus, what seems like an obvious problem is here given a positive spin by the FI and presented as a positive and not negative feature. The FI discusses the reduced resilience from amortization requirements in more detail in (FI, 2017d, p. 26; italics added):

*A stricter amortisation requirement may increase households’ total debt service payments, i.e., their total expenditure on interest and amortisation payments. An amortisation requirement that does not have exemptions may decrease households’ resilience to shocks in the short term and thus increase the risks for both households and the economy as a whole. It must therefore be possible to grant exemptions. Under the current*
Figure 7.6: The percentage of households with a deficit [a negative cash-flow margin] at an affordability-test interest rate of 7% with and without amortization.

Source and note. FI (2018d, diagram 31). Percent. A deficit is a situation with a negative cash-flow margin, that is, when net income falls short of the housing payment plus the standardized living expenses. The sample is FI’s sample of new borrowers in 2017.

[first] amortisation requirement, mortgage firms are permitted to allow mortgagors not to amortise for a limited period on special grounds. This exemption shall also apply to the stricter [second] amortisation requirement. This pertains to situations in which the financial circumstances have deteriorated significantly subsequent to the mortgage being issued. This position is developed on in section 2.10.

Here it seems that “in the short term” referred to in the second sentence is an understatement. Given figures 7.4 and 7.5, “during 10 years” would be more correct. In any case, section 2.10 of FI (2017d) discusses whether—as some consultive bodies of the FI’s proposal had suggested—“the situations in which exemptions may be granted on special grounds should be specified in exhaustive detail” (pp. 52–53; italics added):

The decision memorandum for the current [first] amortisation regulations [FI (2016b)] states that [situations in which exemptions may be granted on special grounds] denotes situations in which the financial circumstances have deteriorated significantly subsequent to the mortgage being issued. It also states that the intention is for there to be scope for mortgage firms to determine what shall be deemed special grounds on a case by case basis. There are many circumstances and situations that could constitute special grounds for allowing a borrower to refrain from amortising for a period. The typical situations listed were unemployment, long periods of absence from work due to illness and the death of a close relative. Finansinspektionen stands by its assessment that mortgage firms are best placed to assess in which situations an exemption may be granted on special
grounds. Accordingly, Finansinspektionen believes that there is no reason to specify in more detail when special grounds can be considered to exist.

Thus, the FI gives the mortgage firms considerable discretion to determine what shall be deemed special grounds for exemptions on a case by case basis. It only specifies that financial circumstances of the borrower should have deteriorated significantly and that typical situations are unemployment, long periods of absence from work due to illness, and the death of a close relative. The FI abstains from specifying in more detail when special grounds can be considered to exist. The actual regulations simply say (FI, 2018a, section 9 in the original and 11 in the amended regulation):

An undertaking may allow a borrower not to amortise in accordance with these regulations during a limited period if special grounds emerge during the term of the loan.

7.8.1 The FI’s exemptions do not include any macroeconomic risk

It seems clear that the situations in which exemptions to amortization may be exempted on special grounds will in practice be situations when individual borrowers face problems in fulfilling their individual debt service for reasons such as those mentioned above. It will not be the situation when borrowers continue to service their debt but reduce their consumption. The FI’s official rationale for having introduced the amortization requirements is the proposed macroeconomic risk from a reduction in indebted borrowers’ consumption. But there is nothing in the FI’s discussion of the special grounds that suggests that mortgage firms should consider borrowers’ consumption, not to speak of any macroeconomic consequences from borrowers’ consumption. It is difficult to believe that mortgage firms would exempt borrowers from amortization on the ground that they cannot maintain their normal consumption, or that they have to reduce their consumption more than less indebted borrowers, or that they are hand-to-mouth consumers. The mortgage firms will most certainly be focused on any risk to the individual debt service rather than on any macroeconomic consequences.

Furthermore, borrowers are left to the complete discretion of mortgage firms, who arbitrarily may or may not allow any exemptions and whose practice may vary across mortgage firms. Also, any exemption is only for an unspecified limited period. It is easy to imagine the uncertainty faced by borrowers, the resulting anxiety and welfare loss, the strong need for precautionary saving, if possible, and the resulting reduced consumption.

In summary, it is clear that FI has not provided any mechanism through which the exemptions to amortization payments would avoid the negative effect on households’ resilience to smooth their consumption.
8 Distortions caused by the tightening

There are several obvious distortions caused by the tightening of lending standards, especially the mandatory amortization requirements. These distortions cause efficiency (welfare) and equity (welfare distribution) losses. In this section, (new) outsiders denote individuals that are excluded by the tightening of lending standards from the market for owner-occupied housing, in the sense of not being able to buy the average Stockholm studio after the tightening but able to buy it without the tightening. Secondary-rental outsiders denote (new) outsiders that have to resort to the secondary-rental market. (Remaining) insiders denote individuals that are still able to buy the average studio after the tightening.  

The FI’s mandatory amortization requirements increase the housing payment and cause a large difference between the housing payment and the user cost of housing and thereby a large involuntary saving. This is shown by figures 3.1 and 3.2. The large difference between the housing payment and the user cost of housing as well as the large involuntary saving cause several distortions compared with an interest-only loan.

The amortization requirements also cause a strongly frontloaded time profile of the debt-service-to-net-income ratios as well as a strongly backloaded time profile of the cash-flow-margin-to-net-income (figures 6.2, 6.6, 7.4, and 7.5). This causes distortions compared with the smoother time profiles resulting from an interest-only loan.

A first obvious distortion is that households without high income or wealth will face higher barriers to entry into owner-occupied housing. Furthermore, because the amortization requirements concern new mortgages and not old ones originated before the introduction of the requirements, a move from an old home with an old mortgage without amortization requirements to a new home will require a new mortgage with amortization requirements. This increases the cost of the move. A second distortion is thus that the mobility within the market owner-occupied housing will be reduced.

8.1 Large housing payment

The large housing payment relative to the user cost prevent liquidity-constrained households that need to borrow from obtaining housing whose user cost they can easily afford. Some of them have to go to the secondary rental market, with very high rents and thus high housing payment and user cost but no involuntary saving (figure 3.3). The large housing payment also affect the lenders’ affordability assessments and reduce the loan amounts for a given income of the borrower.

Consider the individuals that have sufficient wealth to pay the 15% down payment but need to

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79 In the example illustrated in figure 4.11, after the tightening, the (remaining) insiders are the top 20% of the income distribution, that is, those above the 80th percentile. The (new) outsiders are the 30% between the 50th percentile and the 80th percentile. Without the tightening, the (old) insiders and outsiders are those above and below the 50th percentile, respectively.
borrow the remaining 85% of the price of the housing in order to buy it and enjoy the low user cost. For the average Stockholm studio and Stockholm 25–29-year olds, without the tightening, those with incomes at or above the median income, that is, the top 50% of the income distribution, would be able to borrow and obtain the studio, whereas the bottom 50% would not (figure 4.11). With the tightening, only those in the top 20% of the income distribution are able to borrow and obtain the studio, whereas those in the bottom 80% are not. Thus, 60% of those who had been able to borrow without the tightening are excluded from benefit of the low user cost of the studio.

Consider also high-wealth individuals with sufficient wealth to pay a down payment of 50% of the price of the studio and who thus only need to borrow the remaining 50%. They will face lower amortization and have a lower housing payment (figure 3.4) and will be able to get the loan and enjoy the low user cost for an income somewhat less than the median income (figure 4.7). Less wealthy individuals that can only pay a 15% down payment need much higher incomes to borrow 85% of the price (figures 3.2 and 4.3).

It follows that a third distortion is that first-time buyers without high income or wealth are more or less excluded from the owner-occupancy market in Stockholm, exemplified by such Stockholm 25–29-year-olds not being able to get a mortgage to buy the average Stockholm studio. Many of those will have to resort to the secondary-rental market, with its very high rents. It furthermore follows that a fourth distortion is that less-than-high-income outsiders will have higher user cost than high-income insiders. This distortion is illustrated by figures 4.1, 4.3 and 4.11. In addition, there is a fifth distortion, in the form of a less wealthy outsider having a higher user cost than a high-wealth insiders with similar income (illustrated by figures 3.3, 3.4, and 4.7).

8.2 Large involuntary saving

The large involuntary saving caused by the amortization requirement also cause distortions. Households that need to borrow and can afford the large housing payment are forced to save very much. For example, the 35K individual with a monthly net income of about SEK 27,000, who just passes the affordability assessment to borrow 85% of the price of the average Stockholm studio, will face involuntary saving of 37% of net income (housing payment of 47% minus user cost of 11%, with a correction for rounding errors). For most households, especially young individuals, this large saving will be much higher than they would prefer and what would be optimal for them from a life-cycle perspective. This implies that their consumption is constrained to be much lower than they would prefer. Thus, mortgagors are forced to oversave and underconsume, which is a sixth distortion.

In particular, these households are prevented from their preferred consumption-smoothing over time. Their marginal propensity to consume out of current net income (MPC) will be very high. They may indeed be hand-to-mouth consumers with an MPC equal to unity (Campbell and Mankiw,
Thus, mortgagors’ consumption is more sensitive to income shocks. This is a seventh distortion.

The oversaving borrowers and housing owners are not only forced to save too much, they are also forced to save by amortizing and thereby to save in an illiquid asset, housing equity, with the result that the savings are not easily accessible when needed. If the household has sufficient equity in its housing, the household is normally better off by instead building up a more balanced and diversified portfolio of liquid and illiquid, financial and real assets, including bank deposits, bonds, and stocks. In particular, building up a liquidity buffer increases the resilience of the household to income shocks and helps in smoothing consumption. Thus, an eighth distortion is that mortgagors have to save in illiquid housing equity instead of liquid and diversified assets.

8.3 The outsiders that have to go the secondary rental market with its exorbitant rents

Furthermore, the households excluded from the market for owner-occupied housing that have to go to the secondary rental market will face very high housing payments and user cost and thereby zero involuntary housing (figure 3.3). They are also forced to underconsume, but not because of high involuntary saving but because of a high user cost. This is another distortion, to some extent similar to the third distortion above but affecting a different category of households. They are furthermore in a worse situation than those subject to the third distortion, because they are subject to a high user cost instead of high involuntary saving. Indeed, many of them may be caught in a kind of a poverty trap and be excluded from the owner-occupied housing market for a long period or even for a life-time. Thus, a ninth distortion is that secondary-rental outsiders are forced to overpay, undersave, and underconsume.

Because the secondary-rental outsiders are underconsuming and—due to overpaying for their housing in the form of high fixed rents—have little or no room for saving, their consumption will also be very sensitive to their current income, possibly hand-to-mouth. This is also a distortion, caused directly by their exclusion from the owner-occupied housing market but indirectly by the tightening of lending standards. Thus a tenth distortion is that secondary-rental outsiders’ consumption is more sensitive to current income, even hand-to-mouth.

8.4 Less resilience to shocks

The FI’s stated aim of the tightening of lending standards is to increase household resilience to shocks. But, as discussed in section 6, the amortization requirements lead to strongly frontloaded DSTNI ratios. As discussed in section 7, the mirror image of this is strongly backloaded CFMTNI ratios. The amortization requirements reduce insiders’ cash-flow margin and resilience to shocks for many years, for a very small gain in the cash-flow margin and resilience later (figures 7.4 and 7.5).
With amortization requirements, the cost of a substantially lower resilience during the first several years are likely to be significantly larger than the possible benefits a modest increase in resilience during later years. More generally, the marginal welfare loss from less resilience is likely to increase when resilience falls. The marginal welfare loss from a lower CFMT is then larger when the CFM is initially low than when it is initially high. This means that it is optimal to smooth the CFM over time, for the same reason why decreasing marginal utility of consumption makes it optimal to smooth consumption over time.

It follows that the FI’s amortization requirements with its frontloaded CFMTNI profile results in less resilience and a welfare loss compared with the smooth CFMTNI profile for an interest-only loan. More intuitively, the more gradually increasing CFMTNI ratio for an interest-only loan makes borrowers less liquidity-constrained and make it easier for borrowers to smooth their consumption when shocks to their current income occur. Clearly, amortization requirements are a counterproductive way to increase borrowers’ resilience. This is an eleventh distortion.

For the secondary-rental outsiders, the cash-flow margin and resilience is also reduced compared with those for an interest-only loan, but without any later gain in resilience (figures 7.4 and 7.5). Furthermore, their cash-flow does not benefit from lower interest rates in recessions. As a result, their resilience is even further reduced. Altogether, this is a twelfth distortion.

Furthermore, as discussed in section 7.6, by design the amortization requirements make the amortization and associated involuntary saving inherently countercyclical, because the amortization rate tends to rise when LTV and LTGI ratios fall due to housing price and income falls. This makes consumption inherently procyclical and increases the macroeconomic risk that FI wanted to reduce. This is a thirteenth distortion.

8.5 Reduction of construction that was already too low

In addition, the tightening of lending standards and the resulting credit contraction reduces the demand for housing and lowers housing prices. This in turn leads to less construction of new housing, in a situation when housing construction was already lower than socially optimal, because of the structural problem in the form of a large structural excess demand for housing in the major Swedish cities. This makes the structural problem of insufficient supply worse. This is a fourteenth distortion.

These distortions are summarized in table 8.1. It is hardly an exhaustive list of distortions.
Table 8.1: A non-exhaustive summary of distortions caused by the tightening of lending standards, especially by the mandatory amortization requirements.

1. Households without high income or wealth face higher barriers to entry into owner-occupancy.
2. The mobility within the market for owner-occupied housing is reduced.
3. First-time buyers without high income or wealth are excluded from the owner-occupancy market in Stockholm Municipality and many have to resort to the secondary-rental market.
   To prevent such exclusions, housing prices may have to fall by almost 40%.
4. Less-than-high-income outsiders have higher housing user cost than high-income insiders.
5. A less wealthy outsider has a higher user cost than a high-wealth insider with similar income.
6. Mortgagors are forced to oversave and underconsume.
7. Mortgagors’ consumption becomes more sensitive to income shocks.
8. Mortgagors have to save in illiquid housing equity instead of more liquid and diversified assets.
9. Mortgagors are less resilient to shocks for many years, for a small gain in resilience later.
10. Secondary-rental outsiders are forced to overpay, undersave, and underconsume.
11. Secondary-rental outsiders’ consumption is more sensitive to income shocks.
12. Secondary-rental outsiders are less resilient to shocks, without any gain in resilience later.
13. By design the amortization requirements make amortization and involuntary saving countercyclical, which makes consumption more procyclical and sensitive to income shocks.
14. Reduced demand for and lower prices of housing reduce already too-low housing construction and worsen the structural problem of excess demand for housing.

Note: “Outsiders” refer to households excluded from the market for owner-occupied housing because of the tightening of lending standards. “Insiders” refer to households still being able to enter the market for owner-occupied housing after the tightening of lending standards. “Secondary-rental outsiders” refers to outsiders that have to resort to the secondary rental market, with very high rents.
9 Conclusions

The tightening—especially the mandatory amortization requirements—of already tight mortgage lending standards in Sweden has been justified by the FI with reference to household indebtedness posing an “elevated macroeconomic risk,” more precisely that “highly indebted households may sharply reduce their consumption in the event of a macroeconomic shock” (FI, 2017d, p. 9) and that “this can amplify an economic downturn” (p. 1). However, Svensson (2019) has shown that there is no evidence of any such risk in Sweden and that there are no good reasons for the tightening.

Whereas Svensson (2019) thus examines the rationale for the tightening—and finds that there is none—the present paper examines the consequences of the tightening. The FI has stated that “the aim of the [amortization requirements] is to increase the Swedish households’ resilience to shocks” (FI, 2017d, p. 1), more precisely their capacity to maintain their consumption when shocks occur. However, the present paper shows that the amortization requirements actually decrease the households’ capacity to maintain their consumption when shocks occur and thus decrease their resilience to shocks.

The resilience is reduced, because amortization requirements make more borrowers liquidity-constrained, which in turn make their consumption more sensitive to income shocks. In particular, amortization requirements make mortgagors’ debt-service time-profile strongly frontloaded compared with that of an interest-only loan. This means that mortgagors’ cash-flow margins become strongly backloaded. The cash-flow margin is reduced initially and for many years, followed by a small increase later. The net effect is a reduction in resilience to shocks compared with an interest-only loan. The FI’s attempt to deal with this problem by allowing banks to make exceptions to amortizations will not work, because the exceptions concern mortgagors’ individual difficulties with fulfilling their debt service, not their difficulties with maintaining their consumption and the macroeconomic effects from this. In addition, the households’ that are excluded from owner-occupancy because of the tightening—the Stockholm 25–29-year-olds between the 50th and 80th percentile of the income distribution in the example used in the paper—and have to resort to the secondary-rental market will, because of high rents in that market, also suffer from less resilience to shocks.

In addition to this, the tightening of lending standards cause or worsen a long list of other distortions that cause welfare losses and increased inequality (table 8.1).

The obvious effect of the tightening—in particular of the amortization requirements—is to make it difficult or impossible for households without high incomes or wealth to obtain a mortgage and enter the market for owner-occupied housing in the major cities. The policy effectively reduces demand for owner-occupied housing from households without high incomes and wealth while leaving the demand from households with high incomes and wealth undisturbed. The latter will furthermore benefit from any fall in housing prices and less competition for housing and mortgages.
However, the basic structural problem in the Swedish housing market is insufficient supply of housing in the major cities. Due to structural barriers to construction of new housing and inefficient use of the existing housing stock, supply has fallen behind the increasing demand for owner-occupied housing in the major cities. In this situation, to aim to reduce the general demand for owner-occupied housing is a counter-productive policy, because lower demand and lower housing prices reduces the construction of new housing and makes the structure problem of excess demand worse. In addition, to aim to reduce the particular demand for housing from households without high incomes and wealth adds additional inequality to already considerable inequalities in the housing market. It serves to make owner-occupancy in Stockholm a privilege for households with high income and wealth.

Finally, the objective of the FI includes “to ensure that the financial system ... has smoothly functioning markets that meet the needs of households ... for financial services, and provides comprehensive protection for consumers” (Swedish Ministry of Finance, 2017; FI, 2014). A policy that excludes such a large share of the Stockholm 25–29-year-old individuals from borrowing to buy an average studio that they could easily afford—in the sense of both the housing payment without amortization and the user cost being reasonable shares of their net income—is hardly a policy that “meets the need of households for financial services,” nor does it “provide comprehensive protection for consumers” to direct these individuals to the Stockholm secondary-rental market.

In summary, there are only costs and no benefits from this example of macroprudential policy. The conclusion is that the policy is counterproductive and harmful to welfare and social equity.

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Appendix

A A brief history of the first amortization requirement

The story that ends with the first amortization requirement of June 2016 has some twists and turns. In November 2010, at least one bank offered mortgages up to an 85% LTV ratio without any amortization (SBAB, 2010, see the quote on page 26 above). In December 2010, the Swedish Bankers’ Association (SBA) issued a recommendation that mortgages should be amortized down to an LTV of 75% in 10–15 years (Swedish Bankers’ Association, 2010). 80 The Riksbank for several years argued rather intensely in favor of amortization requirements, for example in Sveriges Riksbank (2012), where it also reported that almost 60% of new mortgage holders did not amortize in 2011 (chart 3:7). Household indebtedness and amortization requirements were increasingly debated (about amortization requirements, for example, Svensson, 2013).

In March 2013, the minister for financial markets, Peter Norman—perhaps to some extent in response to the Riksbank’s intense arguing—announced that the government had given Finansinspektionen (FI) an assignment to strengthen the foundation of a “healthy amortization culture” [“sund amorteringskultur”] (Norman, 2013). According to the assignment, the FI should investigate what is needed for an appropriate regulation that would require mortgage firms to suggest an individually tailored amortization plan to mortgage customers or existing customers who increase their loans.

The explicit assignment to the FI stated (Swedish Ministry of Finance, 2013, section 7; my translation):

7. [Finansinspektionen] shall, for the purpose of strengthening the foundation of a healthy amortization culture, investigate the conditions for appropriate regulation that would require mortgage firms to provide proposals for an individually tailored amortization plan to new mortgage customers or existing customers wishing to increase their loans.

By an amortization plan is meant a written plan, which describes the time profile for amortization and extends far into the future. In the amortization plan the mortgage firm shall justify why the plan is in the customer’s long-run interest. The documentation shall also report the customer’s attitude toward the plan. The measure does not intend to restrict the freedom of contract between the mortgage firm and the borrower. The amortization plan shall not include a formal requirement to amortize. ...

That the purpose of the measure was neither to restrict the freedom of contract nor to introduce a mandatory amortization requirement but to give the customers better information was also emphasized by the minister (Norman, 2013, my translation):

The purpose of the commission is to give households better information, not to limit the freedom of choice. There shall not be any formal amortization requirement. Mandatory requirements of amortization risks affecting individual households’ economic situation in a clearly negative way if their situation in life suddenly changes.

In October 2013, FI published a report proposing that the banks should offer their customers individually tailored amortization plans (FI, 2013a). The stated purpose was “to increase consumer awareness of and knowledge about the importance of amortisation, and hence promote sound, stable

80 Assuming 15 years, linear amortization, and starting from the LTV limit of 85%, this means amortizing on average \((85 - 75)/15 = 0.67\)% per year of the mortgage at origination.
financial markets.” FI stated that it could introduce a regulation enforcing the recommendation, but that this would first require an amendment in the Consumer Protection Act. Importantly, the proposal did not include a mandatory requirement for customers to amortize their mortgages.

In response to the public discussion about amortization—and presumably in the hope of avoiding an inflexible regulation—the SBA introduced a recommendation for banks to provide individually tailored amortization plans for borrowers in March 2014, as well as tightening its amortization recommendation to include loans with an LTV of more than 70% rather than 75%. The recommendation should be applied fully from July 2014. (Swedish Bankers’ Association, 2014b,c).81

In October 2014, the SBA announced that it intended to tighten the recommendation, to involve amortization down to 50% (Swedish Bankers’ Association, 2014a). However, the Swedish Competition Authority (SCA) announced in November 2014 that such a recommendation from the SBA is a tightening and would concern a larger share of the stock of mortgages than before. Given that that the SCA considered amortization conditions as one of the most important means of competition for the banks, it had made a preliminary judgment that such a recommendation by an industry association might limit competition in a way that benefits the banks affected and therefore violate the competition regulations. Therefore any limitation of the freedom to choose amortization conditions would better be a regulation by a public authority. Given this, the SBA withdraw its 2014 recommendations (Swedish Competition Authority, 2014).

At this stage, the FI might have re-proposed its more flexible regulation about individually tailored amortizations plans without a mandatory amortization requirement. Instead, in November 2014, the FI announced that it planned to propose a regulation about mandatory amortization. The proposal was announced in March 2015. However, the Court of Appeal of the city of Jönköping noted that the FI did not have the legal authority to introduce the regulation. In September, the government proposed new legislation to give the FI the authority, subject to government consent. The FI proposed a new regulation about amortization requirements in December 2015 (FI, 2015), which after the introduction of the new legislation and the government’s consent were finally introduced in June 2016.

81 Assuming 15 years, linear amortization, and starting from the LTV limit of 85%, this means amortizing on average \((85 - 70) / 15 = 1\)% per year of the mortgage at origination.
B Figures

Figure B.1: Mortgage rates, housing prices, repo rate and disposable income.

- **a. Mortgage rates and repo rate**
  - 3m, 2y, 5y, 10y
  - Repo rate

- **b. Housing prices**
  - Aggregate
  - Apartments
  - Houses
  - Apartments, Stockholm

- **c. Unemployment and CPIF inflation**
  - Unemployment
  - CPIF inflation

- **d. Disposable Income**
  - Sweden, SEK bn (left)
  - Stockholm, SEK bn (right)


Figure B.2: Monthly gross and net income for a single individual.

- **Monthly gross income, SEK thousand**
  - 40
  - 35
  - 30
  - 25
  - 20
  - 15
  - 10
  - 5
  - 0

- **Monthly net income, SEK thousand**
  - 40
  - 35
  - 30
  - 25
  - 20
  - 15
  - 10
  - 5
  - 0

Source and note: Swedish Tax Agency (2017, Tax Table 30, column 1). Linear interpolation with breakpoints SEK/month 0; 1,500; 5,400; 11,000; 30,200; 37,800; 50,600; 54,400; 80,000; and 208,000. Income is earned income. SEK/EUR ≈ 10.

Figure B.3: Monthly gross income, net income, and income tax for a single individual.

- **Monthly net income**
  - 100
  - 80
  - 60
  - 40
  - 20
  - 0

- **Monthly income tax**
  - 100
  - 80
  - 60
  - 40
  - 20
  - 0

Source and note: Swedish Tax Agency (2017, Tax Table 30, column 1). Linear interpolation with breakpoints SEK/month 0; 1,500; 5,400; 11,000; 30,200; 37,800; 50,600; 54,400; 80,000; and 208,000. Income is earned income. SEK/EUR ≈ 10.
Figure B.4: Monthly housing payment, user cost, and involuntary saving; interest rate 1.5%; Without amortization.

Figure B.5: Monthly housing payment, user cost, and involuntary saving; interest rate 1.5%; With amortization requirements.

Figure B.6: Monthly housing payment, user cost, and involuntary saving, including capital gains; interest rate 1.5%; Without amortization.

Figure B.7: Monthly housing payment, user cost, and involuntary saving, including capital gains; interest rate 1.5%; With amortization requirements.

Source and note: Own calculations. See note to figures 3.1 and 3.2. Assumptions as in table 3.1, except that the nominal interest rate is 1.5%, in which case the real after-tax interest rate is \(-0.95\)%, and that the nominal capital gain is 4% per year, which results in a real after-tax capital gain of 1.12% per year. The user cost includes the negative of the real after-tax capital gain. SEK/EUR \(\approx 10\).

C  An unsecured loan to finance the down payment

Figures C.1 and C.2 refer to a situation when the sizable down payment of SEK 420,000—15% of the price of the housing—is partially financed by an unsecured loan of SEK 240,000—10% of the price of the housing—which makes the effective down payment only equal to 5% of the price of the housing. The unsecured loan is assumed to have an interest rate of 7% and to be amortized in full in 10 years.

This case implies higher housing payment, user cost, and involuntary saving compared with the
benchmark case (figures 3.1 and 3.2).

Figure C.1: Monthly housing payment, user cost, and involuntary saving: Without amortization. Unsecured loan with amortization to partly finance down payment. No amortization on mortgage.

Figure C.2: Monthly housing payment, user cost, and involuntary saving: Unsecured loan with amortization to partly finance down payment. Amortization requirements on mortgage.

Source and note: Own calculations. Assumptions as in table 3.1. “Interest after tax 2,” “Amortization 2,” and “Real loan reduction 2” refers to an unsecured loan of SEK 280,000, 10% of the housing price, with an interest rate of 7% and 10% amortization, that is used to partly finance the down payment of SEK 420,000. SEK/EUR \approx 10.

D The real cash-flow margin over time

Figures D.1 and D.2 show the real CFM (in 2017 prices) over time for the 25K and 35K individuals. The figures are constructed under the assumption of housing prices, gross and net income, and the rent growing at 4% per year, corresponding to 2% real growth and 2% inflation. The standardized living expenses are assumed to grow at 3%, corresponding to real growth 1 percentage point lower than that of net income. These are the same assumptions that underlie figures 7.4 and 7.5. The strongly backloaded profile of the CFMs under amortization requirements in figures D.1 and D.2, with initially low and then rapidly rising CFMs reflects the strongly frontloaded profile of the DSTNI ratios in figures 6.2 and 6.6.

E The welfare loss of from a backloaded cash-flow margin

The FI’s amortization requirements lead to strongly frontloaded debt-service and a strongly backloaded cash-flow margin (CFM) profiles over time, whereas an interest-only loan leads to much smoother debt-service and CFM profiles. For a liquidity-constrained individual that is forced to oversave and underconsume, the individual may be a hand-to-mouth consumer, and (non-housing) consumption will simply equal the CFM plus the standardized (basic) (non-housing) living expenses. Then it is obvious that the strongly back-loaded CFM profile caused by the amortization requirements implies less consumption-smoothing over time and therefore a welfare loss compared with the much less frontloaded and much smoother CFM profile from an interest-only loan. This is for two reasons. First, more individuals will be liquidity-constrained, have a marginal propensity to consume close to unity, and have to adjust consumption more or less one-to-one to income shocks. Second, their consumption will on average be too low during the first several years, with
high marginal utility of consumption, under the assumption of decreasing marginal utility of con-
sumption.

Another possible measure of the welfare loss from less resilience due to a back-loaded CFM is
the probability of a negative CFM, that is, that shocks to current income cause the CFM to be
negative, for example, corresponding to some special disutility from consumption falling below the
standardized living expenses. Then it is easy to show that this probability is a convex function of
the amount of amortization (for the reasonable assumption of a unimodal probability distribution
of shocks to current income). This means that, also for this measure of welfare loss, it is optimal
to smooth the cash-flow margin (and thereby the debt service) over time.

To see this, assume the interest payment and the standardized living expenses are constant,
and let net income be stochastic. Let \( \varepsilon \) denotes a zero-mean i.i.d. shock to net income, with an
continuous unimodal probability density function, \( f(\varepsilon) \), monotonically increasing for \( \varepsilon \leq \text{Mode}(\varepsilon) \)
and monotonically decreasing for \( \varepsilon \geq \text{Mode}(\varepsilon) \). Let \( \hat{m} \) denote the expected net income minus the
sum of the constant interest payment and the standardized living expenses. Then we can define
the expected CFM, denoted \( m \), as
\[
m \equiv \hat{m} - a, \quad (E.1)
\]
where \( a \geq 0 \) denotes mandatory amortization, which is determined before the income shock is
realized. Then the realized CFM is given by
\[
m + \varepsilon = \hat{m} + \varepsilon - a. \quad (E.2)
\]

Assume for simplicity that the welfare loss from insufficient resilience is proportional to the
probability of a nonpositive realized CFM (nonpositive instead of negative for simplicity). Then
we can write the welfare loss as a function, \( L(m) \), of the expected CFM, given by
\[
L(m) = \text{Prob}\{ m + \varepsilon \leq 0 \}. \quad (E.3)
\]
The loss function can be rewritten as
\[
L(m) = \text{Prob}\{ \varepsilon \leq -m \} = \int_{-\infty}^{-m} f(\varepsilon) d\varepsilon = F(-m), \quad (E.4)
\]
where \( F(\cdot) \) is the cumulative probability distribution function corresponding to the probability density function \( f(\cdot) \).

Figure E.1: The loss as a function of the expected cash-flow margin and the probability density function of the realized cash-flow margin.

This is illustrated in figure E.1. There, for a given expected CFM, \( \tilde{m} \), the blue bell-shaped curve shows the corresponding probability distribution of the realized CFM, namely the density function \( f(\tilde{m} + \varepsilon) \), where the realized CFM, \( \tilde{m} + \varepsilon \), is measured along the horizontal axis.

The probability of a nonpositive realized CFM is given by the area of the red-colored shape below the probability density and to the left of the vertical axis. This is the loss, \( L(\tilde{m}) \), for the given expected CFM \( \tilde{m} \). It is also plotted as the length the vertical dashed red line at the given expected CFM, \( \tilde{m} \), on the horizontal axes.

If the expected CFM is reduced, \( \tilde{m} \) and the probability distribution shifts to the left, the area of the red-colored shape increases, and the loss increases. This way one can trace out the downward-sloping loss function \( L(m) \) as a function of the expected CFM, \( m \), measured along the horizontal axis.

In particular, for expected CFMs that exceed the mode of the probability distribution of income shock, \( m > \text{Mode}(\varepsilon) \), the loss function is convex. We have

\[
L'(m) = -f(m), \quad \text{and} \quad L''(m) = -f'(m) > 0 \quad \text{for} \quad m > \text{Mode}(\varepsilon),
\]

(where I for simplicity and without loss of generality assume that the probability density function is differentiable). The second derivative of the loss function is positive because the uni-modal probability density function is decreasing to the right of the mode. In figure E.1, the probability distribution is assumed symmetric, so the mean, mode, and median if the income shock are the same and equal to zero, but a symmetric distribution is not necessary. (Realistic income shocks are skewed to the left.)

Figure E.2 shows that, given the convexity of the loss function, the loss is less for a less back-loaded time profile of the expected CFM. Consider two periods, \( t = 1 \) and \( 2 \), and let \( a_t \) and \( m_t = y - a_t \) denote the amortization and expected CFM in period \( t \). Assume that the amortization is front-loaded and thus higher in period 1, \( a_1 > a_2 \). Then the expected CFM is backloaded, \( m_1 < m_2 \). It follows that \( L(m_1) > L(m_2) \).
Because the loss function is convex, the average loss is higher than if amortization would be constant in the two periods and equal to the average, $\bar{a}$, of $a_1$ and $a_2$. Then the expected CFM would constant and equal to the average, $\bar{m}$, of $m_1$ and $m_2$. Clearly $L(\bar{m})$ is less than the average of $L(m_1)$ and $L(m_2)$. (The loss for any convex combination of $m_1$ and $m_2$ is less than the same convex combination of the losses $L(m_1)$ and $L(m_2)$.)

## Additional figures

Figure F.1: Monthly housing payment, user cost, and involuntary saving: Without amortization, with 3% amortization requirements, for rent-controlled rental, and for a secondary rental. Including capital gains; interest rate 1.5%.

Source and note: Own calculations. See note to figure 1.2. Assumptions as in table 3.1, except that the nominal interest rate is 1.5%, in which case the real after-tax interest rate is $-0.95\%$, and that the nominal capital gain is 4% per year, which results in a real after-tax capital gain of $1.12\%$ per year. The user cost includes the negative of the real after-tax capital gain. SEK/EUR $\approx 10$.