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Debt affordability after retirement, interest rate shocks and voluntary repayments

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Abstract

We investigate the affordability of mortgage debt after retirement for different cohorts in the Netherlands. Affordability depends on a number of uncertain macro- and micro-outcomes and institutional features, such as a drop in income upon retirement, future interest rate shocks, the ability of households to voluntarily repay their debt, and the termination of the mortgage interest deduction (MID) after 30 years. These factors impact households in different ways. For instance, it matters if we look at present-day or future elderly people, or at households with different amortization contracts. We also include the possibility of behavioral responses, where households can alleviate the effect of a shock by allocating financial savings or gifts to home equity. This study shows a significant dampening role of voluntary repayments on the effects of an interest rate shock. We show that after retirement, debt affordability varies across cohorts and scenarios. Our baseline specification shows that 5-6% of individuals who had a mortgage in 2015 and who will retire in the next twenty years might no longer be able to afford their debt. We argue that downsizing, renting or entering into a new mortgage contract are not viable options for most of these high-risk households, while rolling over interest-only debt might well be, so long as macroprudential considerations allow this. If this policy option is not supported by financial supervisory authorities, the risk of political involvement might increase, for instance in the form of a re-introduction of the MID beyond 30 years. The size of the group at risk cannot be ignored, and their problems are persistent enough to exclude the chance of such policy intervention.

Samenvatting

We onderzoeken de betaalbaarheid van de hypotheekschuld na pensionering voor verschillende cohorten in Nederland. De betaalbaarheid is afhankelijk van een aantal onzekere macro- en micro-uitkomsten en institutionele kenmerken, zoals het inkomen na pensionering, de toekomstige rentevoet, de bereidheid van huishoudens om hun schuld voortijdig af te lossen en de beëindiging van de hypotheekrenteaftrek na dertig jaar. Deze factoren beïnvloeden huishoudens op verschillende wijze. Het is bijvoorbeeld van belang of we naar huidige of toekomstige ouderen kijken, of naar huishoudens met verschillende hypotheektypes. We houden ook rekening met de mogelijkheid dat gedragsreacties optreden, waarbij huishoudens het effect van een schok kunnen opvangen door financiële besparingen of giften in te zetten ter vermindering van de huidige hypotheekschuld.

Deze studie toont een significante dempende rol van vrijwillige aflossing op de effecten van een renteschok. We laten zien dat de betaalbaarheid van de schulden na pensionering varieert tussen cohorten en scenario's. Onze basisspecificatie laat zien dat 5-6% van individuen die in 2015 een hypotheek hadden en in de komende twintig jaar met pensioen gaan, hun schulden misschien niet meer kunnen aflossen. Wij stellen dat verhuizen naar een goedkopere woning, huren of aangaan van een compleet nieuw hypotheekcontract geen haalbare opties zijn voor de meeste huishoudens met een hoog liquiditeitsrisico. Mogelijk is het verlengen van hun aflossingsvrije renteschuld de enige mogelijke oplossing, als macroprudentiële overwegingen dit toelaten. Als deze beleidsoptie niet wordt ondersteund door de financiële toezichthouders, zou de politiek er bijvoorbeeld voor kunnen kiezen om de hypotheekrenteaftrek weer te verlengen na de 30-jaar termijn om deze gezinnen tegemoet te komen. Toezichthouders hebben zich in het verleden meerdere malen uitgesproken tegen een dergelijke optie. De risicogroep die hier wordt beschreven is groot genoeg en hun problemen aanhoudend genoeg om een dergelijk politiek mogelijkheid uit te sluiten.

1. Introduction

We investigate the affordability of mortgage debt after retirement for different cohorts in the Netherlands. We highlight the impact that financial innovation (especially the popularity of interest-only loans) had on home-buyers. Debt affordability depends on a number of uncertain macro-outcomes, micro-decisions and institutional details. Think for instance of shocks resulting from future interest rates, the ability of households to voluntarily repay their debt, and the termination of the mortgage interest deduction (MID) after 30 years. The issue of debt affordability after retirement is gaining attention in the Netherlands, due to supervisory actions of the European Central Bank (ECB) and new government policy. The ECB requires Dutch banks to monitor borrowers at risk of high residual mortgage debt, whereby customers with potential debt affordability problems must be actively approached by banks and, if needed, advised about debt restructuring. The Authority for the Financial Markets (AFM), which supervises the conduct of the financial sector in the Netherlands, is tasked with monitoring this additional supervisory requirement. The Dutch government, at the same time, launched the initiative *Actieplan Brede Schuldenaanpak* (Broad Debt Approach Initiative), aimed at reducing the number of households with problematic debts.

To this end, we analyze very detailed loan level data within the context of a stress test module, to study the effect of an interest rate (IR) shock on households. As and when interest rates increase in different parts of the world, such as in the US, and with a new wave of quantitative easing, it is possible that also in Europe interest rates would increase from the present historically low levels. As interest rates have been low for a prolonged period, households face relatively low payments on their debt now, compared to prior times. Will increases in interest rates translate into a direct and proportional increase of payments for retiring households? For some cohorts, this might be the case, but other cohorts of borrowers are partly protected by a number of institutional features of the mortgage market. For instance, cohorts retiring after 2030 will only enjoy the benefits of the mortgage interest deduction if their mortgage contract has not yet lasted more than 30 years.

Housing affordability problems in situations of debt have been studied recently for a number of reasons. Many authors have related these to the onset of the financial crisis (Mian and Sufi, 2010). Campbell and Cocco (2015) show how mortgage choices by heterogeneous borrowers help explain the higher default rates on variable- rate mortgages. Anderloni et al. (2012) show that consumer credit fuels affordability problems, and this is true not only for home owners, but also for tenants. This is an overall trend. Gabriel et al. (2005) show that housing affordability is worsening in

various countries. This is also the case for the Netherlands. Haffner and Boumeester (2010) show that the housing affordability gap between private sector tenancy and ownership is widening.

We analyze several standard factors that mitigate the effects of an interest rate (IR) shock. These include, for instance, delays due to a future interest-rate revision date, the tax deductibility of interest paid on mortgages, the amortization of various mortgage types, and possible conjunctural factors (such as decreasing interest rates in the past decade). We also include the possibility of behavioral responses, such as households mitigating the effect of a shock by reducing their debt through voluntary repayments. In most stress-test models, households are assumed to simply pay the higher amounts and to default in case they cannot afford these. However, households could decide to partly immunize themselves against the IR risk by fixing the IR for a longer period or by voluntarily repaying all or part of their debt before maturity. Ponds et al. (2016) show that if the possibility existed to withdraw part of pension wealth as a lump sum, most households would use it also for debt repayment purposes. We therefore extend the static balance sheet approach in standard stress-test models of mortgage credit risk (Constâncio (2015)) by introducing this household behavioral response. Bilston, Johnson, and Read (2015) and Sugawara and Zalduendo (2011) show that standard models do not include a dynamic interaction between banks and the balance sheets of the household sector.

The impact of an IR shock is key to top-down macro stress testing. It is especially interesting to focus on credit as a systemic risk, since financial crises are almost always preceded by steep increases in leveraging or debt-based financing (Mian and Sufi, 2010). However, most stress-test models struggle with the implementation of the pass-through to households, and elderly households are often actually excluded on the assumption that they experience little risk of default. We show that the speed of transmission to households is an empirical matter that depends on institutional, contractual and behavioral factors that are both country-specific and cohort-specific.

This study is based on supervisory loan level data that cover around 85% of the total mortgage market. The information contained is extremely granular and detailed. Survey data of central banks, such the DNB Household Survey in the Netherlands or the Survey on Household Income and Wealth in Italy, also contain loan level data, but they are subject to the typical measurement error that is inherent in self-reported information.

Our strategy is to look first at the debt affordability of present-day elderly. Next, we simulate the mortgage debt position of several cohorts of Dutch mortgagors thirty years into the future under different interest rate development scenarios, considering

possible voluntary repayments, contractual conditions, and tax incentives (see Mastrogiacomo 2017).

Our findings show a number of heterogeneous effects. First, older cohorts are much more likely to hold interest-only debt. This implies that we need to understand how interest rate shocks affect different mortgage types, and thus how they differently impact heterogeneous cohorts. For instance, we find that borrowers with currently high interest rates are more likely to voluntarily repay and thus reduce the potential future financial stress caused by an interest rate shock. This is presumably due to the rising opportunity cost of saving when mortgage interest rates increase. These are typically older borrowers, who are more likely to voluntarily repay, as they have accumulated more financial assets. But if the purpose of their debt is home equity extraction, then voluntary repayments are less interesting for them. This suggests that within the group of older mortgagors, there is a sub-group that is potentially more exposed to interest rate risk. This risk comes on top of the traditional affordability risk connected with the loss of income upon retirement. The recent policy debate has focused on this income drop, mostly because this could be more substantial for specific subgroups, for instance those with only limited pensions. A possible example of this is the self-employed. Recent analysis (Mastrogiacomo, 2019) shows that this group is not particularly at risk, because self-employed persons with a mortgage typically have a higher than average income. This is possibly due to the creditworthiness selection criterion applied by banks.

In this study, we apply the mortgage interest debt service to income ratio. Depending on the dataset used, we define these indicators in the following ways. In the data of Netherlands Statistics (*CBS, Centraal Bureau voor de Statistiek*), we look at mortgage interest expense relative to current income. This we define as DSTI (debt interest service to income ratio). CBS uses tax records as its source, and there only interest expense is reported. This limitation does not appear in the loan balance data of the Dutch national bank (*DNB, De Nederlandsche Bank*), as these include payments of both interest and principal. So there we look at total mortgage payments (interest plus principal) relative to current income. This we define as the mortgage debt service to income ratio (MDSI). The DNB data, however, lack information on current income and household financial wealth, and they obviously do not include households without a mortgage. This means that, depending on the definition, the critical threshold above which affordability problems arise is either 20% (in the first case, for DSTI) or 35% (in the second case, for MDSI). These ratios are somewhat higher than the affordability thresholds recommended in the maximum lending norms.

To preview our results, we show that at least 5% of households with mortgage debt in 2015 and retiring in the next twenty years might no longer be able to afford their debt, even if we account for mitigating factors such as voluntary repayments.

Several general equilibrium considerations are not taken into account here. For instance, despite the benefits of voluntary repayments in reducing risks, it should be noted that at macroeconomic level such repayments could reduce consumption and thus slow down economic growth. Also, a shock in the interest rate could benefit retirees if it leads to a higher return on pension assets. Within a stress-test module, these general equilibrium costs and gains are typically taken into account in the scenario itself as it is beyond the scope of such a module to account for them directly.

Policies that aim at increasing the resilience of households should focus on those with mortgages that have more frequent interest rate revisions and a larger share of interest-only loans. The elderly are a target group mostly because of this second reason. Repaying one's mortgage voluntarily appears to be a more effective strategy to achieve resilience than fixing one's interest rate for longer periods, as the fixation period has already increased substantially in the past.

Section 2 discusses the specifics of the Dutch mortgage market and some relevant policy measures. The data and methodology are described in more detail in Section 3. The results are presented in Section 4 and discussed in Section 5. The conclusions and policy implications are presented in Section 5 as well.

2. Dutch mortgage debt and institutions

The generosity of the mortgage interest deduction, the popularity of interest-only (IO) loans, and the absence of a down-payment requirement have contributed in the past to a sharp increase in the amount of debt held by Dutch households. In an attempt to reduce this, the mortgage interest deduction has been sobered down, IO mortgages are no longer eligible for the mortgage interest deduction (causing their production for new customers to nearly come to a halt) and the LTV cap was gradually reduced to 100%. This potentially decreases total debt and makes households more resilient to an IR shock. However, the effect of sobering down the mortgage interest deduction is less clearly related to shock resilience. Two opposing channels play a role here. On the one hand, in a general equilibrium model the price of houses should decrease when the tax deduction is reduced so that debt becomes more expensive, and that would decrease the demand for debt. On the other hand, reduced demand could in turn lower the price of borrowing and increase its popularity, thus raising again the pressure of high housing debt. These cyclical movements could thus lead to a higher debt burden at some point. The stabilizing effect of taxes works opposite. A lower mortgage interest deduction will decrease the dampening effect of an IR shock. Finally, the repeal of IO loans acknowledges the role of the mortgage type in fueling debt, but at the same time also its role in the transmission of a shock, as interest payments decrease when mortgages are repaid.

A last policy intervention is worth mentioning. The possibility of a tax-free gift, to be used for the purchase of a house or partial repayment of a mortgage loan, was introduced in the aftermath of the financial crisis in order to stimulate voluntary repayment and reduce the risks associated with debt (underwater mortgages and debt affordability). In this study, aside from importance of a possible future IR shock, we also acknowledge the relevance of voluntary repayments. Including such behavioral response is not common in stress-test modeling. Macro stress-testing is a multistage process (Foglia, 2009). Commonly used adverse scenarios include an upward IR shock (which can lead to higher debt-servicing costs), an increase in the unemployment rate (which can lead to a loss in income), and a decrease in asset prices and/or house prices (which can increase the loss upon default due to a lower collateral value).[1] The behavior of households can play an important role in this

1 These macro variables or scenarios are then linked to probabilities of default (PDs) and loss given defaults (LGDs) in the loan portfolios of banks. Typically, there are two methods to determine the probability of default of a household: using an arbitrary threshold or a financial margin threshold (Bilston et al., 2015). The arbitrary threshold, which usually involves calculating

second step of the stress-test framework, because it can affect the transmission of an adverse scenario to the balance sheets of the banks. For example, the savings behavior of households prior to a negative income shock may determine for a bank whether a loan will become non-performing (Ampudia, van Vlokhoven, & Zochowski, 2014).

the ratio of total debt service payments versus disposable income (income after tax) (DSI), is set to a certain percentage (see e.g. Johansson and Persson (2006)). A household is then assumed to default when the measure for that particular household has a value above the threshold. In this study, which focuses on mortgage debt only, a variant of the DSI could be used, namely mortgage debt service to income (MDSI).

3. Data and methodology

3.1 Data and descriptive evidence

Data

In this study we use two main data sources, namely the Income Panel Survey (*Inkomenspanelonderzoek* or IPO) of Netherlands Statistics (CBS) and administrative data from banks. We discuss the latter first. The data used for the predictions in this study are mortgage loan-level data (LLD) collected by DNB, the Dutch central bank. The data collection stems from the full transparency policy of the ECB, which requires lending institutions to complete the reporting template for Residential Mortgage-Backed Securities (RMBS) when they want to use securitized mortgages as collateral.

In addition to the mortgages used for securitization, DNB also receives data on all other mortgages in the portfolios of reporting institutions. The quarterly reported data was first collected in Q4 2012. The data used here cover the periods Q4 2014 and Q4 2015. The dataset on Q4 2015 covers over 85% of the total Dutch mortgage market. Table 1 presents descriptive statistics on the data of Q4 2014 and Q4 2015. We also show how the two datasets relate to the Q4 2015 subsample that we take to extrapolate debt to the future.

The IPO database contains data mostly from the Dutch Tax and Customs Administration and the Dutch Municipality Register. The IPO data are less precise about mortgage debt (debt type, split by loan, date of origination or maturity, and interest rate are not available), but they contain more recent information about current income (in the LLD only income at origination is observed).

Descriptive evidence

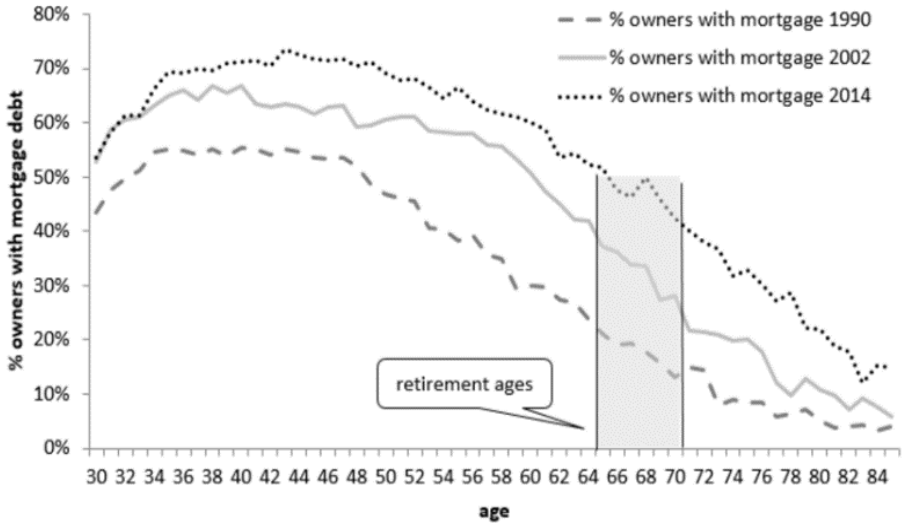
Figure 1 (left panel) shows evidence derived from CBS data. It shows that compared to 1990, mortgage debt ownership has increased over time. This is directly related to the increase of homeownership. However, while homeownership tends to stay constant over the lifecycle of an individual, institutional reasons suggest that debt should decrease again around the age of retirement, if one thinks of a mortgage contract as having a duration of thirty years[2]. As someone typically purchases a home around the age of 30-35, debt should be redeemed by the age of 60-65. Whereas in 1990 less than 20% of those aged 65 still had a mortgage debt, this share had increased

2 Bank practices have adapted to the institutional incentive, to provide 30-years duration mortgages at most. Standard affordability thresholds (the NIBUD norms) also are calibrated on this assumption. From an economic point of view, however, there is no reason why mortgages need to be redeemed in full after 30 years.

to 50% by 2014. While this fact is evident, the reasons behind it are less clear. One reason, we speculate below, could be a preference for liquidity; another reason could be financial innovation in loan types.

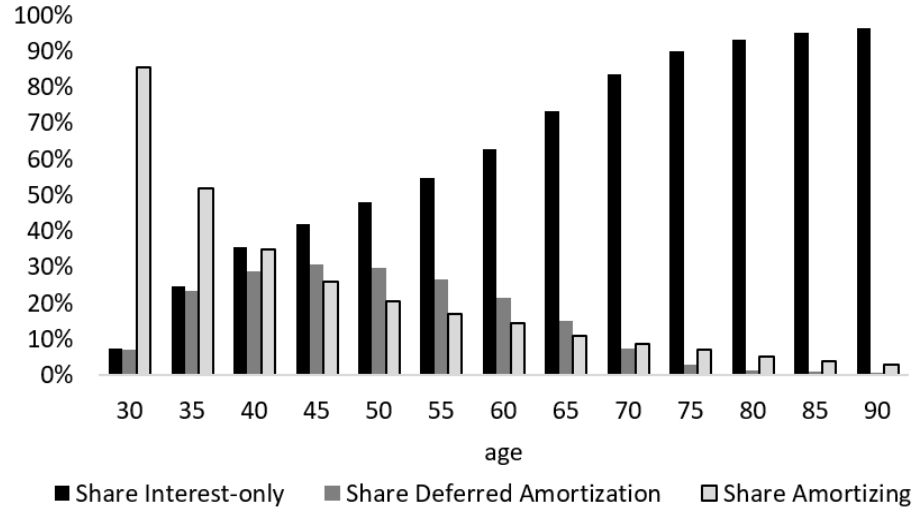
The most common types of loans in the Netherlands were the linear, annuity, savings, life insurance, investment, and IO loans (see Appendix A for a description of loan types). Together these loan types constitute around 98% of the loans in the Q4 2015 data. Figure 2 shows that these loan types are held differentially by different cohorts. Amortizing loans (linear and annuities) are more common at a younger age, deferred amortization loans (saving, insurance, and investment loans) are more common with

Figure 1*: Mortgage debt ownership over time and age*



Source: IPO data, own computations.

Figure 2*: Share of current debt by amortization type*



Source: DNB LLD Q4 2018, own computations.

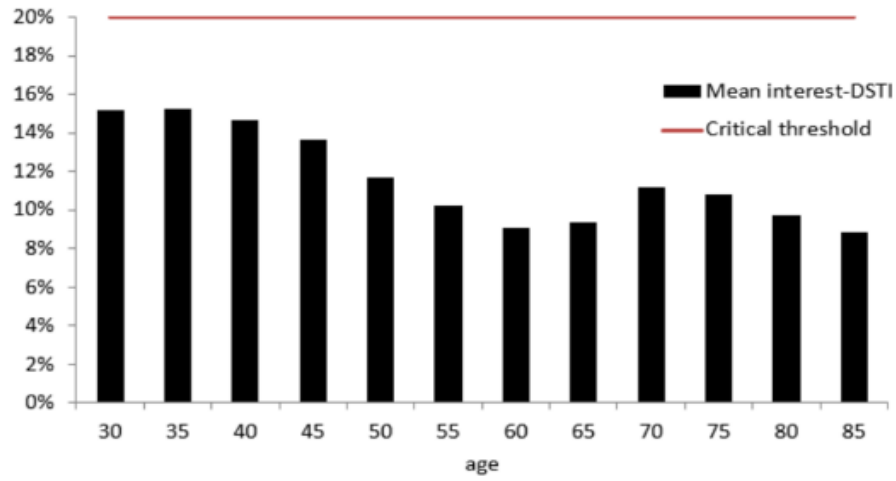
the middle aged, and IO loans are more common with the elderly. This reflects different stages of development of the mortgage market, where some products were either introduced or discouraged at different points in time.

Remarkable is the relatively high percentage of IO loans. Over 75% of borrowers have at least one IO loan, and the figure shows that this is more so with older mortgagors. Around 30% of borrowers have IO loans only and just over 20% have mortgages that require full redemption. This means that over 45% of borrowers combine an IO loan with other types of loans. Additional analysis of the LLD (not presented here) indicates that the share of those with debt that is eligible for the mortgage interest deduction (purchase and renovation) drops from 95% for younger cohorts to 80% for older cohorts (due to home-equity extraction). These two facts indicate that older borrowers are more likely to not qualify for the MID (which is only allowed for annuities and for purposes other than home acquisition).

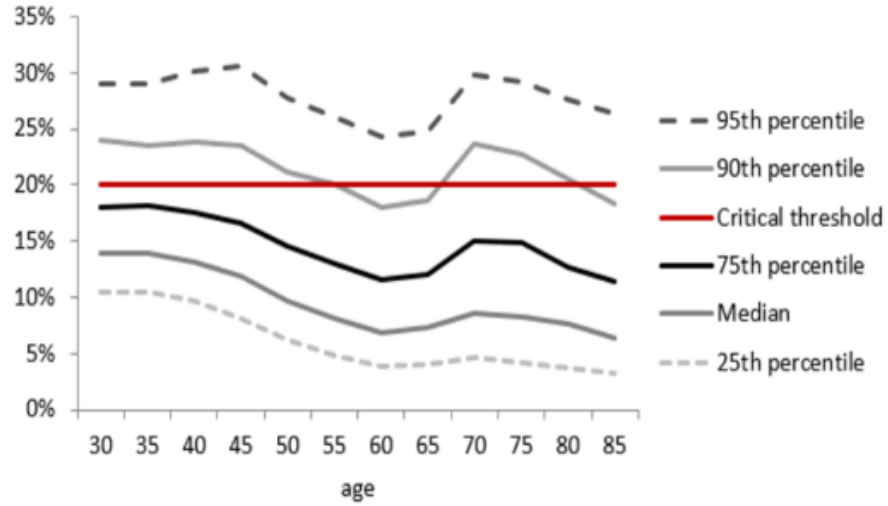
Figure 3a shows the ratio between paid interest and current household income in the IPO data. NIBUD (*Nationaal Instituut voor Budgetvoorlichting*, the National Institute for Family Finance Information) advises that total housing costs should not exceed 30% of household income, including amortization, thus about 20% when one only considers mortgage interest paid. Their advice is implemented in the maximum DSTI norms that the Dutch government issues each year. Figure 3a shows that all cohorts are substantially below this critical threshold (on average) and suggests that, even adding additional housing costs (such as utilities), housing affordability should not be problematic[3]. However, as the figure shows, the ratio for those recently retired rises. This is due to household income becoming lower after retirement and to the factors described above (no tax deduction on part of the debt). However, even with this increase, interest costs still represent about 15% of income, which seems perfectly affordable. Figure 3b investigates different moments of the Interest DSTI distribution. It shows younger cohorts on and above the 75th percentile, thus near the critical affordability threshold, while the upper 10 percent surpasses it. More mature cohorts, also in these higher percentiles, do better. Upon retirement, however, affordability worsens again. It is evident that the average trend in the left figure is largely explained by the development in the top quarter of the DSTI distribution. The LLD confirms these figures.

3 Our analysis focuses only on debt affordability, and our data do not contain any information about the rental market.

Figure 3: *Paid interest-debt-service to income ratio (DSTI), different statistics.*
3a. Paid interest-debt-service to income ratio (Interest DSTI)



3b. Different percentiles of Interest DSTI distribution

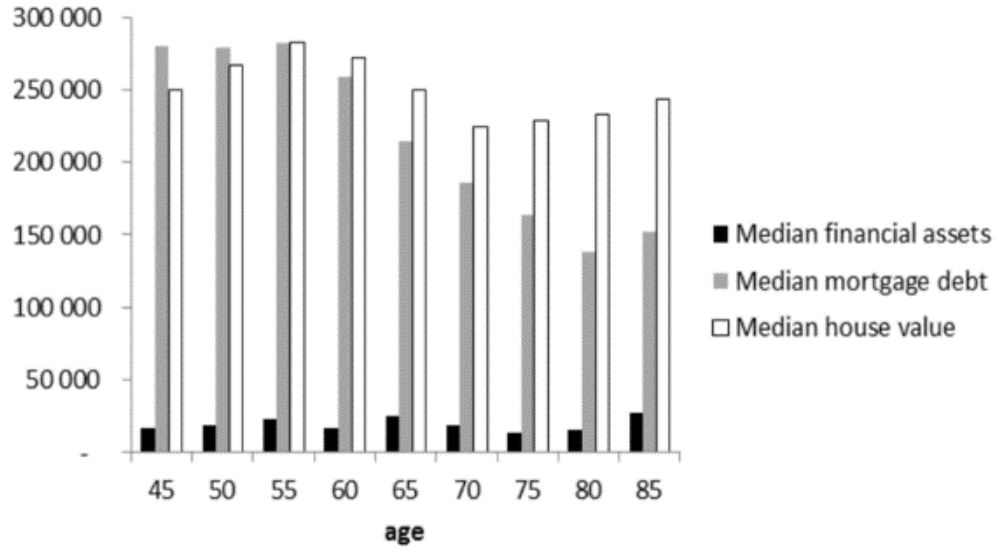


Source: DNB LLD Q4 2018, own computations.

The top 10% of the DSTI distribution thus reveals some debt affordability problems according to common standards. However, affordability depends not only on income, as households that are highly indebted may also hold financial assets.

Figure 4 shows the medians for financial and immobile assets as well as the median for mortgage debt of those with a DSTI above the 90th percentile. Mortgage debt varies between about €200,000 (for older cohorts) to €300,000 (for younger cohorts). Financial assets in the IPO data are about €13,000, with little variation across age groups. Home equity is higher for the elderly. The mean (not reported in the figure) is about €75,000 for this group. These figures suggest that households with top

Figure 4: *Assets and mortgage debt in the 90th percentile of the DSTI*



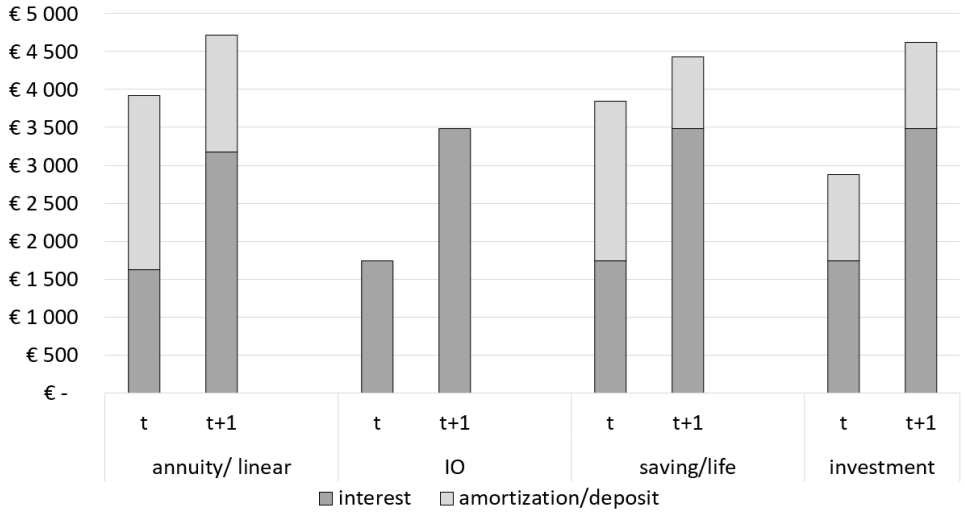
DSTI can only moderately apply savings in case of affordability problems, while their home equity, even though positive, is not large enough to easily allow downsizing.

Affordability in the future, a description

So far, we have described the situation for present-day cohorts of elderly and other mortgagors. Next, we investigate the possible future effects of a hypothetical IR shock. The evidence on loan types presented above is relevant for this study as an IR shock will fully pass through the payments of I0 loans and partly in those of loans being repaid. This suggests that the elderly should suffer more, should an IR shock occur.

The differential impact across loan types of an IR shock is explained in Figure 5, where fictitious loans, maturing in 30 years and with a principal of €100,000, experience an increase in the IR from 3%, five years after origination of the loan, to 6% in year 6. The figure shows two interesting elements. First, when the IR increases, products such as annuities or saving loans 'adapt' the amortization such that the overall impact of the shock is reduced. Second, we show the effect on net periodic payments. MID implies that when more IR is paid a higher tax rebate will be received. So, while in this example net payments double for the I0 loans, they increase only by 15% for a savings-based mortgage loan. MID and amortization thus reduced the IR shock. Also Figure 5 assumes that households are affected immediately by the shock. In reality, Dutch households have a mean IR reset interval of about ten years. This amplifies the effect of amortization even more, as after ten years less interest is paid. These considerations suggest two possible threats to debt affordability in the post-retirement period. The first is that IR shocks pass through more to the I0 loans of the elderly; the

Figure 5*: Effect of an interest rate shock in t+1 on yearly net mortgage payments (interest plus principal) for different loan types*



Explanatory note: Interest rate increases from 3% in t to 6% in t+1. Principal is equal to €100,000 for all loans, and t is equal to 5 years after origination of a loan that matures in 30 years. Payments are net, mortgage interest rate is tax deductible with a marginal rate of 42%.

second is that after 2030 the MID could be lost if any residual debt is left 30 years after origination.

To further illustrate the development of the pass-through, we work with a subsample of borrowers in the six largest Dutch banks that is randomly drawn from the LLD Q4 2014 – Q4 2015. The subsample consists of almost 85,000 loans to 36,336 borrowers. Next, we simulate the evolution of their debt for the 2016-2045 period.

3.2 Analysis of the set-up of the scenarios

We model the development in yearly payments per loan, aggregating these by borrower, for a simulation period of 30 years. In a baseline scenario there is no IR shock. That is, the IR is assumed to be constant, and the positions of households are calculated in a nearly deterministic way (the only stochastic elements being voluntary repayments in the current year). We then model additional scenarios, in which several IR shocks are stochastically and contemporaneously applied to the balance sheets of the households. For the sake of simplicity, we only show results of two such scenarios here. In the first scenario, the IR shock is immediate. The height of the interest rate after the shock, which will replace the original interest rate per loan at the first interest reset date, depends on the original LTV ratio, whether the borrower takes out mortgage default insurance, and the length of the interest rate reset interval. In the second scenario, the interest rate shock occurs in 2021.

We briefly detail our approach here. The increases in the interest rate that we input vary from 250 to 300 basis points on top of the interest rate observed at the end of 2015. Before the shock occurs, borrowers reset the IR when their contract requires this. In that case the interest rate is set to the one observed in Q4 2015 (at the time a historically low rate). This means that, until the shock occurs, the IR stays constant in the economy but might change (reduce in our case) for the borrower. Note that we assume that borrowers respect their mortgage contract (so do not default) and do not modify their present debt amount. Also, we assume that their income stays constant in real terms (thus follows a price/wage inflation of 1% for each year in the simulation). This assumption is in line with that imposed by the ECB for the compulsory monitoring described above. So, affordability worsens only because of interest rate shocks and loss of tax facilities, and it improves due to voluntary repayments and wage inflation.

We can calculate the yearly interest expenses and repayment (in case of an annuity loan) or deposit (in case of a savings, life insurance or investment-based loan) using the loan level information available. In the two scenarios, we also include the stochastic element of voluntary repayments. Borrowers can decide to voluntarily reduce their debt for different reasons (for instance, arbitrage with low interest rates on savings, receipt of a gift, debt aversion, or tax reasons). If they do, they also partly immunize themselves against any future IR shocks.

In order to include voluntary repayments in the interest rate stress-test model, we must describe the voluntary repayment behavior of households. Details of this model and several additional scenarios can be found in Mastrogiacomo (2018). There we use a model in which voluntary repayments are recursively predicted every year using the updated balance sheet positions per borrower starting from 2015.

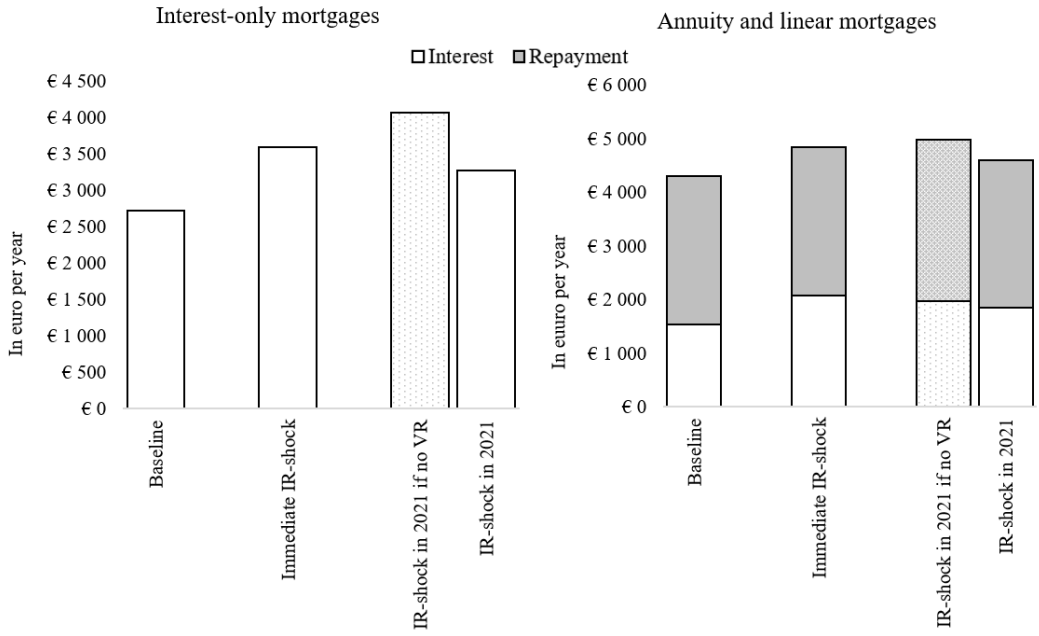
4. Results

Figure 6 displays mean gross mortgage payments for two loan types within our sample: IO loans on the left and annuities on the right.

For IO loans, an immediate IR shock in 2015, applied to all borrowers who would reset their interest rate in 2015, increases mortgage payments from €2,700 per year to €3,500. If the IR shock occurs in 2021, thus allowing more borrowers to reduce their IR to current lower levels and to voluntarily repay, mortgage payments would increase somewhat less, namely to €3,250. For this last scenario, we also highlight the role of voluntary repayments in Figure 6 (dotted bar). If no such repayments take place, mortgage payments would on average be 20% higher. The shock would thus have increased payments to €4,000. IO loans is the category that is most exposed to an IR shock. Annuities on the contrary respond much less, and the absence of voluntary repayments would make the effect of the shock in 2021 about 4% higher. An even lower effect can be found for savings and insurance-based loans (not shown here).

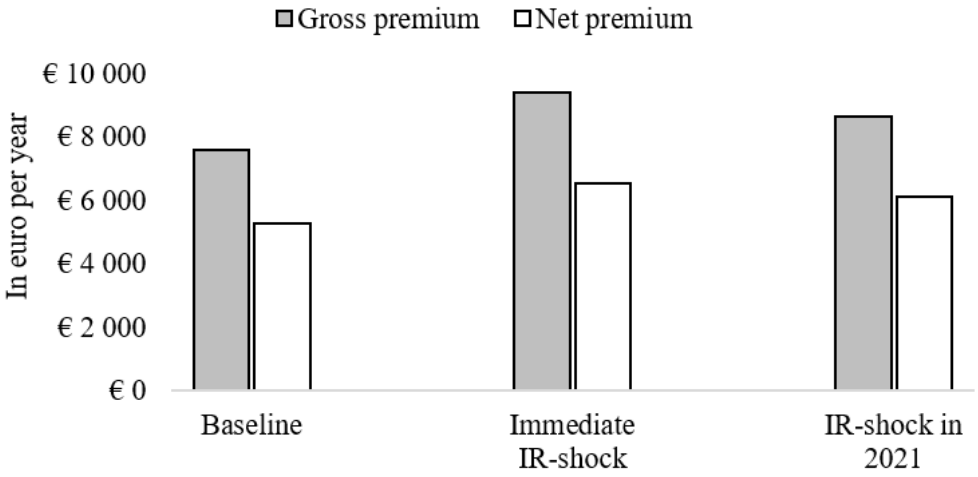
The effect of the MID on debt affordability is summarized in Figure 7. For all three scenarios, we apply the marginal tax rates (these are being reduced by 3 percentage points per year, according to current government policy. The figure shows that the MID reduces mortgage payments by about 30%. The reduction is larger when the IR shock

Figure 6. *Mean gross payments per loan type per scenario (loan-level)*



Explanatory note: The differences in payments with and without voluntary repayments (VR) significantly differ from zero in both instances at a 1% level. This is assessed using a t-test.

Figure 7: *Mean gross and net payments per borrower per scenario over the entire simulation period*



Explanatory note: The tax rebate linked to the MID is computed using a marginal tax rate that solely depends on income.

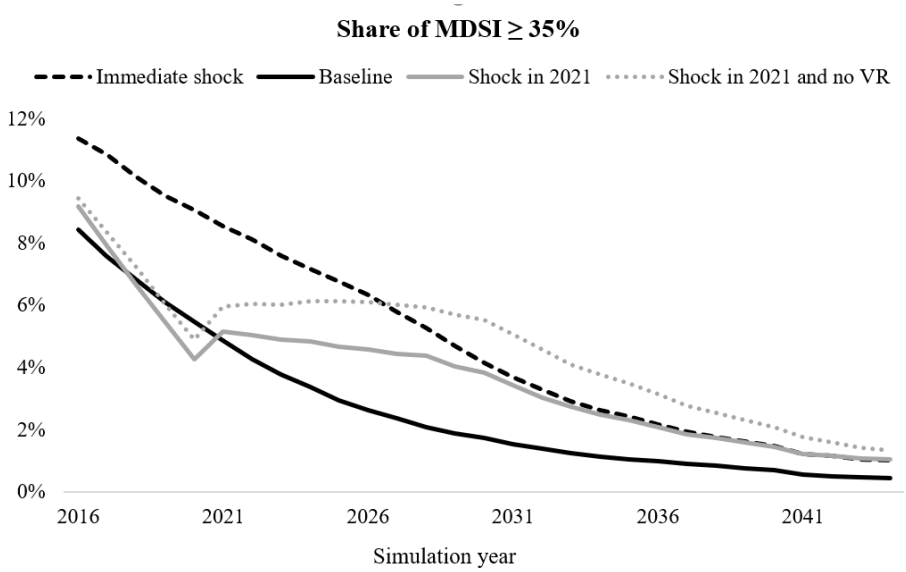
is more severe. For households that do not make contractual periodic repayments on their mortgage, losing this tax benefit will thus substantially worsen debt affordability, and more so with larger shocks to the IR.

We also look at the second measure of affordability, the mortgage debt service to income ratio (MDSI). This is the ratio between current total mortgage payments and income, thus a different indicator relative to the DSTI presented before, where only interest payments were observed and accounted for. We first look at the results for the whole sample, then we zoom in on different cohorts.

Figure 8 presents the shares of all borrowers who have a MDSI equal to or greater than 35%[4] for all borrowers that by each date have not yet repaid their loans, and thus remain in the sample. The downward pattern is driven by the decrease in gross payments over the simulation period (due to mortgages reaching their maturity) and the yearly increase in income. In 2016, the share of borrowers with an MDSI ratio equal to or greater than 35% is around 9% in the baseline scenario and declines each year until it reaches around 0.5% in 2044. An immediate shock would increase this share to 11% already in 2016, one year after the shock. The share increases somewhat less rapidly also after a shock in 2021. In this case it takes eight years to get back to pre-shock levels.

4 This is a common threshold in most studies that identify households with high default risk. As a reference, NIBUD recommends an MSDI ratios of about 25%–30% depending on income. The 35% threshold is thus beyond the recommended affordability threshold to actually be eligible for a loan.

Figure 8. *Share of borrowers with an MDSI ratio equal to or greater than 35% over the simulation period, in different scenarios*

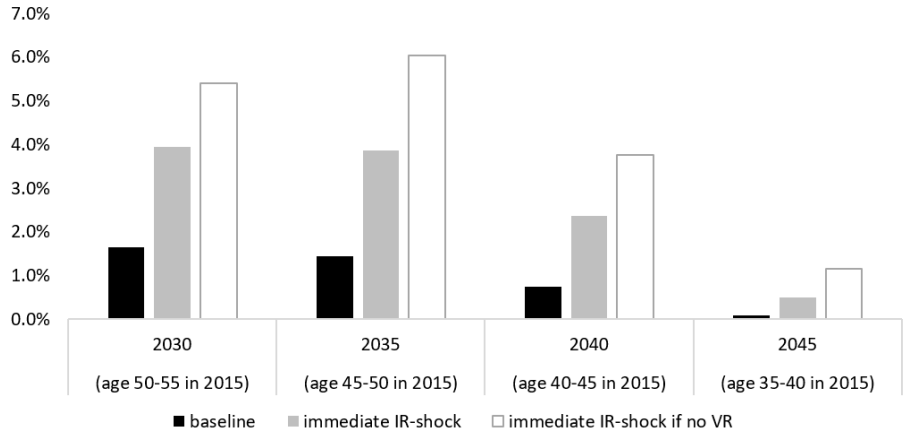


Explanatory note: The MDSI ratios are based on gross payments.

The above figure shows that the speed of recovery is also partly affected by voluntary repayments. Without these it would take eleven years to reduce the share of those with affordability problems back to the pre-shock levels of 2020. The figure above summarizes the evidence for the entire sample of current mortgage owners at different future dates. Most relevant to this study is the focus on the share of MDSI larger than 35% for the different cohorts approaching retirement (at different future dates). Figure 9 shows our main findings.

The figure looks at persons reaching the age of 65-70 starting from year 2030 (thus aged 50-55 in 2015 at the start of the simulation) through 2045 (when those aged 35-40 at the start of the simulation turn 65-70). It describes the share of those who are very likely to be unable to afford their debt any longer. Debt affordability is computed under the assumption that at retirement age (assumed to be equal to the cohort-specific state pension age) income (which had increased by 1% a year) will drop by 70%. We show average figures for persons aged between 65-70 so that we can interpret these figures as relevant for the population that is around retirement age. Also, we remove the benefit of the MID after 2030 from those who used it already for 30 years, assuming that at that time they will be in the lowest marginal tax bracket. In line with the ECB supervisory requirement, we do not assume changes in number of working hours nor unemployment spells, although partial retirement has been documented by several studies (Bloemen et al., 2016). This means that our assumptions may all overestimate actual income afterwards, thereby decreasing the

Figure 9: *Share of borrowers of different cohorts exceeding the 35% MDSI threshold at age 65-70*



Explanatory note: The figure looks at those reaching the age of 65-70 from year 2030 (thus aged 50-55 in 2015 at the start of the simulation) through 2045 (when those aged 35-40 at the start of the simulation turn 65-70). Debt affordability is computed under the assumption that at retirement age (assumed to be equal to cohort-specific state pension age) income (which had increased by 1% a year) will drop by 70%. Also, we remove the benefit of the MID after 2030 to those who used it for more than 30 years, assuming that at that time they will be in the lowest marginal tax bracket. We do not assume changes in number of working hours, nor unemployment spells. Source DNB LLD, own computations.

share of highly indebted households. Combined with the fact that the 35% threshold is higher than current affordability thresholds, this implies that our results can be interpreted as a lower bound.

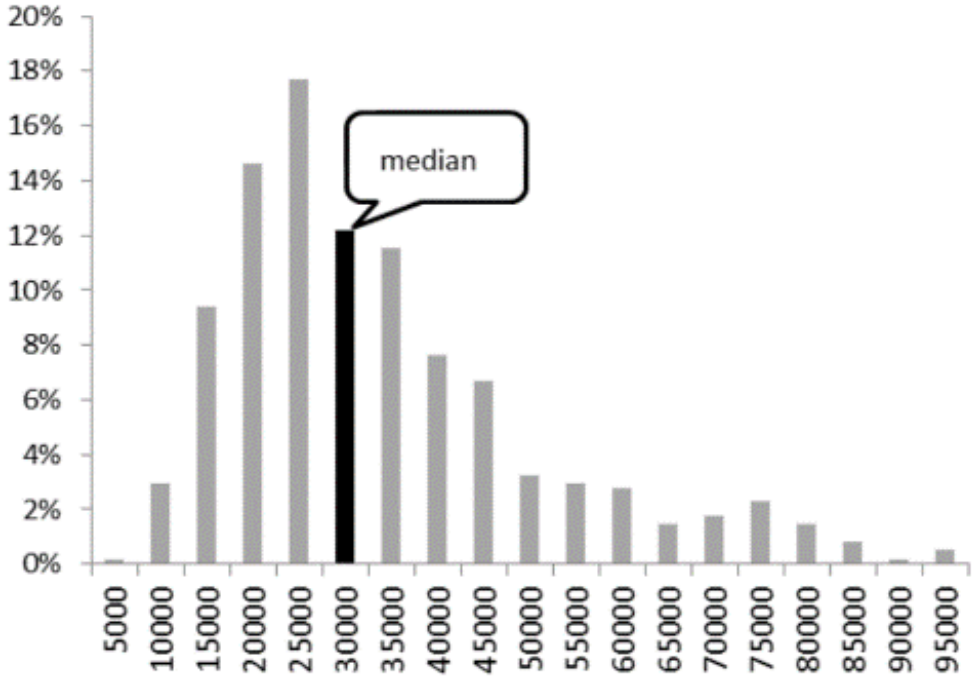
The figure shows that 4% of those reaching their retirement age in either 2030 or 2035 will cross the standard affordability threshold in case of an interest rate shock. Later cohorts, with far less IO debt, are less likely to experience affordability problems. Should these households not save nor voluntarily repay their debt, then the high-risk group increases in size and could get as high as 6% of all retirees up to 2035. As these results are a lower bound for our model, this group will likely not be negligible and require the attention of policymakers.

5. Summary and policy implications

In this paper we have discussed the debt affordability of the elderly, at present and in the future. We have considered the current interest payments on mortgages of the elderly and have investigated the effect of a potential interest rate shock on the total mortgage expenses of future cohorts of retirees. And we have assessed the role of voluntary repayments in the transmission of a shock in the mortgage interest rate by comparing the results of the simulation under different interest rate scenarios, where borrowers either do or do not voluntarily repay.

We have observed that older borrowers are more often exposed to IR shocks because they almost exclusively hold I0 debt. There also seems to be a clear relation between the mortgage interest rate, the amount of I0 debt, and the decision of borrowers to make voluntary repayments. Higher I0 debt and current interest rates are both associated with a higher probability of voluntary repayment. This is presumably due to the rising opportunity cost of savings when mortgage interest rates increase. The effect of an interest rate shock, here exemplified by the share of households with affordability problems, is larger when the interest rate scenario is more adverse. The increase in mean gross payments caused by an immediate interest rate shock is reduced by voluntary repayments. However, about 5% of borrowers who had a mortgage in 2015 will cross debt affordability thresholds after retirement in the next twenty

Figure 10: *Gross household income distribution of 65+ in the 90th percentile of the DSTI*



years. If no additional savings are used to reduce debt levels, this share is likely to increase above 6%.

The high-risk group is small but non-negligible in size. The related problems are persistent, and this has several policy implications. For instance, as Figure 10 shows, looking at the present-day elderly that cross the critical affordability threshold, this group has generally low income, with a median of €30,000. We have also described above their limited financial wealth.

Downsizing is not an easy option for this group, as their home equity is too low to allow purchasing a cheaper home without debt. Transforming their debt from interest-only into an annuity is also not an obvious option, as they would not be able to meet repayment requirements. Even moving to a free-market rental dwelling is not a likely option, as much of this group earns too little, while some earn too much to qualify for subsidized rental.

For the high-risk group described above, the only realistic option to face debt affordability problems is therefore to roll over their interest-only debt, at least in part. At some point, most notably between 2030 and 2045, banks will be confronted, for a large number of borrowers with interest-only debt, with the question of whether to prolong their debts beyond current maturity. In general, the current policy of supervisory authorities to discourage banks from rolling over existing interest-only loans is sensible. We have mentioned the efforts of the ECB and the AFM above, which match the requirements of the Basel agreements in terms of mortgage risk weight and the warning of the European Systemic Risk Board against interest-only debt. However, it is important to realize that for the specific high-risk group described here, this might lead to worsening outcomes, also for banks.

The supervisory authorities for the financial sector should closely monitor developments in debt affordability in order to prevent the need of policy intervention. Think for instance of a re-introduction of the mortgage interest deduction, which supervisory authorities have widely criticized in the past. However, avoiding re-introduction may not be easy, as the loss of the mortgage interest deduction will worsen the debt affordability of this high-risk group and increase the chance that political involvement will again introduce it. If needed, it is advisable, assuming that prudential considerations allow this, that these institutions not oppose the rolling over of interest-only debt for these high-risk households.

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