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Effects of further reductions in the LTV limit

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1. Introduction

The statutory loan-to-value (LTV) limit for residential mortgage loans was introduced in the Netherlands in 2012. This LTV limit is being reduced by one percentage point per year, from 103% today to 100% in 2018. The government has stated that a further reduction in the LTV limit is desirable in due course.[1] This is in line with the recent recommendations made by the IMF and the Wijffels Commission, which advocate further reduction of the LTV limit to 80%.[2] In this context, the Financial Stability Committee (FSC) is discussing the desired structural level of the LTV limit and the pathway to achieving this.

In this memorandum, the costs and benefits of a further, gradual reduction in the LTV limit to 90% are analysed, at the request of the FSC. The analysis shows that this measure will, in the medium term, benefit financial stability as it will reduce volatility in the housing market, lower risk of underwater mortgages, create a more stable financial sector and bring about more balanced economic growth. The macroeconomic costs of a lower LTV limit will be seen mostly in the transitional phase. Most first-time buyers will have to accumulate additional savings before they can afford a home. The average age at which people buy their first home is therefore expected to increase by several years. This has consequences for the number of housing transactions, for house prices and for private savings. It also creates a need for further growth in the supply of rental properties in the non-subsidised segment. Clearly, the macroeconomic costs go before the

1 See the Cabinet's vision paper on the Dutch banking sector, August 2013. 'A further reduction is desirable in due course, not only from the perspective of consumer protection but also to achieve healthier bank balance sheets. [...] The government will continue to follow the adopted pathway for reducing the LTV ratio to 100% up to 2018. Once the housing market has recovered robustly, additional proposals will be made with regard to the final LTV ratio and the continuing pathway to achieving this in the period after 2018.'

2 IMF (2014), Commission on the Structure of Dutch Banks (2013), OECD (2014).

financial stability benefits. In this respect, a cost-benefit analysis of a lower LTV limit is similar to a cost-benefit analysis of sustainable public finances: the costs associated with cuts are tangible and obvious in the short term, whereas the benefits are only felt in the longer term.

This study is structured as follows. The most important findings are summarised in chapter 2. Chapter 3 discusses the effects of a further reduction in the LTV limit on financial stability. Finally, chapter 4 contains an analysis of the macroeconomic effects.

2. Summary

The effects that a further, gradual reduction in the LTV limit to 90% would have on financial stability and macroeconomic development can be summarised as follows.

- A lower LTV limit would enhance the ability of first-time home buyers in particular to absorb shocks. The risk of residual debt will be small as a result of the reduction in the LTV limit to 100% in 2018 and the annuity-based repayment of mortgage loans in order to qualify for mortgage interest deduction, which was introduced in 2013. Still, first-time buyers will remain vulnerable during the first few years as they will have repaid a relatively small amount. In 2013, two-thirds of first-time buyers who bought their home since 2004 were underwater with their mortgages. If annuity-based repayments had been the norm in 2004, an LTV limit of 100% would have resulted in just under half of these households being underwater, while the figure would have been 13% if the LTV limit had been 90%.
- A lower LTV limit reduces the risk of boom-and-bust cycles in the housing market. Empirical evidence shows that structurally lower LTV ratios are associated with less volatility in housing prices. A reduced LTV limit is a supplement to the loan-to-income (LTI) standard, the application of which failed to prevent a housing bubble from developing in the Netherlands.
- Lower LTV ratios mitigate banks' credit risk and reduce the dependence of banks on market funding. A lower LTV limit can also promote competition in the mortgage market, due to the entry of foreign mortgage providers. With its high LTV ratios, the Netherlands currently is an outlier.
- In addition, a lower LTV ratio helps dampen the type of cyclical movements that have affected the Dutch economy over the past few decades. Whereas the releasing of home equity boosted Dutch spending in the 1990s, the downturn in the housing market after 2008

deepened the recession. Moreover, the trend in Dutch house prices in recent decades has contributed to the unequal distribution of wealth across generations.

- The macroeconomic costs of a lower LTV limit will be seen mostly in the transitional phase. Since some potential first-time buyers will not have the private means needed to buy a home, lowering the LTV limit will reduce demand for owner-occupied housing. The fall in the number of housing transactions will lead to a drop in house prices and residential investment. The additional savings required in order to accumulate the required private assets will temporarily reduce private consumption.
- The vast majority of restricted first-time buyers will have saved enough to be able to afford to buy a home after a few years. This will significantly limit the impact on the housing market and the economy as a whole. The macroeconomic effects may be reduced further as a result of gifts provided to first-time buyers by third parties to help them buy a home, although the size of this behavioural effect is uncertain as first-time buyers currently do not need to have any private assets in order to buy a home.
- While the LTV limit is being reduced, demand for rental property will grow by between 11,000 - 19,000 homes a year. That number will fall substantially when the gradual reduction of the LTV limit comes to an end. It not yet clear whether the rental market will be able to accommodate this additional demand. This could be facilitated through complementary policies.
- Once the LTV limit has been reduced to 90%, demand for owner-occupied housing will eventually fall by a maximum of 190,000 homes (approximately 2.5% of the total number of households). In the long term, mortgage debt will fall by almost 6%. If the LTV limit is gradually reduced to 90%, house prices will be 3.5-4% lower after five years

than would have been the case if there were no change in policy, and in the long term this difference will be 4-5%. These figures do not take account of the fact that house prices will recover in the long term when first-time buyers have saved enough to enter the housing market with a larger budget.

- In the long term the real economy will revert to the baseline and there will be no meaningful effects on GDP volume, private consumption, investment and unemployment.

These effects are surrounded by considerable uncertainty. The compulsory down payment when buying a home is a break with the recent past. The empirical results therefore need to be interpreted with caution. In addition, a number of potential consequences have not been taken into consideration. These include the direct consequences of a further reduction in the LTV limit for existing home owners and anticipatory behaviour on the part of potential first-time buyers.

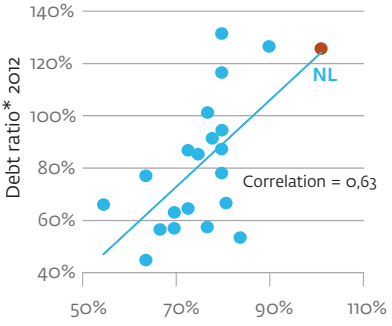
3. Effects on financial stability

3.1 Boom-and-bust cycles

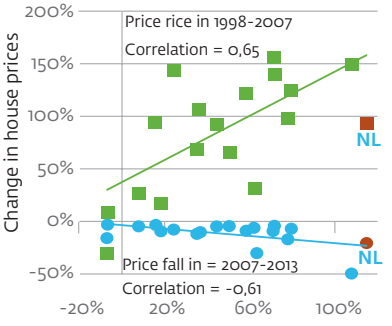
Trends in mortgage lending and house prices are affected by various factors besides the LTV limit, such as the tax system and the elasticity of supply of housing. This makes it difficult to determine the relationship between the LTV limit and the trend in house prices. International cross-sectional analysis found a significant positive correlation between LTV ratios and house price volatility. In countries with higher average LTV ratios, levels of mortgage debt are also significantly higher (Chart 1, left). Moreover, in countries where household debt rose rapidly prior to the crisis, there was a relatively sharp increase in house prices during the boom followed by a larger correction during the bust (Chart 1, right). A recent study by the Netherlands Bureau for Economic Policy Analysis (CPB) found that house prices are relatively volatile in the Netherlands when compared to other OECD member countries.[3]

Chart 1 LTV ratios, mortgage debt and house prices

Countries: AT, AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, JP, NL, NO, PT, SE, US



Typical LTV ratio at time home was bought



Increase in debt ratio* 1998-2007

Source: Almeida et al. (2006), ESRB, OECD, own calculations.

* Total household debt as a percentage of GDP.

3 CPB (2015).

Various empirical studies confirm that a structurally lower LTV limit is associated with less volatility in house prices.[4] Empirical research by the IMF and the OECD has found that a higher LTV ratio is associated with greater upward and downward house price shocks. More specifically, the IMF study shows that income shocks have a significantly greater effect on house prices in countries with a high LTV ratio than in countries with a low LTV ratio. This is consistent with the conclusions of Almeida et al. (2006), who find that house prices and the borrowing capacity of households are more procyclical in countries with a high LTV ratio.

Until now, the borrowing capacity of Dutch households has been primarily determined by the housing cost standard of the National Institute for Family Finance Information (Nibud), from which a loan-to-income (LTI) standard follows implicitly.[5] As this standard is linked to household income rather than trends in house prices, a rise in house prices is not automatically accompanied by an increase in borrowing capacity. Various empirical studies have found indications that a tightening of the LTI standard leads to a slowdown in credit growth.[6] Given this, the LTI standard is potentially an effective instrument for influencing the level of house prices. The LTI standard also determines the risk of over-indebtedness: the higher the LTI standard, the greater the likelihood that a home owner will not be able to meet his or her payment obligations in the event of a fall in income. The LTI standard therefore has a different focus from the LTV limit, which has a direct influence on the risk of residual debt.

4 See, among others, Lamont and Stein (1999); Almeida et al. (2006); IMF (2011); Andrews, et al. (2011) and Duca et al. (2011).

5 Strictly speaking, the Dutch LTI standard contains important elements of a debt service coverage ratio, in which the housing costs are calculated as a proportion of income. Using a minimum reference rate of interest may mean that the housing costs used in this calculation differ from the actual housing costs.

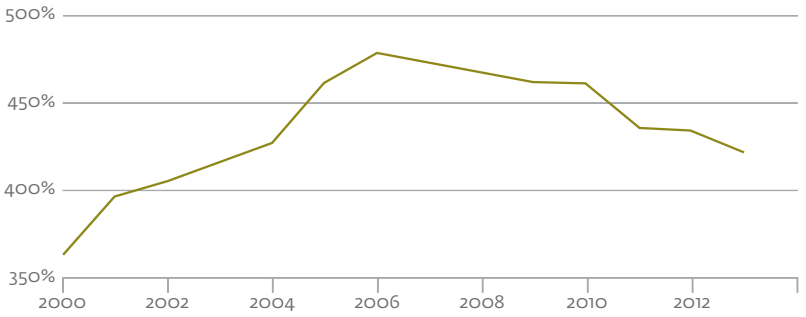
6 See, among others, Lim et al. (2011) and Kuttner and Shim (2013).

It should be noted that the LTI system used in the Netherlands contains procyclical elements, and therefore can increase house price volatility. In the Nibud system, the maximum LTI ratio rises as disposable income increases, and income shocks consequently have a greater impact on the housing market.[7] These procyclical elements contributed to the sharp rise in the LTI ratios of first-time buyers prior to the crisis and the subsequent fall during the crisis (see Chart 2).

In the Netherlands, the LTV limit serves as a counterbalance to the tax incentive provided by mortgage interest deduction, which encourages Dutch households to use as much leverage as possible to finance the purchase of a home. An LTV limit caps the associated risks. Although a

Chart 2 Trend in LTI ratio

LTI ratio of Dutch home owners at time home was bought, in percentage of disposable income



Source: DNB.

7 Interest rates may work to counter the impact of income fluctuations, to the extent that interest rates increase during the upward part of the economic cycle and fall during a downturn. That said, interest rates are primarily determined on the international capital market, and therefore the correlation between interest rates and the Dutch economic cycle is limited.

further cut in mortgage interest deduction is an effective way of reducing risks on the mortgage and housing markets, an LTV limit is still an important tool for preventing over-indebtedness.

The annuity-based amortisation that has been required since 2013 to qualify for mortgage interest deduction, ensures that the LTV ratio gradually falls over the term of the mortgage, provided house prices do not fall. This makes home owners more resilient to house price shocks. Despite this, first-time buyers remain vulnerable during their first few years of home ownership. With an annuity mortgage, relatively little is repaid during the first few years. In the case of a mortgage interest rate of 5%, it takes almost six years for the first 10% of the loan to be repaid. Given the level of house price volatility in the Netherlands, younger generations may still be underwater on a regular basis, even if an LTV limit of 100% applies.

3.2 Ability of households to absorb shocks

The risks associated with excessive lending are borne primarily by households, and in particular first-time buyers on the housing market. In the case of LTV ratios of 100% or more, these households find themselves in a vulnerable position if there is a fall in house prices or income. The fact that lenders are in a strong position to foreclose the collateral in the event of payment arrears only serves to increase this vulnerability. A high LTV ratio at the time a home is bought increases the likelihood that the household will have to sell the property and be left with residual debt in the event of divorce or unemployment, for example. First-time buyers are able to cover part of this risk through the National Mortgage Guarantee Scheme (NHG)[8], which therefore increases the capacity of young households

8 With NHG coverage, borrowers are protected from residual mortgage debt under certain conditions.

to absorb shocks. As a consequence, a significant portion of the risk is transferred to the government.

Owing to the high initial LTV ratios and the recent fall in house prices, at the moment approximately 28% of Dutch mortgages loans exceed the value of the collateral.[9] When buyers use more of their private means to fund the purchase of their home, their mortgages are less likely to end up underwater if there is a downward price correction. This effect is partly dependent on the frequency and extent of falls in house prices. Using historical data, Table 1 shows that price falls of over 10% occur internationally once every 25 years, while price corrections of over 20% occur once every 50 years. In the Netherlands, there were two periods during the past 50 years in which house prices fell by over 20%.

Table 1 How frequently does a major price correction occur on the housing market?

Nominal decline in house prices	Number of episodes	Frequency
More than 0%	34	Once every 16 years
More than 10%	22	Once every 25 years
More than 20%	11	Once every 50 years
More than 30%	6	Once every 91 years
More than 40%	3	Once every 182 years

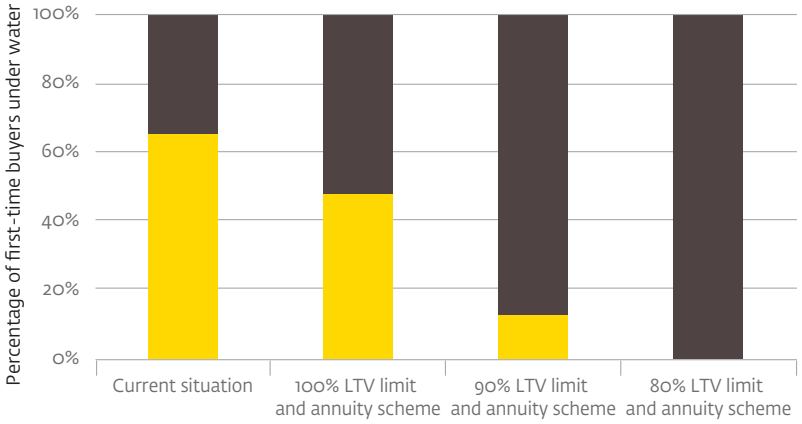
Source: OECD, own calculations

Note: based on dataset of 25 EU Member States covering the period 1970-2012 (546 observed years in total). Decline measured from peak to trough.

9 See CBS (2013) and DNB (2014).

Chart 3 LTV limits and underwater mortgages of first-time buyers

Impact of LTV limits on share of first-time buyers (aged under 30 when home was bought in 2004-2012) underwater in 2013



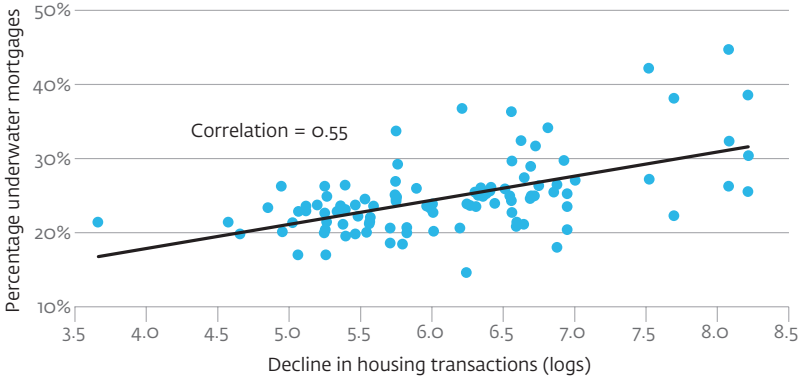
Source: DNB, loan level data.

At the end of 2013, 65% of households that took out a mortgage as first-time buyers during the period 2004-2012 were underwater with their mortgage. Chart 3 shows how many first-time buyers would have been underwater if a stricter regime had applied at the time the mortgage was originated, based on a mechanical analysis. As part of this, the level of the initial debt has been adjusted to reflect hypothetical LTV limits of 100%, 90% and 80%, and it is assumed that the entire mortgage will be repaid on an annuity basis. We assume that other factors, such as trends in house prices, remain unchanged. In addition, no account has been taken of potential behavioural responses. A regime in which there is an LTV limit of 100% and annuity-based repayments are the norm (i.e. the regime that will apply to all first-time buyers with effect from 2018) would have reduced the proportion of underwater mortgages of these households from 65% to 48%. If an LTV limit

of 90% had applied, just 13% of them would have been underwater with their mortgages, while virtually none of them would have been if the LTV limit had been 80%. This illustrates how further reducing the LTV limit to less than 100% is necessary if the risk of residual debt is to be substantially reduced. Households that are in negative equity are less likely to put their home up for sale, or will only do so for a relatively high price, particularly if they are unable to obtain funding to cover any residual debt.[10] This reduces the number of transactions, slows down the adjustment process on the housing market and reduces the mobility (including labour market mobility) of households. Chart 4 shows that the percentage fall in the number of transactions is highest in those municipalities where there are a large number of households with underwater mortgages. This provides some indication that underwater mortgages have had a detrimental effect on mobility. A lower LTV limit reduces the likelihood of negative equity. This makes it easier for first-time

Chart 4 Underwater mortgages and housing transactions

Observations per NVM region in the Netherlands (2-digit postcode). Decline in transactions (logs): 2012 vs 2008.



Source: NVM, DNB (LLD).

10 Van Dijk (2013); Genesove and Mayer (2001); Rabobank (2014).

buyers to move into rented accommodation or buy a more affordable home in the event of a fall in house prices. This means that if they lose their job or face the threat of unemployment, for example, they will be able to accept work elsewhere in the country.

A lower likelihood of negative equity also means that households will be in a better position to manage the risks associated with a more flexible labour market. Greater flexibility in the labour market is making the development of income over the life cycle of the mortgage more uncertain. The income of a household at the time the home is bought is therefore becoming less indicative of future income. An LTI standard may provide protection against small changes in income or housing costs, but it provides hardly any protection against major fluctuations in income or a housing market crisis. The higher the level of uncertainty regarding income, the less effective the LTI standard is as a tool for preventing payment problems. A prudent LTV limit, which limits the loss in the event of non-payment, is therefore increasingly important.

3.3 Spillover effects upon the economy

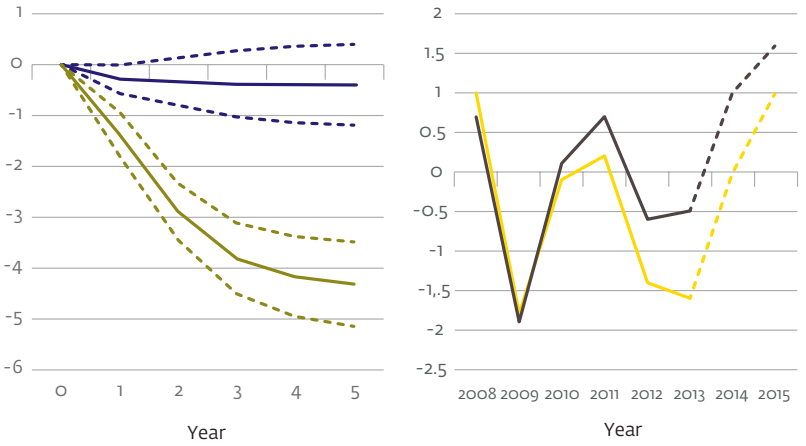
During the upswing of the credit cycle, lending and rising house prices push up economic growth, whereas during a downturn the economy is further slowed down. As owner-occupied homes generally make up a substantial proportion of the gross assets of households, fluctuations in house prices have a major impact on household spending. This is particularly true of households that have high levels of debt or negative equity. As such households are less able to absorb setbacks, they adjust their consumption more than other households.[11] This is one reason why recessions that are accompanied by falling house prices are considerably deeper and longer

11 See, for example, Mian at al. (2013); Bunn (2014); Van Es and Kranendonk (2014).

Chart 5 Impact of housing market on consumption

International (IMF): effect of house price correction on consumption (%-points), median plus one standard deviation (dashed line)

National (CPB): effect of home equity on consumption (y-o-y % change)



Source: IMF (WEO Spring 2012), CPB (MEV 2015)

than recessions in which house prices do not fall (Chart 5, left).[12] To the extent that a lower LTV limit helps dampen boom-and-bust cycles in the housing market, it also helps to reduce economic fluctuations.
During the past few decades, fluctuations on the housing market have

12 See, among others, Reinhart and Rogoff (2010). Claessens et al. (2008) found that recessions that are accompanied by falling house prices are on average four times longer than other recessions, and that lost output is, on average, two to three times higher in such recessions.

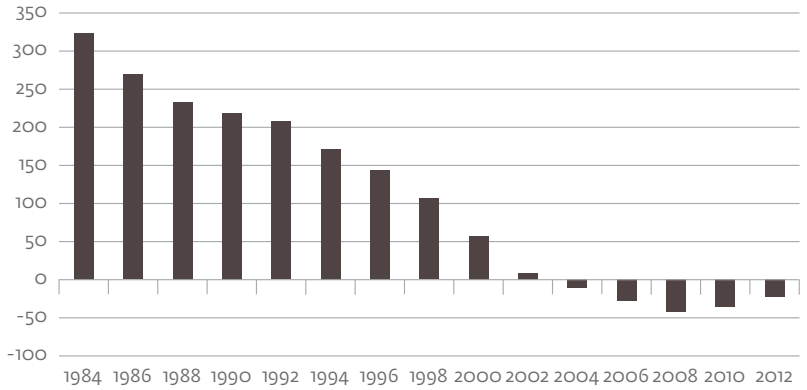
had a visible impact on economic growth in the Netherlands. Rocketing house prices at the end of the 1990s had a procyclical effect on economic growth. This boosted GDP volume by one percentage point in 1999 and 2000, according to estimates made by DNB.[13] The subsequent introduction of rules governing home equity loans made releasing equity less appealing from a tax perspective and therefore mitigated this flywheel effect during the boom phase. In recent years, the economic consequences of the bust phase on the housing market have become visible. According to calculations made by the Netherlands Bureau for Economic Policy Analysis (CPB), the fall in house prices has held back annual growth in consumption by 0.5 percentage points since 2010 (Chart 5, right). Young households in particular are having to contend with underwater mortgages. This group tends to have a high propensity to consume, and consequently capital losses have a relatively strong impact in terms of lower spending. In effect, their only buffer is their income. Moreover, this also has costs at a micro level, to the extent that such households are restricted in smoothing their consumption over their lifespan.

Over the past 30 years, trends in house prices have had a major impact on the distribution of home equity across generations (Chart 6). Older generations benefited from the strong rise in house prices in the period 1985-2008, when the value of the average home increased nearly five-fold. Younger generations have not been able to benefit from this, and many younger households are in negative equity owing to high levels of mortgage debt and the sharp fall in house prices since 2008. These arbitrary capital gains and losses may put solidarity between generations under strain, which may also have knock-on effects on other policy areas, such as pensions.

13 See DNB (2002).

Chart 6 Intergenerational distribution of home equity

Average home equity by year of first home purchase, in EUR thousands



Source: DNB, loan level data.

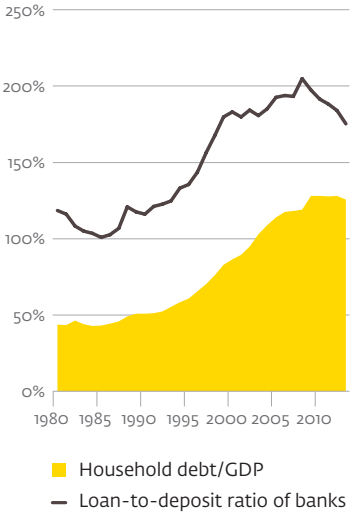
3.4 Stability of financial sector

Banks are not able to fund all mortgage lending in the Netherlands from deposits, and this has created a deposit funding gap. In recent decades, the loan-to-deposit (LTD) ratio for the Netherlands moved in parallel with growth in mortgage finance (Chart 7, left). Banks were forced to rely increasingly on market funding as an alternative to deposits. This is normally an attractive source of funding, but during the crisis the dependence on market sentiment turned out to be a source of vulnerability.[14] The introduction of the Net Stable Funding Ratio (NSFR) reduces this vulnerability. In spite of this, since 2008 international investors

14 This is one of the key driving forces behind the creation of the national mortgage institution (*Nederlandse Hypotheekinstelling* or *NHI*), which would enable banks to transfer risks from their mortgage portfolios to investors and hence reduce the funding risks to which they are exposed.

Chart 7 Bank reliance on market funding

Dutch household debt and LtD ratio of Dutch banks



Risk spread covered bonds issued by Dutch banks (in bps)

Source: Datastream, Dialogoc, DNB.

and rating agencies have become increasingly aware of the high LTV ratios and the fact that a substantial proportion of Dutch households are underwater with their mortgages. Although the credit losses have been very low so far, investors are demanding higher risk premiums and more security for bond loans issued by Dutch banks than they did prior to the credit crunch (Chart 7, right).

A lower LTV limit would bring the Netherlands more into line with other European countries, where LTV limits range from 80% to 90% (Table 2).

Table 2 International comparison of LTV ratios

At 31 December 2012

Country	LTV limit	Average initial LTV ratio	Applicable to	Exceptions
Netherlands	106-100%	101%	All mortgages	Residual debts, energy saving
Germany	80%*	70%	Cooperative mortgage banks	All other institutions
United Kingdom	-	75%	-	-
Denmark	80%	-	Mortgage banks	Other banks without covered bond funding
Sweden	85%	-	All institutions	Non-mortgage finance under EUR 30,000
Finland	90%	87%	Banks	No
Belgium	-	63%	-	-
France	-	79%	-	-
Italy	80%*	59%	All institutions	Higher LTV ratio permitted with additional collateral
Austria	80%	84%	Cooperative mortgage banks	All other institutions

Source: ESRB, Shim et al (2013)

* limit implemented by means of regulations governing covered bonds.

In countries that do not have formal LTV limits, LTV ratios tend to be lower than in the Netherlands. Bringing the LTV limit more into line with that in surrounding countries may encourage investors to continue to provide funding for Dutch banks. It may also reduce the entry barriers for foreign mortgage providers, thus increasing competition in the Dutch mortgage market. Moreover, a lower LTV limit would make it easier for Dutch banks to meet the new Basel liquidity requirements, under which an average LTV ratio of 80% is one of the criteria that is used to determine whether securitised mortgages qualify as liquid assets.[15]

Banks currently seem to be following lending policies that encourage households to take out mortgages with lower LTV ratios. For example, banks are charging higher spreads for maximum-value mortgages. In the fourth quarter of 2014, the average LTV ratio for new mortgages was 87%, while the figure for first-time buyers (persons aged under 35) was 92%. One possible explanation for these figures is that banks are already taking action in anticipation of the further reduction of the LTV limit up to 2018. According to the IMF, in view of this development it is possible to increase the rate at which the LTV limit is reduced after 2018.[16]

15 This requirement is not yet a binding restriction, since an alternative standard, based on the debt service coverage ratio, has been developed in a European context. In addition, a lower LTV ratio may limit the impact of a future risk-weight floor. The design of this floor is currently being developed within the context of the Basel Committee on Banking Supervision (BCBS), and it is expected to introduce a wider differentiation by LTV ratio.

16 See IMF (2014).

4. Macroeconomic effects

Reducing the LTV limit will potentially have a wide range of macroeconomic effects, which are difficult to examine in a single analytical framework. This section focuses primarily on the macroeconomic effects of changes in demand for owner-occupied housing and in the additional savings of households. An estimate is also provided of the scale of the required adjustment in the rental market.

Using a single model as a starting point for quantifying the effects is dangerous, due to the lack of available data and because at an international level little experience has been gained in the area of modelling the consequences of a reduction of the LTV limit. We have opted for a method based on three different approaches. These approaches have different limitations and possibilities, and consequently produce a more robust picture of the range of results. That said, a great many uncertainties remain.

The first approach focuses on calculating the consequences of a reduction of the LTV limit using DELFI, DNB's standard macroeconomic model. To this end, we first calculated what a reduction in the LTV limit would mean for the number of housing transactions, by using microdata to work out how many households would not have enough private assets to afford to buy a home and how long it would take them to save enough. The fall in the number of transactions was then translated into effects that can be calculated in DELFI, specifically consequences for mortgage debt, private savings and residential investment. This approach is explained in detail in section 4.1.

The advantage of using DELFI is that the consequences for the entire economy can be considered, but the drawback is that an additional intermediate step is required, as the number of transactions is not incorporated in DELFI as a variable. For this reason, in the second approach a new model was developed which directly correlates the number of

transactions to the effects on house prices. This approach is explained in detail in section 4.2.

The starting point used in the first and second approaches is a change in the number of transactions following a reduction in the LTV limit. The actual LTV ratio has not been included in the models, however. In the third approach the LTV ratio is included directly in a new model. The advantage of this approach is that fewer assumptions need to be made, but the drawback is that the validity of the results for the specific example of a reduction in the LTV limit can be called into doubt. This is because the estimates are inevitably based on past observations, which cover hardly any years in which there was a fall in the LTV ratios of first-time buyers. The modelling of the third approach and the assumptions made in this approach are explained in detail in section 4.3. Section 4.4 sets out the results of the model calculations in the three approaches.

Finally, in order to determine the scale of the drop in demand and the additional savings required, the analyses always focus on households that have very few, if any, private assets. This is because a reduction in the LTV limit would directly affect households in this category. In practice, this category consists mostly of first-time buyers. Given this, the LTV of first-time buyers was used in the analysis.[17]

4.1 First approach

In the first approach, microdata is used to translate a reduction in the LTV limit into consequences in terms of the number of transactions (see section 4.1.1). These consequences are subsequently translated, using statistical rules of thumb, into changes in levels of mortgage debt, private

17 Duca et al. (2011), among others, focus specifically on first-time buyers for the same reason.

savings and residential investment (see section 4.1.2). These effects are calculated using DELFI, DNB's standard macroeconomic model for the Dutch economy.[18] The effect on house prices is a particular point for attention. Appendix A contains a more theoretical discussion about the effect on house prices.

4.1.1 Impact of reduction in LTV limit on housing transactions

The first approach starts by calculating the effect of reducing the LTV limit on transactions by first-time buyers: how many potential first-time buyers will postpone buying a home, how long will it take for them to return to the market, and how many potential first-time buyers will never own their own home. This analysis was performed using confidential microdata held by DNB, specifically loan-level data (LLD). This database contains data on 5.6 million mortgage loans provided by Dutch banks, including some personal data pertaining to the relevant mortgagors, such as year of birth, income, collateral value and LTV ratio. As a result, adjustments can be made to allow for the fact that some households have taken out several mortgage loans secured against the same home. As first-time buyers are not defined in the database, this group has been approximated by selecting mortgagors who were no more than 35 years old when they bought their first home.[19]

In order to gain an understanding of the effect of a reduction in the LTV limit on transactions by first-time buyers, a single representative year was taken as a starting point. The selected year was 2012, which was the most recent available year for which the database was relatively full at the time the calculations were made. It is assumed that in all subsequent years the

18 See DNB (2011), DELFI, DNB's Macroeconomic Policy Model of the Netherlands, DNB Occasional Studies, Vol. 9, No.1, for a detailed description of the model. The long-term version of the model was used to calculate the longer-term effects.

19 This calculation was also performed using a maximum age of 30. The results turned out to be fairly insensitive to this.

cohort of first-time buyers that want to buy a home will have the same features as the 2012 cohort. As far as the number of transactions by first-time buyers is concerned, 2012 is not an appropriate choice as the number of transactions was at a historic low that year. We estimated the number of transactions in a normal year to be 200,000, or 4.6% of the housing stock. This percentage is higher than that for the years following the credit crunch, but lower than the percentage for the preceding period. The annual number of transactions by first-time buyers was subsequently assumed to be 100,000.[20]

In 2012, the mortgages of first-time buyers had an average LTV ratio of 96%. The proportion of the original loan that would not have been provided if the LTV limit were gradually reduced from 106% (the LTV limit in 2012) to 90% was calculated for the group of first-time buyers. The calculations revealed that if the LTV limit for 2028 is set at 90%, the median amount of credit rationing is EUR 19,000, while the average amount of credit rationing is EUR 19,600.

In order to determine whether the relevant households that face restrictions will decide not to buy a home, it has been assumed a household will not go ahead with a purchase if the amount of rationing exceeds a certain percentage of income. In our calculations we have assumed that this percentage is 7.5%, which corresponds to approximately EUR 2,500 in the case of an average income. A sensitivity analysis revealed that the effect on transactions is relatively insensitive to the assumption regarding this percentage. The micro-analysis revealed that if the LTV limit is 90%, approximately 73% of potential first-time buyers would not initially go

20 This assumption might be on the high side, in which case the effects of a reduction of the LTV limit would be overestimated. This assumption is closely linked to the assumption regarding the length of the chain. See footnote to Table 3.

ahead with a purchase. For the sake of brevity, this group is referred to below as first-time buyers who face restrictions.

As noted previously, some of these first-time buyers who face restrictions would still be able to go ahead with their planned purchase because they would be able to benefit from a gift or loan from a third party, normally their parents and/or grandparents. It is difficult to make assumptions concerning this behavioural effect, as first-time buyers are currently not required to use private assets to make a down payment. Despite this, in order to gain an impression of this effect, a survey was conducted using the DNB Household Survey (DHS). In this survey, 43% of respondents stated that they were willing to give money to a child or grandchild to help them buy a home of their own. The average amount that these respondents were prepared to give was approximately EUR 35,000 per child or grandchild.[21] This percentage seems to be on the high side. Some time ago, De Volkskrant reported that 10%-15% of housing transactions carried out in the first half of 2014 were made with the assistance of a gift provided by a third party.[22] According to regular DHS surveys, almost 6% of home owners who were interviewed received a gift from a family member in order to finance the purchase or furnishing of their home. In the 1990s, this figure was almost 9%. In this context, it should be noted that a down payment has not been necessary since the mid to late 1990s. It is assumed below that 10% of first-time buyers who face restrictions will still be able to go ahead and buy a home thanks to a gift (or cheap loan) provided by a member of their family. These gifts come on top of the gifts that were

21 We do not know whether they would actually have this money at their disposal. Given the extent of the average amount of home equity held by older generations, the respondents who are home owners should normally be able to mobilise a sum of this kind.

22 Providing a gift was a particularly popular move at the time, as gifts of up to EUR 100,000 that were provided for this purpose qualified for a temporary tax exemption. Although this temporary relaxation has not applied since 1 January 2015, gifts may still qualify for tax exemption, subject to an upper limit of just over EUR 50,000.

ade in 2012 and have therefore been processed in our dataset. This can be considered a prudent assumption, in view of the above. As the results are quite sensitive to this assumption, below we have also calculated the effect on demand for rented accommodation if 25% of first-time buyers who face restrictions receive a gift or loan.

For a great many first-time buyers who face restrictions, postponing the purchase of a home will not necessarily mean that this aspiration is ultimately abandoned. A large proportion of the households that decide not to buy a home owing to the lower LTV limit will start saving so that they will be able to afford a home at a later stage. The amount of time it takes households to be able to buy a home, i.e. the savings period, will determine the trends in transaction volumes and additional savings. The savings period is dependent on the additional amount of capital required in order to be able to afford to buy a home and also on the amount that can be saved from current income and income growth, i.e. the savings capacity.

In consultation with Nibud,[23] the initial savings capacity of households that face restrictions was calculated on the basis of their income and the mortgage standards as set by Nibud once a year. The mortgage standards determine the minimum expenditure on basic and luxury goods that a household can reasonably maintain in the long term, based on its income. This minimum expenditure is then used as a basis for determining the maximum housing costs. The initial savings capacity is calculated as the difference between the maximum housing costs according to the Nibud standards and the current housing costs of households that face restrictions. In order to determine the savings capacity in subsequent years, we have taken income growth among first-time buyers into consideration. In this

23 With thanks to Marcel Warnaar for his constructive contribution.

case, we no longer follow Nibud's mortgage standards system. The income of young households rises relatively quickly due to greater experience and career moves. Breakdowns of income profiles by age group, which were obtained from the Netherlands Bureau for Economic Policy Analysis CPB show that the income of working people in the 25-35 age group grows by over 4% a year on average, not including any contractual wage rises.[24] These wage rises provide first-time buyers with an ideal opportunity to increase their savings. This is because they can save the additional income without having to cut consumption. The Nibud mortgage standards are based on a snapshot of income and do not take any account of dynamic effects of this kind. For this reason, we have assumed in our analysis that first-time buyers save three quarters of their net wage rises.[25]

The current housing situation and housing costs were derived from the Woon Onderzoek 2012 housing survey (WoON 2012) and differentiated by income group. The WoON survey on housing and the housing environment is carried out every three years. A total of 69,000 respondents completed questionnaires for the WoON 2012 survey. The information obtained from the questionnaires was enriched using other sources of information, such as the Netherlands' Cadastre, Land Registry and Mapping Agency (Kadaster) and the Dutch Tax and Customs Administration, and weighting factors were used to extrapolate the data to cover all private households in the Netherlands.

24 The figure for people with a lower level of education is approximately 0.5 percentage points lower, while the figure for people with a higher level of education is approximately 0.5 percentage points higher.

25 If the Nibud system is followed, around a third to a half of the net wage increase can be saved. The impact of lower levels of savings from income growth on the drop in demand are discussed further on in this section. For technical reasons, our calculation takes account of a potential change to a higher tax bracket due to income growth and an increase in income growth. Annual income growth is defined as a percentage of the original income.

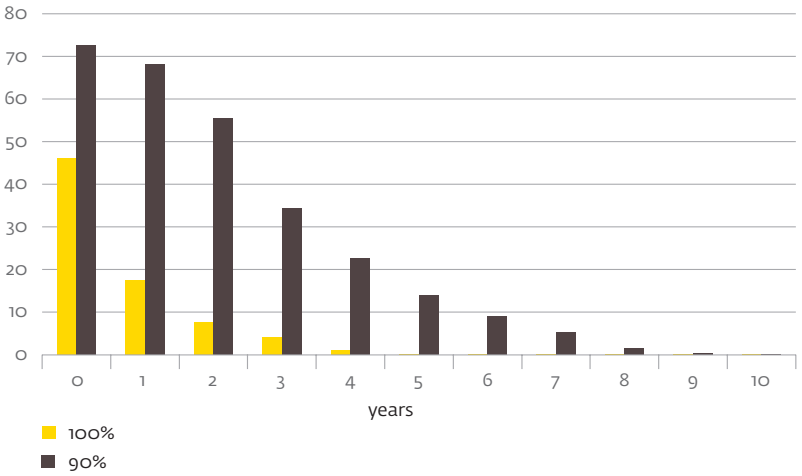
It is particularly significant that 40% of first-time buyers still live with their parents or are otherwise in a situation where they do not live independently, and as a result they are able to accumulate savings relatively quickly. No account has been taken of the fact that part of this group will decide to live independently during the savings period and will therefore move into rented accommodation. This will result in higher housing costs and therefore reduce the scope for savings. The effects of a reduction of the LTV limit is therefore underestimated to the extent that such first-time buyers decide to live independently during the savings period. No account has been taken of possible anticipatory effects either. The effects of a lower LTV limit at the time of introduction are overestimated to the extent that potential buyers start saving before they intend to buy their own home or conclude a mortgage and buy a home before the lower LTV limit comes into force.

The trend in the percentage of the cohort that is made up of first-time buyers who face restrictions is shown in Chart 8.[26] This percentage gradually increases if the LTV limit is reduced in stages. In 2018, when the LTV limit is 100%, 46% of first-time buyers face restrictions. As almost 29% of first-time buyers will be able to save the required down payment within one year, the proportion of this cohort that is made up of first-time buyers who face restrictions will fall to 18% one year later. In 2028, when the LTV limit is 90%, 73% of first-time buyers initially face restrictions. There is a gradual fall in this percentage owing to additional savings, but this fall is less rapid than when the LTV limit is 100% because the amount of savings required is considerably higher. The sharpest decline takes place after three years. After five years, 14% of first-time buyers will still face restrictions and not be in a position to buy a home.

26 Every year there is a group of young households that wish to buy a home. In this document, we refer to this group as a cohort. Chart 8 tracks the cohort over time and shows the percentage of households in the cohort that still face restrictions in a given year. The cohorts wishing to buy a home in subsequent years are therefore not taken into consideration here. These cohorts follow the same pattern but have a different starting year.

Chart 8 Comparison of percentage of first-time buyers facing restrictions over time

per cohort, under different LTV limits



If the LTV limit is reduced to 90%, first-time buyers will, on average, have to save for two more years compared to a situation in which there is an LTV limit of 100%. If we only consider first-time buyers who face restrictions, the savings period is almost three years longer on average in the case of an LTV limit of 90%, as a result of which the total savings period for this group is almost four years. We have assumed that those first-time buyers who face restrictions and have to save up for more than ten years will permanently abandon their plans to buy a home. However, this applies to less than 0.2% of the first-time buyers who face restrictions. By adding up the numbers of first-time buyers who face restrictions over time, it is possible to form a picture of the additional level of reliance on the rental market due to first-time buyers not purchasing their own homes until they are older or deciding not to buy a home at all. The analysis indicates that in the long term

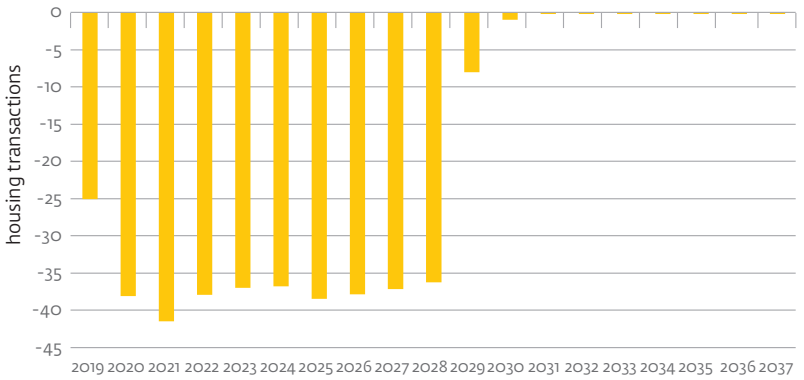
a gradual reduction of the LTV limit to 90% will increase demand for rented accommodation by a minimum of approximately 95,000 homes and by a maximum of approximately 190,000 homes. In the long term, this would mean that approximately 1.3%-2.5% more households would rent instead of buying their own home than would be the case if there were no change in policy. The vast majority of these households will save so that they can still buy their own home at a later stage. Section 4.4.2 looks at the additional demand for rented accommodation over time in greater depth.

Finally, in order to be able to determine the effect on transaction volume, we assumed that the drop in demand from first-time buyers will also have an effect on demand from existing home owners who move on to other homes. In the current situation, most existing home owners want to sell their home before they start looking for a new one. Consequently, when a first-time buyer buys their first home this creates a chain of transactions. Based on the WoON 2012 survey, it has been assumed that the length of this chain is 2, i.e. that for every first-time buyer who does not buy a home there is also one housing transaction by an existing home owner that does not go ahead. No account has been taken of the fact that a lower LTV limit may lead to some existing home owners also facing restrictions, which implies that the effect on housing transactions is an underestimate.

Chart 9 shows the effect of a gradual reduction of the LTV limit to 90% in 2028 on the total number of housing transactions, as contrasted to the situation in which there is no change in policy. The fact that the LTV limit will already be reduced to 100% in 2018 has been taken into account. The number of housing transactions that will not go ahead amounts to 25,000 in 2019 and approximately 37,000 a year for the period 2020-2028, with a spike of 41,000 in 2021. After 2028, the number of transactions that do not go ahead falls rapidly to zero.

Chart 9: Effect of gradual reduction of LTV limit to 90% on number of housing transactions

In thousands



It follows from the above that various assumptions have been made in order to determine the effect on the number of housing transactions. Sensitivity analyses of the most important assumptions were performed in order to determine the robustness of the results. The results are summarised in Table 3, which also provides a summary of possible behavioural and other effects that could not be modelled. The results are relatively insensitive to the age limit used to identify first-time buyers and the assumption concerning available private assets. By contrast, the trend in the number of housing transactions is sensitive to the assumptions concerning the rate at which potential first-time buyers accumulate savings. If first-time buyers are not able to save as much, there will be an increase in the number of first-time buyers who abandon their plans to buy a home because they have to save for more than ten years. If first-time buyers who face restrictions are able to save half of their income growth, approximately 2.5% of first-time buyers will not be able to save enough to be able to afford to buy a home

Table 3: Main assumptions for effect on housing transactions and sensitivity

Assumption	Basic scenario	Sensitivity
Age limit for first-time buyers	35 years	Low
Available capital (approximated, as a % of income)	7.50%	Low
First-time buyers facing restrictions who receive a sufficiently large gift	10%	Average
Scope for savings	Maximum net financial burden according to Nibud standard less current housing costs plus 75% of net wage growth	High
Length of chain	2.0	High*
First-time buyers who start to live independently and move into rented accommodation during savings period	Not in basic scenario	Effects underestimated
Anticipatory behaviour displayed by first-time buyers	Not in basic scenario	Effects overestimated
Restrictions faced by existing home owners who move on to other homes	Not in basic scenario	Effects underestimated

* The assumption regarding the length of the chain is linked on a one-to-one basis to the assumption concerning the proportion of the housing market that consists of first-time buyers. A longer chain corresponds to fewer first-time buyers in the housing market. Any adjustment to either of these assumptions is accompanied by a compensatory adjustment to the other assumption. This limits the sensitivity of the results to a change in one of the assumptions.

within 10 years. This figure increases to over 14% if first-time buyers who face restrictions are not able to save any of their income growth. However, if first-time buyers who face restrictions are able to accumulate additional savings by cutting back on so-called luxury goods, such as cars and holidays, the average savings period could fall by a year or more.[27]

The results are sensitive to the assumption regarding the number of transactions by existing home owners that do not go ahead because one transaction by a first-time buyer does not go ahead (length of the chain). This sensitivity is, however, negated to a degree by the fact that a longer chain is associated with fewer first-time buyers, which has the reverse effect on the results (see footnote to Table 3). The results are reasonably sensitive to the assumption regarding the number of first-time buyers that receive a sufficiently large gift.

4.1.2 Effects on mortgage debt, savings and residential investment

Since the number of housing transactions is not included in DELFI, the number of transactions have to be translated into variables that are incorporated in the model. The variables we selected are private consumption, residential investment and mortgage debt. These were chosen for the following reasons. If first-time buyers save more, this puts private consumption under pressure. A fall in the number of transactions also directly affects residential investment, which includes property transfer costs, such as the fees for estate agents, architects, notaries and surveyors, as well

27 When determining its mortgage standards, Nibud uses a basic budget for the minimum amount of necessary expenditure (this is the same for all income levels) as well as spending on 'luxury goods' for specified income levels. To put it roughly, for a pattern of expenditure to be considered sustainable in the long term, spending on 'luxury goods' must correspond to at least 50% of the average for all households with the same income level. In our basic pathway, the scope for savings was calculated on the basis of this standard. That said, the required savings period is almost always much shorter than the term of a mortgage. First-time buyers who face restrictions could achieve additional savings for a limited period of time by cutting back further on 'luxury goods'. If all first-time buyers who face restrictions limit themselves to only necessary expenditure, the average savings period falls by over one year.

as investments in new housing and the renovation of existing housing. Finally, a reduction in the number of new households entering the housing market leads to a fall in mortgage debt, which is a determinant variable for house prices in DELFI. Various assumptions were made when translating the number of transactions into consequences for mortgage debt, private consumption and residential investment. These assumptions and their sensitivity to the results are discussed in Appendix B.

In the calculation, the gradual reduction of the LTV limit leads to mortgage debt being some EUR 46 billion lower in 2028 than would have been the case if there were no change in policy. To put this into perspective, total mortgage debt in 2018 (the baseline year) is EUR 635 billion. There is downward pressure on private consumption since each transaction that does not go ahead results in a one-off reduction in spending on furnishings for the new home. In addition, there is a fall in consumption because first-time buyers who face restrictions need to accumulate additional savings. In combination, these effects lead to consumption volume being some EUR 0.7 billion lower in 2028 than would have been the case if there were no change in policy. In order to determine the effect on residential investment, it has been assumed that the property transfer costs component, which is directly related to the number of transactions, makes up 20% of total residential investment.

4.2 Second approach

The starting point for the second approach is, once again, a calculation of the effects of a reduction of the LTV limit on transaction volume in the housing market, for which microdata is used (see section 4.1.1).[28] In this approach, however, the consequences for the housing market are calculated using a simple structural vector autoregression (SVAR) model that was

28 With thanks to Marcus Morsink for his assistance with the estimation of the model.

designed especially for this purpose. In contrast to DELFI, this model includes a short-term correlation between transactions and house prices. The model was estimated using quarterly data covering the period 1985-2013.[29] The endogenous variables used in the SVAR model are nominal house prices, mortgage lending, disposable income, the effective mortgage interest rate and the transaction ratio (i.e. the ratio of the number of homes sold to the number of homes for sale).

The thinking behind the modelling is analogous to DELFI, and is as follows: when a household is looking to buy a home, it is primarily guided by the maximum amount it can borrow from the lender. The price of the house is therefore primarily determined by the mortgage loan. The maximum size of the loan is determined by the affordability of the mortgage. For this reason, disposable income and interest rates are the main determinants when it comes to lending. The model is described in more detail in Appendix C.

4.3 Third approach

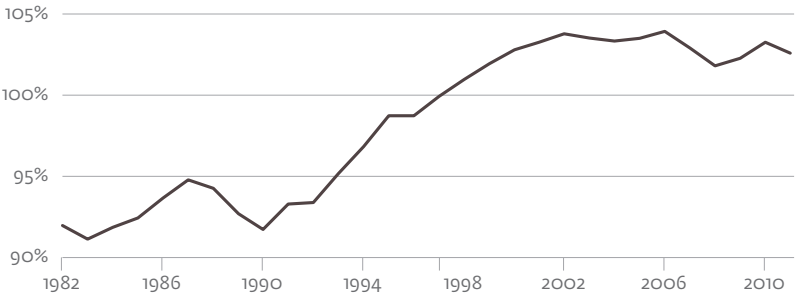
The disadvantage of the first two approaches is that the LTV ratio is not included in the models directly. In the approach described in this section, equations are estimated in which the average LTV ratio of first-time buyers is included as an explanatory variable. As a result, fewer assumptions need to be made. On the other hand, the validity of the results relating to the situation in which the LTV limit is reduced can be called into question owing to various empirical complications.

A series of the LTV ratio for first-time buyers was constructed on the basis of a number of specific questions in the DNB Household Survey (DHS).[30]

29 Data on transactions prior to 1985 are not available.
30 The questionnaire that was used in Timmermans (2012) was applied for this purpose. The DHS survey was repeated, providing 40% more data points.

The resulting series is presented in Chart 10. One of the complications is visible immediately: the LTV ratio increased throughout virtually the entire estimated period. As also described in Appendix A, it is by no means certain that the effects of a rising and falling LTV ratio are symmetrical. This is all the more likely when we consider that, for much of the estimated period, the LTV limit was so generous there was no need in principle for households to use private assets to make a down payment when purchasing a home. Since 2014, the introduction of the lower LTV limit has resulted in a different regime, in which households need to use their own capital to make down payments, and so the historical relationships that were identified may no longer apply. Another complication in the third approach is that a time series analysis based on this LTV series may attribute too many effects to changes in the LTV ratio, because when the LTV standards were relaxed in the 1990s the LTI standards and other lending criteria were also eased. To mitigate this problem, both the average

Chart 10 Average LTV ratio of first-time buyers



Source: DNB Household Survey (DHS).

31 The LTI limit for first-time buyers was constructed using the Standards of the National Mortgage Guarantee Scheme (NHG), taking into account a gradual relaxation of the qualifying income in the first half of the 1990s, when the partner's income could be taken into consideration for the first time.

LTV ratio for first-time buyers and the LTI limit for first-time buyers have been included as explanatory variables in the model.[31]

To determine the macroeconomic effects of a change in the LTV limit, we estimated a vector autoregression (VAR) model for the period 1982-2012.[32] This model estimates the effect on house prices and consumption. The disposable income of households, net household wealth and the LTI limit for first-time buyers are controlled for. The model is described in more detail in Appendix D. One drawback of the VAR model is that it does not include any long-term relationships. This makes the model unsuitable for analysing the long-term effects of the lower LTV ratio.

There is a difference between the LTV limit and the average LTV ratio of first time buyers because not all first-time buyers take out a mortgage for the maximum amount. It has been estimated, using the loan-level data, that a fall in the LTV limit of one percentage point is associated with a 0.6 percentage point fall in the average LTV ratio for first-time buyers. The effect is initially somewhat smaller in the case of an LTV limit of 100%, and increases as the LTV limit falls further below 100% and more households are squeezed.

4.4 Results

4.4.1 Macroeconomic results

The macroeconomic effects calculated in DELFI are shown in Table 4.[33] These effects are presented as cumulative percentage changes from the central projection. For example, the -4.1% change in house prices in year 5

32 Owing to the lack of reliable data prior to 1982, we could not start the sample period any earlier than 1982, which meant we could not include the housing market crisis at the end of the 1970s in the analysis.

33 With thanks to Robert-Paul Berben for producing the DELFI calculations.

Table 4 Macroeconomic effects of a gradual reduction in the LTV limit to 90%, using the DELFI model

LT = long term

Year	1	2	3	5	10	20	LT
	Cumulative percentage deviation from central projection						
Volumes							
Gross domestic product	-0.1	-0.2	-0.2	-0.3	-0.3	0.1	0.1
Private consumption	-0.1	-0.2	-0.5	-0.9	-1.2	-0.5	0.0
Corporate investment	-0.1	-0.4	-0.6	-0.9	-0.6	0.4	0.2
Residential investment	-2.6	-4.1	-4.8	-4.9	-4.9	-0.4	0.0
Exports of goods and services	0.0	0.0	0.0	0.0	0.1	0.2	0.1
Imports of goods and services	-0.1	-0.2	-0.3	-0.3	-0.3	0.1	0.1
Prices							
House prices	-0.2	-0.9	-2.1	-4.1	-6.3	-4.0	-4.1
Inflation (HICP)	0.0	-0.1	-0.1	-0.3	-0.7	-0.1	-0.1
Gross contractual wage bill of companies	0.0	-0.1	-0.2	-0.4	-0.9	-0.1	0.0
Labour market							
Unemployment (% working population)	0.0	0.1	0.1	0.2	0.2	0.0	-0.1
Employment (persons)	0.0	-0.1	-0.2	-0.3	-0.3	0.0	0.1
Other							
Mortgage debt	-0.5	-1.4	-2.2	-3.5	-6.5	-6.0	-5.9
EMU balance (% of GDP)	0.0	-0.1	-0.2	-0.3	-0.4	-0.1	0.1
EMU debt (% of GDP)	0.1	0.2	0.5	1.3	3.4	2.5	1.6

implies that after five years (i.e. in 2023) house prices will be 4.1% lower than would have been the case if there had been no change in policy. If, in the central projection, house prices in 2023 are 14.1% higher than in 2018, the envisaged reduction in the LTV limit would result in house prices increasing by 10%.

In DELFI, in the long term the trend in house prices is determined by factors affecting demand, and by mortgage debt in particular. In turn, in the long term the trend in mortgage debt is determined by disposable income, the net mortgage interest rate and credit conditions. The fall in the number of housing transactions leads to a reduction in mortgage debt, as a result of which house prices are over 6% lower after 10 years. The consequences for consumption are quite moderate, which explains why the GDP effect is not very great either. In the long term, rebalancing mechanisms come into effect and the real economy reverts to the original path. Demand for owner-occupied housing falls on a permanent basis, however, as each cohort of first-time buyers has to save for a number of years before buying a home. As a result, house prices fall by approximately 4% on a structural basis. In the long term, mortgage debt is almost 6% lower than in the situation where there is no reduction in the LTV limit.

The other models can only calculate the effects on real house prices and private consumption. This is summarised in Table 5, which also includes the relevant results from DELFI for comparative purposes. As the VAR model is not well-suited to determining long-term effects, these effects have not been reported. According to these models, house prices are lower in the short, medium and long term than would have been the case if there were no change in policy. The results differ in the extent of the decline in house prices. In the first five years, the models do not differ greatly in terms of their results.

Table 5 Effects on house prices and consumption according to different models

LT = long term

Year	1	2	3	5	10	20	LT
	Cumulative percentage deviation from central projection						
House prices							
DELFI	-0.2	-0.9	-2.1	-4.1	-6.3	-4.0	-4.1
SVAR model	-0.1	-0.7	-1.6	-3.7	-8.5	-7.9	-5.2
VAR model*	0.0	-0.5	-1.3	-3.3	-9.0	-10.9	
Private consumption							
DELFI	-0.1	-0.2	-0.5	-0.9	-1.2	-0.5	0.0
VAR model	0.0	-0.1	-0.2	-0.5	-1.2	-1.2	

* Relates to real house prices.

The differences between the results increase slightly when a period of 10-20 years is considered. This is unsurprising, since the long-term results are determined largely by the restrictions imposed on the models. In the long term, for example, house prices recover in DELFI and the SVAR model to a certain extent, whereas there is no such recovery in the VAR model owing to the specifications that were selected. It should be noted that the timetables are stylised scenarios that often become less plausible as the horizon increases. In this regard, in the long term the supply of owner-occupied housing and rented accommodation will adapt to accommodate new institutions on the housing market, but no account has been taken of this in the analyses. In addition, in the very short term the results of the models are not so comparable and depend on the exact specifications. In the VAR model, for example, the effect of a change in the LTV ratio on house prices is

delayed by one year, as a result of which the effect in year 1 is zero. In DELFI and the SVAR model, by contrast, house prices react during the first year.

In the long term, and assuming there is no change in the supply of housing, the increase in house prices is 4%-5% lower than would have been the case if there were no change in policy. These figures do not take account of the fact that house prices will recover when first-time buyers have saved enough to enter the housing market with a larger budget.

4.4.2 Consequences for the rental market

It follows from the analysis in section 4.1.1 that reducing the LTV limit to 90% will lead to demand for owner-occupied housing declining by a maximum of approximately 190,000 homes in the long term. This drop in demand is mostly due to the fact that first-time buyers have to save first and will enter the housing market at a later stage. This group corresponds to approximately 2.5% of the total number of households in the Netherlands. The majority of these households will resort to the rental market. With regard to policy, this raises the question of whether the rental market will be able to accommodate this additional demand without bottlenecks arising. The answer to this question depends on the duration of the transitional period, among other things. To gain an impression of the effect on the rental market, we have considered the cumulative additional demand for rented accommodation over time. As it is uncertain how a change in policy will affect housing preferences, it is difficult to calculate the additional demand for rented accommodation precisely, and so lower and upper limits have been determined.

The lower limit for the additional demand for rented accommodation was determined by the number of potential first-time buyers who face restrictions, who already live in rented accommodation and who will stay there for longer due to the lower LTV limit. By not moving, they will create

additional demand for rented accommodation. According to WoON data, 60% of all first-time buyers lived in rented accommodation (subsidised or otherwise) before they bought their first home. The additional demand for rented accommodation as calculated in this way is a low estimate for two reasons. First of all, first-time buyers who continue to live with their parents or are otherwise not living independently will be able to save money at a faster rate, on average, than first-time buyers who live in rented accommodation. Consequently, tenants will be overrepresented among first-time buyers with a longer savings period, and therefore the assumption of 60% is on the low side. In addition, some of the first-time buyers who face restrictions and do not live independently will, in the course of time, decide to live independently and look for rented accommodation.

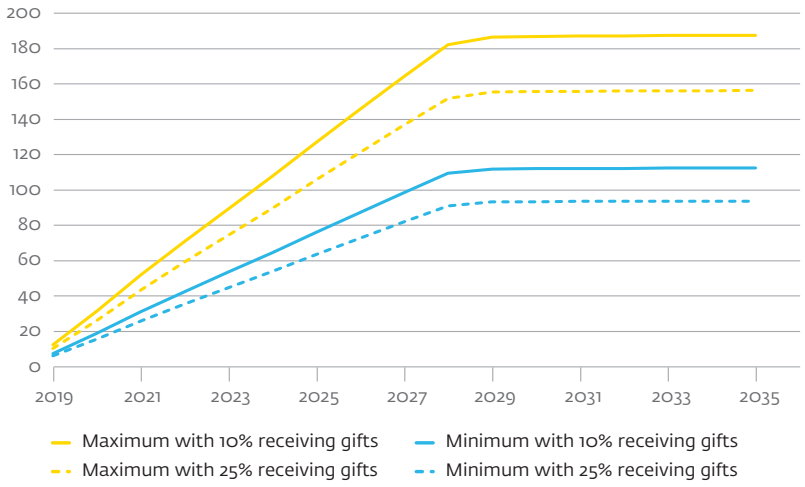
The upper limit for additional demand for rented accommodation is determined by the total number of first-time buyers who face restrictions. It has been assumed that all first-time buyers who face restrictions and do not live independently will temporarily opt for rented accommodation owing to the reduction in the LTV limit. A substantial portion of these first-time buyers who 'still live at home' will probably not decide to enter the rental market. Of this group, 94% will be able to save enough to buy a home after two years if they continue not to live independently. If they decide to rent first, these first-time buyers who face restrictions will not be able to save money as quickly, and so they will not be able to afford to buy a home until later. There is therefore a clear incentive for not renting in the meantime.

In Chart 11, the lower and upper limits are shown by continuous lines. The additional demand for rented accommodation during the period in which the LTV limit is reduced (up to the end of 2028) ranges from 11,000 to 19,000 homes a year.[34] This corresponds to cumulative additional demand

34 There is a one-off increase in demand of up to 21,000 homes in 2021.

Chart 11 Cumulative additional demand for rented accommodation in the event of a gradual reduction in the LTV limit

In thousands



of between 112,000 and 187,000 rental homes in 2030. After 2030 there is hardly any increase in additional demand for rented accommodation. In the basic scenario, the assumption is that 10% of first-time buyers who face restrictions will receive a sufficiently large gift. By way of a sensitivity analysis, we examined what the consequences would be if a higher proportion (i.e. 25%) of first-time buyers received sufficiently large gifts (see dotted lines in Chart 11). In this case, there is less demand for rented accommodation, and cumulative additional demand ranges from 95,000 to 160,000 rental homes.

The Cabinet has taken steps to boost supply and demand in the non-subsidised rented housing segment. At the moment, it is still too early

to gain an idea of the effects of this policy. There was a sharp increase in non-subsidised rented housing as a proportion of the total housing stock between 2006 and 2012 (from 2.9% to 4.7%). However, this increase may be temporary in nature, because it is partly attributable to owner-occupiers with two homes temporarily offering one home for rent owing to the financial crisis. Based on the number of building permits that have been granted, it seems that the rate at which new housing is constructed in future will not be fast enough to satisfy the expected demand for non-subsidised rented accommodation. In the event of a further reduction in the LTV limit, demand for non-subsidised rented accommodation will increase further, putting additional strain on the non-subsidised rented housing segment.
In addition to constructing new housing, the supply of non-subsidised rented accommodation can be increased by converting owner-occupied housing into rented accommodation and transferring subsidised rented accommodation to the private segment. However, it is difficult to predict the extent to which this will happen. The government could increase supply on the private rental market and also reduce the strain on the rental market as a whole by introducing complementary policy measures.

Appendix A How does a reduction in the LTV limit affect trends in house prices?

The mechanisms that arise depend on the regime

If there were no constraints on credit, potential house buyers would choose a home that is in keeping with their preferences, approach the bank for a loan to fund the part of the purchase that they cannot immediately pay for themselves, and then move into their new home. In reality, however, many households face credit restrictions. Our focus below is on this group of households.

Many potential buyers of homes are first-time buyers, who often have few private assets, if any, and therefore have to depend on mortgage finance in order to buy a home. Many first-time buyers will be prepared to take on a large mortgage because they expect their income to rise or they want to benefit from the tax subsidy for mortgage interest payments. Moreover, there is not enough suitable rented accommodation in the non-subsidised sector. In order to curb excessive risks, the bank and the government impose a limit: the maximum size of the mortgage is limited by the housing cost standard under the Nibud system, which implies a loan-to-income (LTI) limit. To date, this LTI limit has been determined by the borrowing capacity, and hence the budget, of first-time buyers on the housing market. Up to now, the LTV limit – which is 103% for 2015 – has always been high enough to enable households to buy a home without using any private assets to make a down payment (assuming the purchasing costs to be paid by the buyer amount to around 4% of the value of the property). Under a regime of this kind, the LTI limit determines the size of the mortgage loan.

However, we are now at a pivotal point. A further fall in the LTV limit from its current level would imply that in future first-time buyers would, to an increasing extent, have to use private assets to make a down payment when purchasing a home. For some first-time buyers, raising the private assets needed to buy a home will be relatively painless, because they

can use savings they accumulated in the past or they have a gift or loan from a family member, for example. First-time buyers who are not in this position will have to buy a less expensive (or smaller) home than they had originally planned. In practice, however, this will not be an appealing option for many households.[35] Two other options remain: saving and therefore postponing the purchase of a home, or, if accumulating the required savings takes too long, abandoning all plans to buy a home and renting on a permanent basis.

A second group of potential buyers that would be affected by a reduction in the LTV limit consists of existing home owners who are underwater with their mortgage. A reduction in the LTV limit would affect them in two ways. First, they would be directly affected, because they would have to use more private assets for a down payment when they buy their next home. They would therefore need to save even more in order to buy a new home. This group would also be affected indirectly, as the reduction in the LTV limit means the buyers of their existing homes would have restricted budgets (many of these buyers will be first-time buyers).

Consequences of a lower LTV limit for house prices

A further reduction in the LTV limit would lead to a drop in demand in the short term, as some potential first-time buyers would have to save before they can afford to buy a home. This effect would become greater as the LTV limit is reduced further, because the LTV limit would be binding on more and more households. Initially, this would lead to a drop in the number of transactions. On the face of it, it seems presumable, all other things being equal, that in the first years following the change in policy

35 Let us imagine a situation in which there are no purchasing costs to be paid by the buyer and the LTV limit is 95%. In this situation, a first-time buyer with private assets of EUR 10,000 would be able to buy a house valued at EUR 200,000. If the LTV limit is then reduced to 94%, the private assets of EUR 10,000 would restrict the first-time buyer to houses worth up to EUR 166,667 (i.e. 16% cheaper).

house prices would be lower than they would have been if there were no change in policy, but the extent to which this would happen depends largely on the transitional period that is chosen. Many potential first-time buyers would rent a home while they save, while others would continue not to live independently. As the supply of housing (including owner-occupied housing) is highly inelastic in the Netherlands, this means, all other things being equal, that over time rents would rise and owner-occupied housing would fall in price.[36] The opposite occurred in the 1990s, when greater availability of mortgage finance increased demand for owner-occupied housing and contributed to rocketing house prices.

Moreover, various anticipatory effects may arise in the short term. If, for example, a further reduction in the LTV limit is announced, potential first-time buyers may decide to start saving sooner so that they can afford to make the required down payment in due course. This may mean that the lower LTV limit places less downward pressure on housing transactions and house prices. It is also conceivable that households may quickly take out a mortgage and buy a house before the new, lower limit comes into effect, which would have the effect of temporarily increasing the number of transactions and house prices. That said, there is a risk that the announcement of a further reduction in the LTV limit would adversely affect the confidence of first-time buyers in the housing market and that this would lead to them postponing the purchase of a home. This could have a negative effect on the number of transactions and house prices.[37]

At the moment, it is not clear what long-term effect a lower LTV limit would have on house prices. The age at which the average first-time buyer buys his or her home would increase. This implies a permanent shift from

36 Swank et al. (2002) show that the housing supply in the Netherlands is inelastic.
37 If this effect arises, the credit quality of the mortgage portfolios held by banks may deteriorate in the short term.

owner-occupied housing to rented accommodation. It may be the case that the capacity of some potential first-time buyers to save is so low that they are no longer able to afford to buy a home at all. One effect of this permanent drop in demand for owner-occupied housing would be a smaller supply of owner-occupied housing, since less new owner-occupied housing would be constructed. Moreover, the drop in demand would push house prices down. That said, after some time the vast majority of first-time buyers would return to the housing market with a larger budget. At this point, their budget would consist of the mortgage, which might be the same as it would have been if there were no change in the LTI ratio or income, plus the private assets they saved so that they could comply with the lower LTV limit. As a result, these potential first-time buyers could offer more money for a home than was previously the case, which may have the effect of driving house prices up.[38]

Ideally, empirical evidence should be used to assess whether house prices would be higher or lower in the long run than if there were no change in policy. In practice, however, this is difficult as the required time series are not available, are not long enough, or are not sufficiently reliable or representative. Moreover, in the past there were mostly increases in the LTV limit, and an increase in the LTV limit does not have the same effect as a reduction in the LTV limit. The effects of various mechanisms in situations when credit restrictions are increased are different from those that occur when such restrictions are reduced. In addition, the dynamics of the effects that occur will not be symmetrical.

38 The extent to which their budgets increase would depend on their personal preferences. Some first-time buyers would be willing to carry on saving until they could obtain the maximum mortgage based on the LTI standard, while others would weigh the disadvantage of the longer savings period against the perceived benefits of the envisaged quality of their home.

Appendix B Translation of transactions into mortgage debt, savings and residential investment

When determining the effect on nominal mortgage debt, the assumption was made, on the basis of data obtained from the database, that the average mortgage loan of first-time buyers who face restrictions amounts to EUR 207,000. Every transaction by a first-time buyer that does not go ahead due to the new policy will lead to total mortgage debt falling by this amount.[39] This does not apply to transactions by existing home owners that do not go ahead, as these households already have a mortgage. No account has been taken of the fact that existing home owners normally increase the size of their mortgage when they move, as the new home is often more expensive. This implies that the effect on mortgage debt is an underestimate. In this calculation, the gradual reduction in the LTV limit results in the level of mortgage debt being some EUR 46 billion lower in 2028 than would have been the case if there were no change in policy. To put this into perspective, total mortgage debt in 2018 (the baseline year) is EUR 635 billion.

The effect on private consumption consists of two components. First, each transaction that does not go ahead results in a one-off reduction in spending on furnishings for the new home. This amount has been assumed to be on average 2% of the value of a starter home, or approximately EUR 4,000.[40] If the housing transaction goes ahead at a later date, spending on furnishings will also occur at that point. Second, first-time buyers who face restrictions will save up so that they can still afford to buy a home at a later stage. These savings will reduce consumption by EUR 3,500 a year on average for the duration of the savings period.

39 The thinking here is that if the housing stock is fixed, there will be one household that ceases to be an owner-occupier for every household that becomes a new owner-occupier. It is assumed that households that cease to be owner-occupiers (a group which consists mostly of older people and deceased persons) will no longer have any mortgage debt.

40 This sum of EUR 4,000 has also been applied to existing home owners. The average value of a new home bought by an existing home owner is higher than that of a starter home, and this implies that the effect on consumer spending is an underestimate.

In combination, these effects lead to consumption volume being some EUR 0.7 billion lower in 2028 than would have been the case if there were no change in policy. Private consumption amounts to approximately EUR 300 billion in 2018, the baseline year.

To determine the effect on residential investment, it has been assumed that approximately EUR 35 billion will be spent on investment in 2018, the baseline year. The property transfer costs component is directly related to the number of transactions. The share of residential investment attributable to property transfer costs in a normal year has been fixed at 20%.[41]

The main assumptions and their sensitivity to the results are contained in Table B1.

Table B1 Assumptions used when determining the effect on mortgage volume, consumption and residential investment, including indication of sensitivity

Assumption	Basic scenario	Sensitivity
One-off furnishing costs	EUR 4,000	Low
Annual additional savings of first-time buyers who face restrictions	EUR 3,500	High
Annual residential investment	EUR 35 billion	Average
Proportion of residential investment attributable to property transfer costs	20%	Average
Effect due to existing home owners increasing mortgage when moving house	Not in basic scenario	Effects underestimated

41 See CPB (2007).

Appendix C Relationship between transactions and prices on the housing market: a DELFI-based approach

This appendix describes a model that captures the relationship between transactions and prices on the Dutch housing market. The model is a structural vector autoregression (SVAR) model that is estimated using quarterly data. The SVAR model follows the specifications in DELFI (DNB's macroeconomic model) for the long-term relationship between house prices and lending and for the correlation between lending, disposable income and the effective mortgage interest rate. The estimated results are set out in the appendix, which illustrates the model dynamics using shocks that affect the transaction ratio and mortgage lending.

C1.1 Long-term SVAR model follows DELFI specifications

The long-term relationships in the SVAR model are based on DELFI. We replicate the DELFI equations by imposing various restrictions when estimating the SVAR model. In DELFI, the level of house prices is modelled as a function of mortgage lending:

(1) $\ln PCQ_t = \alpha_1 + \beta_1 * \ln WOHG_t$

where PCQ is house prices and WOHG is lending. In turn, the level of lending is explained in terms of disposable income and the effective mortgage rate:

(2) $\ln WOHG_t = \alpha_2 + \beta_2 * \ln LDUID_t + \beta_3 * RHEFF_t$

where LDUID is disposable income and RHEFF is the effective mortgage interest rate. We embed both of these relationships in a SVAR model, in which the endogenous variables are house prices, lending, the transaction ratio, disposable income and the effective mortgage rate. In line with DELFI, we use the unemployment rate as an exogenous variable.

C1.2 The six variables in the SVAR model

The model contains six variables. The price index is a series for house prices based on constant quality. Mortgage lending, disposable income and unemployment are obtained from the DELFI database. The effective mortgage rate is calculated by adjusting the nominal mortgage interest rate for the highest tax bracket: RHEFF = ln(RH/100) + ln(1 – TAXTR). The transaction ratio is the number of homes sold in a quarter divided by the average number of homes for sale during that quarter.
We opt to model the six series as I(1), even though the house prices and mortgage lending seem to have I(2) properties, formally speaking (see Table C1). There are three considerations that lead us to select I(1). First, a trend in the growth of house prices and growth in lending is not economically plausible. Second, although the series seem to be I(2), the model is able to generate stable and plausible forecasts. Third, differencing in house prices and lending does not lead to clear improvements.

Table C1 Tests of stationarity for six series in SVAR model

Variable	Level	First difference	Second difference	Formal conclusion
House prices	-1.85	-1.99	-16.12***	I(2)
Mortgage lending	-1.83	-0.82	-13.65***	I(2)
Transaction ratio	-0.62	-5.43***		I(1)
Disposable income	-1.76	-6.78***		I(1)
Mortgage rate (effective)	-1.87	-7.98***		I(1)
Unemployment rate	-2.76*	-3.55***		I(1)

NB: The table gives t-values for augmented Dickey-Fuller (ADF) test.
*/**/*** indicates whether the null hypothesis of the unit root test can be rejected at the level of 10%, 5% or 1%, respectively. Sample: First quarter of 1985 to fourth quarter of 2013.

C1.3 Comparison of estimated results with DELFI

The estimated results for the long-term relationships are comparable to those obtained in DELFI. As is the case in DELFI, we find a positive, significant relationship between lending and house prices (equation 3). We also find a positive correlation between disposable income and lending, and a negative correlation between the mortgage rate and lending (equation 4). In both cointegration relationships, the coefficient for a linear trend (T) is significant. The standard errors are shown in brackets.

(3) ln PCQ = -6.50 + 1.12 ln (WOHG) – 0.01 T
(0.07) (0.00)

(4) ln WOHG = -24.66 + 3.46 ln (LDUID) – 0.13 RHEFF – 0.01 T
(0.42) (0.09) (0.00)

The estimated results for the dynamic equations for house prices and the transaction ratio are plausible. The estimates for the SVAR model are shown in Table C2. Both error correction terms have a negative influence on the dynamic equations for house prices and the transaction ratio. In the case of mortgage lending, there only is a weak effect of the error correction terms. Disposable income and the interest rate are positively influenced by the cointegration relationships.

Table C2 Estimates for the SVAR model

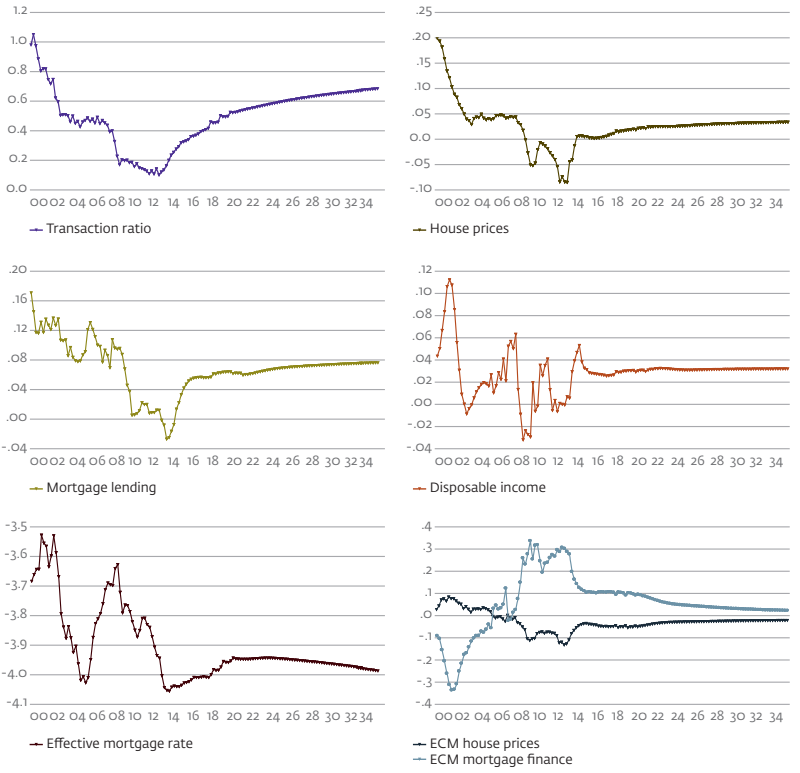
	House prices	Mortgage lending	Transaction ratio	Disposable income	Mortgage rate
ECM 1	-0.08	0.03	-0.39	0.07	0.35
(house prices)	(0.02)	(0.03)	(0.24)	(0.03)	(0.20)
	[-3.47]	[1.33]	[-1.64]	[2.28]	[1.74]
ECM 2	-0.03	-0.01	-0.24	0.04	0.19
(mortgages)	(0.01)	(0.01)	(0.10)	(0.01)	(0.08)
	[-2.95]	[-1.40]	[-2.49]	[3.35]	[2.28]
House prices					
-1	0.47	0.10	-0.48	0.20	0.22
	(0.09)	(0.10)	(0.94)	(0.13)	(0.79)
	[5.32]	[0.94]	[-0.51]	[1.60]	[0.28]
-2	0.37	-0.06	-0.41	0.04	-0.74
	(0.10)	(0.11)	(1.02)	(0.14)	(0.86)
	[3.90]	[-0.58]	[-0.40]	[0.30]	[-0.86]
mortgages					
-1	-0.01	0.24	-0.70	-0.12	0.32
	(0.08)	(0.09)	(0.87)	(0.12)	(0.74)
	[-0.10]	[2.52]	[-0.80]	[-1.03]	[0.44]
-2	0.08	0.29	-1.26	0.26	0.59
	(0.08)	(0.09)	(0.85)	(0.12)	(0.71)
	[0.97]	[3.17]	[-1.49]	[2.29]	[0.82]
Transaction ratio					
-1	0.00	-0.01	-0.01	-0.00	-0.03
	(0.01)	(0.01)	(0.11)	(0.01)	(0.09)
	[0.40]	[-0.68]	[-0.11]	[-0.13]	[-0.35]
-2	0.02	0.01	0.02	0.01	-0.07
	(0.01)	(0.01)	(0.10)	(0.01)	(0.08)
	[2.18]	[0.65]	[0.23]	[0.93]	[-0.77]
Disposable income					
-1	-0.07	0.16	-0.56	0.33	1.28
	(0.07)	(0.08)	(0.77)	(0.10)	(0.65)
	[-0.91]	[1.96]	[-0.73]	[3.18]	[1.98]
-2	0.05	-0.12	-0.51	0.30	1.51
	(0.08)	(0.09)	(0.81)	(0.11)	(0.69)
	[0.69]	[-1.36]	[-0.63]	[2.72]	[2.21]
Mortgage rate					
-1	-0.01	-0.04	-0.25	0.00	0.11
	(0.01)	(0.01)	(0.12)	(0.02)	(0.10)
	[-0.46]	[-2.75]	[-2.05]	[0.13]	[1.10]
-2	0.00	-0.01	0.05	-0.01	-0.15
	(0.01)	(0.01)	(0.13)	(0.02)	(0.11)
	[0.32]	[-1.06]	[0.36]	[-0.51]	[-1.39]
Constant	0.00	0.01	0.06	-0.00	-0.04
	(0.00)	(0.00)	(0.02)	(0.00)	(0.02)
	[0.17]	[3.40]	[2.42]	[-0.82]	[-1.95]
Unemployment rate					
-1	-0.05	-0.01	-0.44	-0.04	-0.14
	(0.02)	(0.03)	(0.26)	(0.04)	(0.22)
	[-1.90]	[-0.26]	[-1.69]	[-1.01]	[-0.64]
-2	0.07	-0.05	0.08	0.04	-0.16
	(0.02)	(0.03)	(0.26)	(0.04)	(0.22)
	[2.82]	[-1.92]	[0.31]	[1.14]	[-0.74]
Adjusted R^2	0.81	0.69	0.05	0.27	0.13
Standard error	0.01	0.01	0.07	0.01	0.06
F-statistic	35.7	19.2	1.4	4.0	2.2
Log likelihood	416.2	400.9	149.3	374.6	168.7
AIC	-7.1	-6.8	-2.4	-6.4	-2.7

NB: Estimates for a SVAR model in which the endogenous variables are the house price index, lending, disposable income and the effective mortgage rate. The unemployment rate is exogenous. The sample covers the period from the first quarter of 1985 until the last quarter of 2013. The figures represent parameters, standard errors and t-values.

C1.4 Forecasts based on the SVAR model

The estimated SVAR model can be used to generate stable long-term forecasts. The estimates up to 2035 are shown in Figure C1. It has been assumed that the exogenous variable (unemployment rate) will gradually fall until it reaches the long-term average. The forecasts are shown as levels (transaction ratio and interest rates) or year-on-year growth (the other four series). It follows from the figure that the transaction ratio (top left Chart) will initially recover before eventually stabilising at a level of 0.7. In addition, house prices (top right Chart) exhibit year-on-year growth of approximately 3% during the period covered by the forecast.

Figure C1 Forecasts based on the SVAR model



NB: Actual values in period 2000-2013. Forecast values for period 2014–2035. Year-on-year changes in house prices (PCQ), mortgage lending (WOHG) and disposable income (LDUID). Levels for transaction ratios; natural logarithms of levels for effective mortgage interest rate (RHEFF) and the two cointegration relationships.

C1.5 Two scenarios: transaction volume and mortgage finance

This section contains two tables that provide further information on the dynamics in the SVAR model. The first table shows that a series of shocks in transaction volume corresponding to 1% a year between 2019 and 2028 would eventually reduce house prices by 1.7% (Table C3). Moreover, in the long term mortgage lending would be 1.5% lower than the baseline level, while disposable income would be 0.4% lower than the baseline level.

Table C3: Table for transaction volume

Effect on levels (% difference from baseline level)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040	2050
House prices	-0.0	-0.0	-0.1	-0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-0.8	-0.9	-1.0	-1.6	-1.7
Mortgage lending	0.0	-0.0	-0.0	-0.1	-0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-0.7	-0.8	-1.4	-1.5
Transaction ratio	-0.9	-1.8	-2.6	-3.4	-4.2	-4.9	-5.6	-6.3	-7.0	-7.7	-7.3	-7.0	-5.5	-5.0
Disposable income	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.4	-0.4
Mortgage interest rate	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.5	0.6

The second table shows that a series of shocks in the volume of mortgage lending corresponding to 0.1% a year between 2019 and 2028 would eventually reduce house prices by 0.3% (Table C4). Moreover, in 2050 lending would be 0.3% lower than the baseline level, while disposable income would be 0.1% lower than the baseline level.

Table C4 Table for mortgage finance

Effect on levels (% difference from baseline level)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040	2050
House prices	-0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.3
Mortgage lending	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.3
Transaction ratio	-0.2	-0.4	-0.5	-0.7	-0.8	-0.9	-1.0	-1.2	-1.3	-1.4	-1.3	-1.2	-1.0	-0.9
Disposable income	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1
Mortgage rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1

Appendix D VAR model with explicit LTV ratio

This appendix describes the essence of the VAR model that is at the basis of the results for the third approach. It also describes the data we used. For a more detailed description of the method and data, we refer to De Jong and De Veirman (2015).

We estimated a VAR model on an annual basis, covering the period 1982-2012. The model consists of two equations: one in which the change in real house prices is the endogenous variable, and one in which real consumption growth is the endogenous variable. In each of these equations, in addition to the own lag in consumption growth and house price movements, we also included the first lag for growth in real disposable income, growth in real net assets, the change in the average loan-to-value (LTV) ratio and the change in the maximum loan-to-income (LTI) ratio for first-time buyers. By including one lag for all control variables, we follow the information criteria.

The policy experiment in which we are interested is a reduction of the maximum permitted LTV ratio. That said, in the VAR analysis we used the average LTV ratio for first-time buyers for estimation purposes, because a long historical time series for the maximum permitted LTV ratio is not available. To estimate the economic effects of the policy experiment on the basis of the presented VAR model, we performed an intermediate step. In particular, we translated the change in the maximum permitted LTV ratio into an effect on the average LTV ratio. We did this using data on individual loans obtained from the loan-level data set (LLD). The LLD contains data on approximately 6 million outstanding mortgage loans and therefore covers a large part of the Dutch mortgage market. By identifying the first-time buyers who would be affected by a reduction in the maximum LTV ratio, we estimated how the average LTV ratio would change if the maximum ratio were reduced. We used this effect on the average LTV ratio as an impulse in our VAR model in order to estimate the effect on house prices and consumption.

In addition to the time series for the average LTV ratio for first-time buyers, we also used annual data for real house prices, real private consumption, real total net assets, real net disposable income and the maximum LTI ratio for first-time buyers in the VAR model. All real amounts were calculated by means of the personal consumption (PC) deflator. All variables are expressed in logarithms and are included in the VAR model in first differences, which is approximately equivalent to using percentage changes.

We calculated the series for the average LTV ratio for first-time buyers on the basis of a survey conducted as part of the Dutch Household Survey. In this survey households were asked about their LTV ratio at the time they bought their first home. The data are available on an annual basis. In view of the low number of respondents per year, we smoothed the LTV ratio series by taking a three-year weighted average. Specifically, we gave the responses of households in the central year a weighting of 100% and gave observations from the two years either side a weighting of 75%. Owing to the low number of respondents, these filtered series are only an approximation of the actual (but unobserved) average LTV ratio.

The series for the maximum LTI ratio for first-time buyers was compiled using the maximum level of financial charges and the reference rate of interest according to the Standards of the National Mortgage Guarantee Scheme (NHG), and the average gross income for first-time buyers. The maximum level of financial charges could only be calculated for 1995 and subsequent years, and so a constant has been assumed for previous years. Assuming an annuity mortgage with a repayment period of thirty years, these three variables (maximum level of financial charges, interest rate and gross income) together determine the maximum mortgage loan that a first-time buyer can take out. When constructing the series for the LTI ratio, we specifically took account of the fact that in the 1990s the partner's income started to be taken into consideration for determining the maximum LTI ratio.

The house price index was compiled using two sources. For 1995 and subsequent years, the source used was the price index for existing own homes (PBK) compiled by the Netherlands' Cadastre, Land Registry and Mapping Agency (Kadaster)/Statistics Netherlands. The PBK series goes back further, but until 1995 it did not include the features of homes sold. For this reason, in earlier years we used the repeat sales index of Bussel, Kerkhoffs and Mahieu (1996), which adjusts for quality.

The series for private consumption and household disposable income come from the National Accounts. The data on total net assets of households were derived largely from data contained in the National Accounts, supplemented by an estimate of total home equity produced by DNB.

References

AFM/DNB (2014), De systematiek van financieringslastnormen bij hypotheken, internal memorandum.

Almeida, H. M. Campello and C. Liu. (2006), The financial accelerator: Evidence from the international housing markets, *Review of Finance*, 10(3), pp. 321-352.

Andrews, D., A. Caldera Sánchez and Å. Johansson (2011), Housing markets and structural policies in OECD countries, OECD *Economics Department Working Paper*.

Bunn, P. (2014), Household debt and spending, *Bank of England Quarterly Bulletin*, third quarter, pp. 304-315.

CBS (2013), Eigen woning van één miljoen huishoudens onder water, CBS web magazine, www.cbs.nl.

Claessens, S., M.A. Kose and M.E.Terrones (2008), What happens during recessions, crunches and busts? *IMF Working Paper*, WP/08/274.

Commission on the Structure of Dutch Banks (2013), Naar een dienstbaar en stabiel bankwezen, www.rijksoverheid.nl

CPB (2007), *Centraal Economisch Plan 2007* (Central Economic Plan 2007), p. 64.

CPB (2015), *De Nederlandse consumptie. Goede tijden, slechte tijden.* CPB Policy Brief 2015/03.

DNB (2002), Het vermogensbeheer van Nederlandse gezinnen onder de loep, *DNB Kwartaalbericht*, June, pp. 29-38.

DNB (2014), Overview of Financial Stability, Spring 2014, No. 19, www.dnb.nl.

Dijk, M. van (2013), Verliesaversie op de woningmarkt, *CPB Background Document*, www.cpb.nl.

Duca, J.V. J. Muellbauer and A. Murphy (2011), *House prices and credit constraints: making sense of the US experience*, The Economic Journal, 121 (522), pp. 533-551.

Es, F. van and H. Kranendonk (2014), Vermogensschokken en consumptie in Nederland, *CPB Background Document*, www.cpb.nl.

FSC (2014), Verslag Financieel Stabiliteitscomité 20 mei 2014, www.financieelstabiliteitscomite.nl.

Genesove, D. and C. Mayer (2001), Loss aversion and seller behavior: evidence from the housing market, *Quarterly Journal of Economics*, 116(4), pp. 1233-1260.

Haas, R. de, A. Houben, J. Kakes and H. Korthorst, (2000), De kredietverlening door Nederlandse banken onder de loep, *DNB Monetaire Monografieën*, 18.

He, D. (2014), The effects of macroprudential policies on housing market risks: evidence from Hong Kong, *Financial Stability Review*, Banque de France.

IMF (2011), Housing finance and financial stability – back to basics?, *Global Financial Stability Report*, April, pp. 111-157, www.imf.org.

IMF (2014), Concluding statement of the 2014 Article IV mission, www.imf.org.

Jong, J. de, and E. De Veirman (2015), Measuring the Macroeconomic Effects of Changes in Regulatory Loan-to-Value Limits, Mimeo, De Nederlandsche Bank.

Kuttner, K.N. and I. Shim (2013), Can non-interest rate policies stabilise housing markets? Evidence from a panel of 57 economies, *BIS Working Paper*, no. 433, www.bis.org.

Lamont, O. en J.C. Stein (1999), Leverage and Housing Price Dynamics in U.S. Cities, *RAND Journal of Economics*, 30(3), pp. 498-514.

Lim, C., F. Columba, A. Costa, P. Kongsamut, A. Otani, M. Saiyid, T. Wezel, and X. Wu (2011), Macroprudential Policy: What Instruments and How to Use Them? Lessons from Country Experiences, *IMF Working Paper*.

Mian, A. and A. Sufi (2014), *House of Debt*, University of Chicago Press.

Mian, A. K. Rao and A. Sufi (2013), Household balance sheets, consumption, and the economic slump, *Quarterly Journal of Economics*, 128(4), pp. 1687-1726.

Moody's (2013), *Dutch RMBS 2014 Outlook*.

OECD (2014), *Economic Surveys – Netherlands*, www.oecd.org.

Ortalo-Magné, François and Sven Rady (1999), 'Boom in, Bust out: Young Households and the Housing Price Cycle', *European Economic Review*, 43, pp. 755-766.

Shim, I., B. Bogdanova, J. Shek and A. Subelyte (2013), Database for policy actions on housing markets, *BIS Quarterly Review*, September, pp. 83-95.

Temporary Committee on House Prices (2013), *Kosten koper*, www.tweedekamer.nl.

Rabobank (2014), Onderwaarde en doorstroming op de woningmarkt, *Themabericht*, https://economie.rabobank.com.

Reinhart, C. and K. Rogoff (2010), Growth in a time of debt, *American Economic Review*, 100(2), pp. 573-578.

Swank, J., J. Kakes and A. Tieman (2002), The housing ladder, taxation, and borrowing constraints, *Ocfeb Research Memorandum*.

Timmermans, M. (2012), *The Effects of Tightening the Mortgage Loan-to-Value Ratio in the Netherlands*, University of Amsterdam.

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