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Loan-to-income limits and mortgage lending outcomes

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Abstract

In this *Note*, I describe a model of mortgage home loan lending in Ireland, focusing on estimates of the loan-to-income (LTI) ratio distribution of new lending under different macroprudential policy calibrations. The model can be used to estimate responses by borrowers and lenders to the calibration of the Central Bank of Ireland's mortgage measures, which control shares of lending extended at high loan-to-income ratios to owner-occupiers. It covers three responses to an increase in the limits: leveraging among borrowers willing and able to access larger credit amounts, a plausible change in residential property prices in response to credit availability, and the possibility that new borrowers participate in the market. Under the revised calibration of the mortgage measures, and assuming that broader credit conditions remain comparable to the early 2020s, raising the first-time buyer LTI limit from 3.5 to 4 would increase average LTI ratios from 2.95 to 3.20 in the medium term.

1 Introduction

When calibrating borrower-based macroprudential polices, authorities are interested in the likely responses of market participants, including mortgage borrowers and lenders. This *Note* presents a model of the market for Irish mortgage home loans. It describes how the distribution of mortgage lending may change in response to a new calibration of the Central Bank of Ireland's borrower-based mortgage measures. After a change to the mortgage measures, many households considering a mortgage to purchase a home would be likely to change the amounts of debt that they would draw down. This would have implications for household debt burdens and, through those, on credit risk and cyclicality in the mortgage and housing markets, all of which play roles in the Central Bank of Ireland's macroprudential policy objectives.

The behavioural responses to mortgage measures that are described in this *Note* incorporate three main responses to the availability of larger loan amounts: leveraging among borrowers and lenders willing and able to take on more debt, a plausible change in residential property prices in response to additional credit availability, and new borrowers entering the market. Loan-level information on recent mortgage home loan borrowers is used to assess likely responses to an increase in the loan-to-income (LTI) ratio limit. For example, borrowers unconstrained by the previous LTI limit may not respond to the policy change as directly as borrowers constrained by the limit, such as those taking mortgages at LTI ratios just below the limit.

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The model focuses on the effects of varying the LTI limit and the share of lending allowed to exceed the LTI limit from one policy calibration to another. Its findings have been used to inform the recent review of the Central Bank of Ireland's macroprudential mortgage policy framework, as part of a suite of risk and resilience assessment tools.

Analysis of one calibration, chosen to reflect the Central Bank of Ireland's new mortgage measures framework, suggests that average LTI ratios may rise from 2.95 in the baseline to 3.20 in the medium term, an increase of 8.3 per cent.[2] The largest increases would be among first-time buyer (FTB) borrowers, whose average LTI ratios are found to increase from 3.19 to 3.47, an increase of 8.6 per cent.

2 The loan-to-income ratio

2.1 Motivating borrower-based macroprudential policies

Macroprudential policies address systemic risks that could cause disruptions to the provision of financial services, such as the risk that unsustainable patterns of lending could introduce excessive risk to the financial system. In Ireland, the objective of borrower-based mortgage measures is to ensure sustainable lending standards in the mortgage market, including the aim to prevent an unsustainable relationship between credit and house prices. The reduction of systemic risk and the mitigation of future financial crises were leading motives for the introduction of borrower-based measures in Ireland (Cassidy and Hallissey, 2016).

Aikman, Kelly, McCann and Yao (2021) characterise the beneficial aims of borrower-based macroprudential policies. Borrower-based measures reduce the prevalence of higher-risk debt, which improves the well-being of society as a whole, mainly by reducing the frequency and severity of financial recessions caused by housing markets and credit cycles, which are regularly followed by long-lasting weaknesses in output and labour markets. In addition to society-wide benefits, there are also benefits that accrue specifically to lenders and borrowers, such as improvements in the resilience of debt repayment capacity and bank balance sheets, as well as associated costs.

There is evidence that borrower-based measures can change the likelihood of the economy to endure systemic problems in housing and mortgage markets, through the interaction between credit, housing prices and housing market activity. In particular, the unsustainable mortgage credit expansion in several developed countries prior to the global financial crisis (GFC) has been found to have exacerbated asset price inflation and subsequent price collapses, and to have caused income losses on a systemic scale (Crowe et al, 2014; Jordà, Schularick and Taylor, 2016).

In addition, housing loans comprise the majority of household debt in many developed countries, including Ireland. Where this is the case, borrower-based mortgage measures can influence overall indebtedness among households and across the economy. In Ireland, 85 per cent of outstanding household credit from banks in December 2021 was for house purchase purposes. Market-wide limits on excessive credit can thus have a meaningful impact on the resilience of lenders and borrowers to adverse economic developments in general, such as labour market or interest rate developments that may pose challenges to household finances.

[2] Using mortgage lending during 2020 as the baseline. Averages in this *Note* are weighted by loan size.

2.2 Channels of operation of the borrower-based loan-to-income limit

In this *Note*, I model the impact of varying the borrower-based LTI limit for the Irish mortgage market. This measure sets a maximum limit on the borrower's total housing credit as a multiple of their income at the time of origination of a mortgage, in order to maintain sustainable lending standards in the mortgage market.

The Central Bank of Ireland's mortgage measures set an upper limit for LTI ratios of owner-occupier mortgages, while allowing flexibility to lenders to issue some mortgages above the limit.[3] The limit is 3.5 times gross income. Lenders have allowances to exceed this limit. In 2018, allowances were set at 20 per cent of mortgage credit to households who have never taken a previous housing loan (first-time buyer, or FTB, borrowers) and 10 per cent of mortgage credit to second-time and subsequent buyer (SSB) borrowers. Lenders decide the allocation of high-LTI lending, subject to the maximum share of allowances. For these reasons, modelling a change of borrower-based regulation will involve several channels which may offset or reinforce each other to an extent.

A macroprudential measure on LTI ratios of mortgages may limit credit through a number of channels, including:

1. An "intensive margin" effect, reducing the loan amounts of borrowers who transact at lower amounts due to the regulation. For example, households may commit larger downpayments to reduce leverage, or may reduce the price of their chosen housing purchase relative to what they would have chosen in the absence of mortgage measures.

2. An "extensive margin" effect, under which some potential borrowers may delay or forego borrowing until they attain sufficient savings or income to purchase their desired value of housing using the amount of credit available under the measures.

3. The expectation of stable, sustainable lending standards may cause a reduction in long-term expectations about the creation of unsustainable, pro-cyclical housing credit during upswings of the housing market. This may reduce speculative expectations of pro-cyclical outcomes, which can exacerbate housing price cycles.

This *Note* combines two approaches to simulate these channels: a detailed behavioural model of the "intensive margin", and macro-financial modelling of the other channels at economy-wide level, with an indicative set of calibrations. It illustrates the channels by simulating a change in borrower-based measures, outlined in the calibration in section 6. Previous research has studied the "intensive margin" based on the number of borrowers constrained under the Central Bank of Ireland's mortgage measures (Gaffney, 2019). The model in this *Note* goes further by calibrating extra factors that would affect the mortgage market as a whole, including price-credit dynamics arising from additional credit and purchasing power.

3 Data

The model relies on two granular loan-level data sets that describe mortgage home loans in Ireland, submitted by lenders to the Central Bank of Ireland every six months.

[3] There is also a loan-to-value (LTV) ratio mortgage measure not modelled in this *Note*. Furthermore, certain types of mortgage transaction are exempted from the mortgage measures framework, primarily refinance and switcher mortgages with no increase in the debt owed by the household.

The first data set comprises supervisory returns submitted by mortgage lenders to show that they are compliant with the Central Bank of Ireland's mortgage measures. "Monitoring Templates" describe origination conditions of mortgages issued during the previous half-year, including the LTI and loan-to-value (LTV) ratios which are regulated by the measures, and whether the mortgage is in-scope of the measures or exempted. These returns are submitted by lenders extending mortgage credit of 50 million euro or more during a half-year reporting period, including both banks and non-bank financial service providers. Monitoring templates data describe the Irish mortgage lending market comprehensively, covering 97 per cent of new mortgage lending between 2015 and 2020.

The second data set is the "Loan Level Data" returns, a granular update by major retail banks about their outstanding mortgage loan books submitted every six months, gathered by the Central Bank for supervisory and prudential purposes. These were described originally by Kennedy and McIndoe-Calder (2012), and have since been expanded to cover all major retail banks in the Irish mortgage market. Banks describe the repayment performance and outstanding credit balances of each mortgage, plus evidence about current and origination conditions comparable to those gathered in Monitoring Templates Data.

Lending during the year 2020 is chosen as a "baseline" distribution. Although the COVID-19 pandemic caused a temporary reduction in house purchase and mortgage activity during 2020, much of the disruption involved delays to purchases that eventually occurred later in the same year. Central Bank of Ireland New Mortgage Lending statistics show that loan characteristics such as average LTI and LTV ratios remained stable during 2020 compared to 2019 and 2021, and average household incomes and property values largely followed medium-run trends.[4]

4 The initial response of borrowers and lenders to new limits and allowances

The initial response of borrowers and lenders to a change to borrower-based measures is modelled at the loan level based on the LTI ratio of each mortgage. This section describes these different responses; for the purpose of illustrating the model, it assumes an increase in LTI limits.

A large majority of mortgages would not change in response to the variation of LTI limits, because the choice of loan size is not affected by the limit. This applies to two groups of borrowers.

First, mortgages at LTI ratios sufficiently below the previous, lower limit are assumed to experience no initial change in their chosen loan amount, because their chosen mortgage would comply with the limit. The "sufficiency" buffer is chosen as 0.05 times income, based on the evidence outlined in Gaffney (2019): borrowers with LTI ratios between 3.45 and 3.5 appear qualitatively different when compared to borrowers in slightly lower LTI bands.

Second, mortgages that transacted with allowances to exceed the 3.5 LTI limit, but with an LTI ratio below the counterfactual limit, are also assumed to retain their existing credit amount as an initial response. This is because the limits would not have reduced the borrower's choice of loan size in either situation. Borrowers with an LTI allowance face no further LTI ceiling under the measures; lender credit policies and borrower aversion to high debt levels are likely to act as market-based ceilings, in addition to the regulatory LTV limit.

[4] Notwithstanding these similarities on average, the share of high-LTI allowance lending was lower in 2020 than 2019 or 2021.

Mortgages covered by the two categories above would be expected to show no immediate response in the scenario.[5] By contrast, the impact of a changed limit on two other groups of borrowers could be more substantial.

Of primary importance, there are mortgages whose credit amounts are at or just below the existing LTI limit, suggesting that they are constrained by the limit. These are assumed to respond to the new limit by adding extra credit in the counterfactual scenario.

Across all calibrations, the group treated in this manner is mortgages above 3.45 LTI and at or below 3.5 LTI. Gaffney (2019) shows that mortgages between 3.45 and 3.5 LTI are disproportionately numerous relative to other LTI bands, and that their borrowers exhibit different characteristics to borrowers at slightly higher or lower LTI levels. For example, their incomes and LTV ratios are significantly lower than among other comparable groups of borrowers.

The modelled response of these borrowers uses the "bunching estimator" method, based on the literature introduced by Kleven and Waseem (2013). The method for Irish mortgage data is first described in Gaffney (2019) and comprises the following steps, applied separately to FTB and SSB borrowers:

1. Estimating the number of borrowers between 3.45 and 3.5 LTI who would have chosen that LTI ratio even in the absence of the measures. The trend in the proportion of borrowers in nearby LTI ratio bands is extrapolated to the 3.45 – 3.5 LTI band; this relies on the assumption of smooth preferences for housing finance costs as a share of income across households. Borrowers estimated to have chosen the LTI ratio in the absence of the measures do not change their loan size as an initial response to the change in the limit.
2. The remaining, larger share of borrowers between 3.45 and 3.5 LTI is assumed to have a preference for taking on more debt, leading to "bunching" at the 3.5 LTI limit.
3. Within this group, households who transacted at, or within one per cent of, the LTV limit are assigned no change in loan size. These households are assumed to be limited on the LTV measure, or to have a strong preference for retaining liquid assets.[6]
4. Other households close to 3.5 LTI respond to the counterfactual LTI limit by borrowing more. To quantify the number of LTI-limited households moving to each new LTI band, they are randomly assigned to higher counterfactual credit demand levels. The distribution of this random variable follows a smooth downward trend, beginning with the amount at LTI bands just below the current limit of 3.5 LTI, and ending at zero at 5 LTI, which is assumed to be the general market-determined limit on credit available to borrowers under prevailing credit conditions, based on the rarity of lending above this ratio.
5. In this way, some borrowers are assigned to credit amounts above the new LTI limit. If lending above the new limit would exceed the allowance share, some of these borrowers are selected randomly and assigned lower credit amounts that instead move to them the new LTI limit, so that high-LTI lending is reduced to less than the allowance share.

The steps assume that most borrowers at 3.5 LTI would not simply respond to the higher LTI limit by borrowing up to the new maximum. Although there is no empirical evidence from Irish data about the effects of an increase in the LTI limit, this assumption is consistent with the tapering of higher LTI ratios among the share of mortgages with allowances to exceed the LTI limit. An

[5] For example, in the empirical data used to illustrate the calibration of mortgage measures in this *Note*, most mortgage lending was at LTI ratios below 3.1, which is not close to the LTI limit.

[6] In reality, it may be possible for some of these borrowers to offer a larger downpayment, especially if alleviation of the LTI ratio constraint would allow them to access a larger credit amount.

alternative assumption would be that credit demand does not taper and more borrowers would increase credit to the higher limit. This would lead to more credit growth and larger LTI ratios.

A secondary group that may be affected directly by a new calibration is borrowers seeking to attain credit amounts above the new LTI limit, who would require an allowance. Upon a sufficient reduction in the allowance share, it is possible that this group could be directly affected by the new policy, leading to a reduction in mortgage issuance above the new LTI limit.

There is evidence that, in practice, lenders extend a smaller share of mortgage lending above the LTI limit than the maximum permissible allowance, by several percentage points. To account for this in the model, the "maximum in-practice" share of mortgage lending above limits is set two percentage points below the allowance share. If the modelled share of mortgages above the new LTI limit is too high compared to this "maximum in-practice" level, some mortgages that would have exceeded the new limit are instead capped at the new limit.

5 Additional macro-financial channels

The initial impacts of the chosen LTI calibration are "intensive margin" effects, mainly affecting borrowers at or close to macroprudential lending limits. This section adds macro-financial channels that reflect broader factors affecting the mortgage market as a whole, specifically, price-credit dynamics and lending to new borrowers. The sub-sections cover each of these channels, describing simplified dynamics of macro-financial factors to show the expected medium-term impact of moving from one policy to another, even if countervailing factors arise in the short term, such as a change in broader credit conditions or risk appetite: any such change would have effects that are difficult to compare in magnitude to the results of the model.

5.1 The effect of credit availability on residential property price-to-income ratios

All else equal, an increase in house price-to-income ratios would be expected as a result of higher availability of mortgage credit, as has been communicated by the Central Bank of Ireland and housing market researchers. In the model described in this *Note*, borrowers and lenders are assumed to increase loan sizes and LTI ratios to achieve the same property purchases at higher prevailing price levels. This requires a number of other assumptions. For example, it is assumed that lenders are willing to extend credit at the newly available purchasing price; that borrowers who are currently below the LTV limit can add downpayments to ensure that they are not constrained by the LTV rule at their new loan amount; and that borrowers would not adjust their property market behaviour in response to changes in purchase prices.

Modelling these in different ways could vary the result to an extent, generally by reducing the estimated amount of additional credit. For example, under the assumptions listed above, loan size would increase by proportionately more than the average increase in property prices. This is because mortgages fund leveraged property purchases: assuming borrowers do not commit additional downpayments, loan size must increase disproportionately to cover the gap between the old and new purchase prices.

The change in LTI is simulated at the loan level using granular data on LTV ratios. For example, at LTV ratios between 70 and 80 per cent, a 1 per cent increase in house price-to-income ratios would lead to an increase in loan size and LTI ratios of between 1.25 and 1.45 per cent.

5.2 New borrowers entering the mortgage market

The second macro-financial channel accounts for the "extensive margin" of prospective mortgage borrowers who enter the market in response to credit availability at high LTI ratios. It models an increase in the number of participants in the mortgage market when a larger number of households can reach their desired housing finance spending amount as a share of income.[7]

The extensive margin amplification effect is modelled by adding new entrants to the market at the new LTI limit. This can be interpreted as an upper bound for the range of possible impacts on average LTI ratios from this amplification effect. The characteristics of non-participants in the mortgage market cannot be observed in empirical data. To estimate their choice of loan size for the purpose of calculating weighted average statistics, the new entrants are represented by using the characteristics of existing mortgages at the new LTI limit.

6 Calibration

6.1 Specifying a change in LTI limits and allowances

The regulation modelled as the LTI limit in this *Note* is a maximum 4 LTI ratio for FTB mortgages and a maximum 3.5 LTI ratio for SSB mortgages. Thus, the limit increases by 0.5 LTI for FTB borrowers in the counterfactual. The share of FTB lending allowed to exceed limits would change from 20 per cent above 3.5 LTI to 15 per cent above 4 LTI. The share of SSB lending allowed to exceed limits would increase from 10 to 15 per cent.[8]

6.2 Indicative magnitudes of the initial response

1. 13 per cent of mortgages in the baseline are at LTI ratios between 3.45 and 3.5, and are not close to the LTV limit.
2. From among this group, 1.1 per cent of mortgages would have transacted at their chosen LTI ratios even if the LTI limit were higher.
3. The other 11.9 per cent of mortgages in this group would have transacted at a higher LTI ratio in the absence of the limit. Using the approach described above, 1.0 per cent of borrowers would have taken mortgages between 3.5 and 3.55 LTI. The trend in the number of borrowers per LTI band continues downward until reaching zero at 5 LTI. Most of these mortgages move to LTI ratios between 3.55 and 3.85.
4. After accounting for higher borrowing among this group, the share of mortgage lending assigned to LTI ratios above the limits for FTB and SSB borrowers is slightly above 13 per cent in each case. To reach the headroom under allowances, a very small number of mortgages is reset to the relevant LTI limit for its borrower type.

[7] If new entrants were to be representative of the average borrower in the baseline, then there would be no reason to expect that the increase in credit volumes would raise average LTI ratios. However, it would be difficult to motivate their entry to the market in response to higher available LTI ratios.

[8] Changes in the LTV ratio regulation are not explicitly modelled in the loan-level model of initial LTI selection. Instead, the aggregate impact of the recalibration is represented in the calibration of the first macro-financial channel, using the estimates of Arigoni, McCann and Yao (2022). One consequence affecting the initial response is that it does not account for the amount of the new allowance share that would be used for lending above the LTV limit. However, in practice, very little mortgage lending has occurred at LTV ratios above the revised limit of 90 per cent during the mortgage measures period.

5. Portfolio-level weighted average LTI rises from 2.95 to 3.02 after the initial response, an increase of 2.2 per cent. The FTB average rises from 3.19 to 3.28 (+2.6 per cent), reflecting the interplay of higher limits and lower allowances. The SSB average rises in response to the larger allowance share from 2.66 to 2.70 (+1.5 per cent).

6.3 Macro-financial channel calibration

Market-wide additional credit availability resulting from the recalibration would be expected, all else equal, to increase the house price-to-income ratio by between 2.8 and 4 per cent over the medium term (Arigoni, McCann and Yao, 2022). Due to the range of economic and policy factors that affect residential property prices, there is significant uncertainty around these estimates. To specify a single figure for the calibration of the price-credit channel, I use estimates from an internal Central Bank of Ireland macroeconomic model of historical responses to credit conditions in the Irish mortgage market. The resulting house price-to-ratio uplift of 3.5 per cent is within the range provided by the model described by Arigoni, McCann and Yao.

To calibrate responses of prospective homebuyers to the availability of mortgages at higher LTI ratios, an internal Central Bank analysis was conducted to estimate potential growth in mortgage market participation. A simple linear regression model was deployed to predict transaction volumes based on the 90th percentile of LTI ratios in a given year. This approach is taken because it is considered more likely that a marginal entrant to the mortgage market may be influenced by the availability of credit at high LTI ratios than by credit conditions for the average borrower. The resulting estimate is that, all else equal, a one-unit increase in the 90th percentile of LTI ratios is associated with 11.3 per cent more mortgage transactions.

6.4 Overall impact

The impact of higher property prices is to increase average LTI ratios increase from 3.02 after first-round effects to 3.13 after incorporating price-credit dynamics under the first macro-financial channel. The increase in average LTI ratios at this stage is 0.11, in addition to 0.07 from the response of constrained borrowers alone.

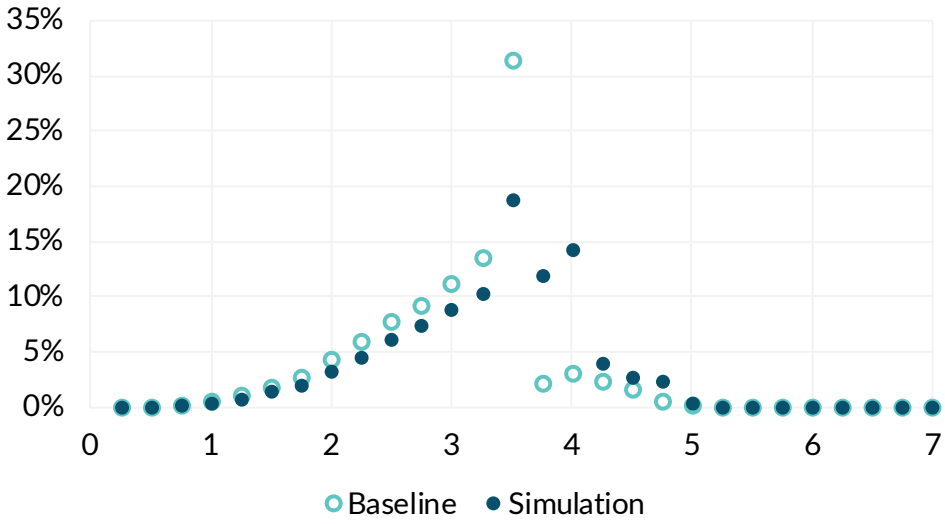
Based on the higher average LTI ratio that results from the loan-level simulation and the first macro-financial channel, the estimated increase in the number of transactions that comprises the second macro-financial channel is 6.4 per cent. These are assumed to take above-average LTI ratios. As a result, the addition of new transactions raises average LTI ratios by a further 0.07, to 3.20.

The total increase in average LTI ratios is 0.25, leading to an 8.3 per cent increase in LTI ratios in the medium term. In total, average LTI ratios among FTB borrowers would increase from 3.19 to 3.47 (+0.28, or 8.6 per cent). The average for SSB borrowers would increase by a somewhat smaller amount, from 2.66 to 2.85 (+0.19, or 7.1 per cent).

Chart 1 depicts the new and old distributions of LTI ratios. In the baseline, over 30 per cent of mortgage lending was bunched at the 3.5 LTI limit. This reduces to less than 20 per cent in the new calibration, comprising mainly SSB borrowers. After the revision of limits, 15 per cent of mortgage lending is at or close to 4 LTI, mostly FTB borrowers at or close to the 4 LTI limit, but also including a smaller number of SSB borrowers with allowances to exceed the 3.5 LTI limit. The respective distributions for FTB and SSB borrowers are shown in the Appendix. A slightly larger share of lending is above 4 LTI in the simulation than in the baseline, and the share of lending at LTI ratios

below 3.2 is lower. At lower LTI ratios, these changes reflect the estimated property price dynamics and the assumption that households seek larger loan amounts to complete property purchases.

Chart 1: Shares of mortgage home loan lending at different LTI ratios, under baseline and simulation scenarios



Source: Central Bank of Ireland New Mortgage Lending data; staff calculations.
Notes: Baseline shows LTI ratios of home loan mortgages under the mortgage measures in 2020. Simulation shows LTI ratios under a scenario with 4 LTI limit for FTB borrowers, a 3.5 LTI limit for SSB borrowers, and allowance shares of 15% of FTB and SSB mortgage lending in excess of LTI limits. Shares are weighted by loan size. Each point depicts the share of lending in an LTI band of 0.25 width.

7 Conclusion

This *Note* has described a model to simulate mortgage lending and assess macro-financial impacts of a change in the regulation of LTI ratios under the Central Bank of Ireland's mortgage measures. Using behavioural rules for borrowers participating in in the mortgage market, and illustrative calibrations of macro-financial impacts on prices and lending activity, it is possible to estimate lending volumes issued at different multiples of income.

While there is significant uncertainty around these estimates, they provide useful benchmarks of potential medium-term increases in lending amounts to inform the judgement of policymakers. In particular, it suggests the potential initial response among credit-limited homebuyers, as well as the eventual changes in activity across the mortgage market as a whole that would ensue from expectations of more credit availability for home buyers.

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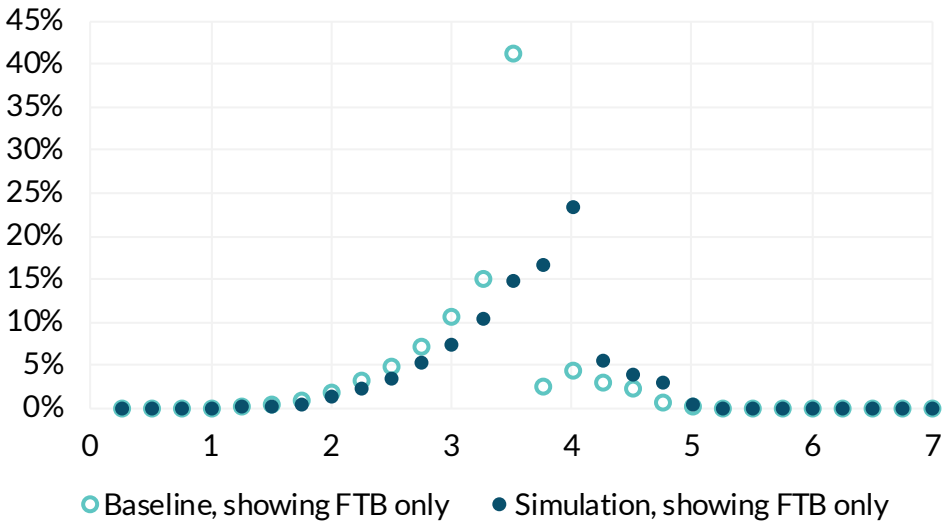
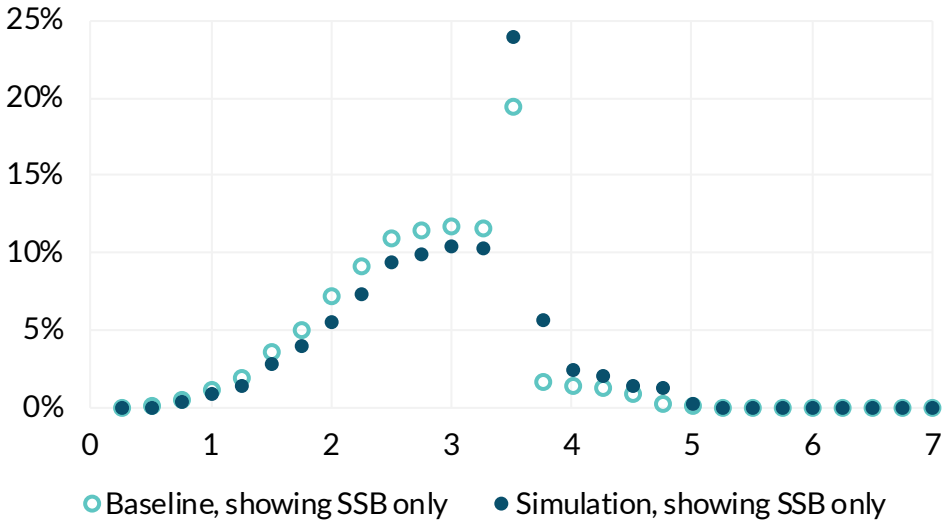
Appendix

Chart A1: Shares of mortgage home loan lending to FTB borrowers at different LTI ratios, under baseline and simulation scenarios



Source: Central Bank of Ireland New Mortgage Lending data; staff calculations.
Notes: Baseline shows LTI ratios of home loan mortgages under the mortgage measures in 2020. Simulation shows LTI ratios under a scenario with a 4 LTI limit for FTB borrowers, a 3.5 LTI limit for SSB borrowers, and allowance shares of 15% of FTB and SSB mortgage lending in excess of LTI limits. Shares are weighted by loan size. Each point depicts the share of lending in an LTI band of 0.25 width. Chart depicts mortgage home loans reported as FTB.

Chart A2: Shares of mortgage home loan lending to SSB borrowers at different LTI ratios, under baseline and simulation scenarios



Source: Central Bank of Ireland New Mortgage Lending data; staff calculations.
Notes: Baseline shows LTI ratios of home loan mortgages under the mortgage measures in 2020. Simulation shows LTI ratios under a scenario with a 4 LTI limit for FTB borrowers, a 3.5 LTI limit for SSB borrowers, and allowance shares of 15% of FTB and SSB mortgage lending in excess of LTI limits. Shares are weighted by loan size. Each point depicts the share of lending in an LTI band of 0.25 width. Chart depicts mortgage home loans reported as SSB, including home mover buyers, refinance and switcher customers.

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