



Banc Ceannais na hÉireann
Central Bank of Ireland

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Financial Stability Notes

Mortgage borrowers at the loan-to-income limit

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Vol. 2019, No. 11

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November 2019

Abstract

I show that lenders respond to Ireland’s macroprudential mortgage measures by reducing lending and leverage to households seeking high loan-to-income ratios. Applying a bunching estimator to supervisory mortgage records in Ireland, it is shown that at least one in eight owner-occupier borrowers in 2018 took on less debt than they would have if there were no loan-to-income limit. The total reduction is at least one-half of one per cent of all new mortgage lending. Households at the limit earn less than other borrowers and are more likely to be single-income, two characteristics that have been associated historically with higher credit risk. These households reduce leverage by committing more gifts and non-earned deposits than other borrowers. The results suggest that due to the loan-to-income regulation, households with high credit-risk characteristics tend to borrow less, easing their burdens of leverage and debt service.

1 Introduction

The Central Bank of Ireland’s mortgage measures aim to increase the resilience of banks and borrowers to negative economic and financial shocks, and to dampen the pro-cyclicality of credit and housing prices, so that a damaging cycle of credit and prices does not emerge. The lending regulations include a system-wide limit on loan-to-income (LTI) ratios that applies to most new mortgages, preventing borrowers from taking on large debts relative to their incomes. Housing loan service is a large, regular expense that may be hard to defer if a borrower endures an income reduction during the lifetime of the mortgage. An LTI limit may thereby help to alleviate distress after falls in income, like the loss of a job or a reduction in hours of work.

How does a borrower-based measure improve the resilience of households? Overall, improved resilience results from borrowing less at times when too much credit would have otherwise been on offer, due to inappropriately loose underwriting standards. However, the distribution of mortgage lending also matters. If lenders were to respond to the rules mainly by limiting credit to low-risk households, borrower-based measures would contribute less to household resilience.

Using a comprehensive set of supervisory owner-occupier mortgage records, this note highlights constrained borrowers who appear to take on less mortgage debt than they would have otherwise done, if lenders did not have to conform to the mortgage measures. These owner-occupiers access the housing market by adapting to the credit on offer. For example, a borrower may provide a larger deposit, choose a lower-price location, or a lower-priced dwelling in their area, compared to a market with no LTI regulation. Borrowers retain more income, and face less financial risk.

I identify borrowers who “bunch” at, or just below, the 3.5 LTI limit in Ireland’s mortgage measures. A bunching estimator reveals that at least one in eight borrowers in 2018 would have taken more debt if there were no LTI measure. The borrowers identified in this way would have received loans

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at LTI ratios above 3.5, and are required by their lenders to take LTI ratios below 3.5. They bunch at the largest loan size available, typically borrowing just €250 less than the regulatory limit.

Borrowers with high-risk characteristics appear to take on less mortgage debt due to the regulation of LTI. Households at the LTI limit are more likely to depend on a single income and to engage in lower-paid work. These factors have been shown to signal credit risk, historically. Overall, borrowers at the limit have lower incomes than the average borrower at any other LTI ratio. However, the age, region and previous homeowner status of borrowers at the limit are similar to other borrowers, including those who have allowances to exceed the limit.

Constrained borrowers adapt to the LTI rule by accepting lower leverage. In particular, first-time buyers pledge more equity when they are at the LTI limit, relative to property value and household income. They fund larger deposits using gifts and other non-earned wealth. Furthermore, they choose less-valuable properties. Borrowers therefore keep more monthly income after making mortgage payments due to the measures, and are less exposed to the risks of leveraged investment.

Section 2 outlines Ireland's borrower-based macroprudential measures on mortgages, providing context, rationale and detail. Section 3 describes the comprehensive supervisory records of mortgage originations. Section 4 discusses the selection and distribution of LTI ratios in the mortgage market. Section 5 estimates the share of borrowers who are LTI-limited and who take less credit. Section 6 characterises borrowers across LTI bands, showing that the group at the LTI limit signals high risk on several indicators. Section 7 concludes.

2 The loan-to-income rule in Ireland's mortgage market

Borrower-based macroprudential policies can address systemic credit allocation risks that are not covered by traditional oversight of financial institutions. In this way, macroprudential policies can limit types of lending which would, in excess, introduce instability to the financial system. The regulation of LTI ratios may limit credit through several key channels:

1. **Expectations.** LTI ratios may tend to increase during property price growth periods due to speculative investment and loose underwriting standards. A stable limit through the economic cycle may reduce the element of credit demand that is motivated by speculation and changing credit standards (McCarthy and McQuinn, 2017).
2. **Extensive margin.** Some potential borrowers may not find a regulated mortgage contract that allows them to purchase a satisfactory home, either delaying or foregoing their purchase.
3. **Intensive margin.** Some borrowers may reduce their leverage with a larger deposit, move to a different region with lower prices, or accept less residential amenity in the same location that they would have otherwise chosen. The intensive margin is the focus of this note.

The Central Bank of Ireland's mortgage measures set an upper limit of LTI for most owner-occupier mortgages, while allowing flexibility above the limit. The limit is 3.5 times gross income. A lender may exceed this limit in up to 20 per cent of mortgage credit to households who have never taken a previous housing loan, and up to 10 per cent of other mortgages. Each lender is free to choose which borrowers receive these allowances. The mortgage measures also regulate loan-to-value (LTV) ratios with limits and allowances.

Kinghan, Lyons and Mazza (2018) find that borrowers with LTI allowances in 2017 were more likely to be single applicants, buy properties in the expensive Dublin region, and draw down larger loans over longer terms. In Section 5, I show that some of these patterns are true for higher-LTI borrowers in general, whereas some arise from banks' choices of which borrowers receive allowances.

3 Supervisory mortgage records

Lenders file supervisory returns on new mortgage lending to the Central Bank of Ireland to show that they comply with LTI and LTV ratio limits. While every regulated financial service provider must comply with the mortgage measures, they file returns upon extending mortgage credit of 50 million euro or more during a half-year reporting period. These loan-level returns describe 95 per cent of the number and value of Irish mortgages, and closely match aggregate statistics by origination quarter and buyer type (Gaffney, 2018). Records began upon the introduction of the regulations on 9 February 2015.

I use the loan-level returns lodged by six lenders between 1 January 2018 and 30 June 2019.² I select owner-occupier mortgages for purchases by excluding refinances, restructures, top-ups, equity releases, simple transfers of title, and residential investment loans to non-occupiers, including the buy-to-let market. The remaining sample includes standard purchase mortgages, “purchase to renovate” mortgages among which the collateral valuation reflects a project value, and “self-build” mortgages drawn down in phases by the future homeowner. Table 1 summarises owner-occupier mortgages for purchases between January 2018 and June 2019, separating the loans at LTI ratios below 3.45, between 3.45 and 3.5, and above 3.5.

To compare bunching before and after the regulation, I exploit loan-level records on outstanding exposures from Ireland’s five largest mortgage banks, which include origination conditions such as loan balances, collateral values and household incomes.³ These have been reported every six months since December 2011. However, borrower income is not listed in a large share of mortgage exposure returns, so the sample of original LTI ratios before 2014 is less comprehensive than the later evidence from new lending reporting.

I use loans originated per year, as listed on exposures records, to cover the period before the mortgage measures and new lending submissions began. I compare 2018 new lending to mortgages originated in 2003 and 2011, when the average LTI was similar to 2018, and to 2014, the year before the beginning of mortgage measures. The comparative analysis in sections 4 and 5 excludes 2019H1 new mortgages to reflect the working of the mortgage measures, which regulate lending over each calendar year.

4 Selection and distribution of loan-to-income ratios

When choosing an LTI ratio, a borrower is faced with a prevailing price level for housing that is determined by economic and financial conditions. However, dwellings are available at different prices, reflecting factors like location, property size and local quality of life. This leads to a role for consumer choice: a trade-off between spending money to service a mortgage and pay for housing, or buying other services and consumer goods. As a consequence, borrowers choose different amounts of credit and leverage relative to their incomes.

Loan size is determined by repayments, term, interest rates and the principal repayment rate. Other loan characteristics such as age and fixation period strongly determine term and interest rates, and almost all new home loans in Ireland are amortising. Therefore, for a prevailing housing-price-to-income ratio, LTI should mainly reflect preferences about the burden of mortgage repayments relative to income. This includes asset accumulation through capital repayments, but because so many alternative savings products exist, the choice of mortgage repayment ratio is ultimately characterised by the share of income devoted to interest payments.

² Allied Irish Banks, Bank of Ireland, KBC Bank Ireland, Pepper Finance Corporation (Ireland), permanent tsb and Ulster Bank Ireland submitted owner-occupier mortgage returns during this time.

³ These are provided by the same lenders that submit new mortgage lending returns, excluding non-bank Pepper Finance Corporation (Ireland).

One should not expect to see large cohorts at particular points of the LTI distribution, assuming smooth preferences over debt service as a share of income. Figure 1 displays the distributions of LTI in three different years before the borrower-based mortgage measures and in 2018. Density is expressed using bands of 0.05 LTI width, inclusive of the endpoint. In euro value, a household with annual earnings of €80,000 would move to the next band if it borrowed €4,000 more. Before the LTI regulation, small bunches appeared in the distribution at limits set by each bank, typically 4 or 4.5. However, the scale was small: in 2014, 1.2 per cent of borrowers took LTI between 3.95 and 4.

During the first year of LTI regulation, four per cent of all households took mortgages between 3.45 and 3.5 LTI, according to the highest-quality loan-level source on new lending (Figure 2). This group was already larger than the borrowers limited by banks' own LTI policies before the rule. However, it may have been expected to grow further. Prices in 2014 were low relative to incomes, and banks selected new clients very cautiously due to uncertain economic conditions as Ireland prepared to exit the EU-IMF assistance programme. By contrast, the LTI rule was expected to bind when property prices grew more rapidly than borrower incomes.

In the years after the introduction of the mortgage measures, prices did outpace incomes, as new housing supply recovered more slowly than the job market. As the economy expanded, banks offered more mortgages. Amid this growth, the share of borrowers between 3.45 and 3.5 LTI grew larger each year. Table 1 shows that this cohort includes 17 per cent of borrowers since 2018. Despite the very different shapes of the curve, similar shares of borrowers were below 3.5 LTI in recent years: 86 per cent in 2014 versus 90 per cent in 2018. However, the share was only 67 per cent in 2003 and 2011, due to a long tail of LTIs between 5 and 7 that did not exist by 2014.

The large cohort of borrowers between 3.45 and 3.5 LTI arose after the LTI rule, it had no known precedent, and it would not be expected to arise if borrowers and lenders chose their preferences without any mortgage measures. Bunching therefore suggests that some borrowers and lenders choose a different debt service ratio than would be the case in the absence of a limit.

It seems that the average borrower at just below 3.5 LTI would have chosen a higher LTI in the absence of the mortgage measures. When faced with excess demand for loans above the limit, lenders must choose which borrowers will receive offers of lower, conforming credit amounts. A credit offer of 3.5 LTI would be the conforming contract that comes closest to satisfying a high debt service-to-income preference. As empirical evidence for this downward shift in high-LTI mortgages, Figure 1 shows that smaller shares of borrowers took more than 3.5 LTI after the mortgage measures, even though average LTIs were similar in 2003 and 2011, and lower in 2014.

A bank may also, possibly, have a motive to lend more to borrowers below the limit, so that it could offer more high-LTI allowances to other households. Borrowers would have to agree to take more credit than they wanted, and deposit requirements would also dampen demand. Nonetheless, Acharya et al. (2018) find potential evidence for this channel. During the first year of the mortgage measures, leverage increased among conforming, high-income borrowers. However, growth was small, the baseline was very low, and prices were growing more quickly than incomes during the first years of the mortgage measures, putting upward pressure on LTI ratios in general.

5 Counter-factual scenario

I estimate the number of borrowers who have chosen 3.5 LTI as a result of the mortgage measures by creating a counter-factual scenario. To create the scenario, one must estimate the shape of the counter-factual distribution. It should resemble the patterns in 2003-2014 shown in Figure 1, which reflect bank and borrower preferences over debt service without an LTI regulation.

The bunching estimator for “notches” introduced by Kleven and Waseem (2013) is used to estimate the underlying density of a smooth distribution to which a step-change in incentives has been applied, causing excess bunching of observations in one range, followed by a missing mass of observations in the next range. The estimator's validity relies on a smooth underlying distribution

of preferences. This is justified in the case of LTI if debt service preferences are continuously distributed across the population of banks and borrowers.

Applying this logic to balances, DeFusco and Paciorek (2017) show bunching at conforming loan size among United States mortgage purchasers. In the United Kingdom, Best, Cloyne, Ilzetzki and Kleven (2018) identify bunches at LTV ratios above which mortgage interest rates increase. LTI is more likely to satisfy the assumption of smooth underlying preferences than either loan size or LTV. First, borrower income is determined separately from and prior to the loan contract, then certified and declared to the lender. Borrowers have few incentives to under-declare income when seeking a mortgage. By contrast, borrowers with the same asset holdings may choose different deposit sizes and LTVs, depending on their leverage and risk-taking preferences. Second, as a ratio, LTI is more likely to take non-rounded values than loan size, leading to a smoother distribution.

5.1 Applying the bunching estimator to Irish mortgage originations

Figure 3 illustrates results from the bunching estimator. It fits a counter-factual distribution to LTIs between 0 and 3.45, and projects this through the LTIs that are affected by the regulation. According to the estimator, one would expect 3 per cent of borrowers to take LTI between 3.45 and 3.5 if there were no limit. This implies that 13 per cent of loans have been constrained by the limit. These mortgages have LTI ratios in the 3.45 to 3.5 range, when the preferences of borrowers and lenders over repayment-to-income would suggest that they wanted a higher ratio.

Most mortgages in the bunch are close to the regulatory limit. This justifies the assumption that borrowers have been constrained to move below a desired LTI. In total, four per cent of all owner-occupiers choose mortgages of exactly 3.5 times income. Within the bunch, half of buyers borrow €0 to €250 less than the limit. For context, most property prices are integer multiples of €5,000, so the typical buyer in the bunch could not make a larger bid on their chosen property by moving to exactly 3.5 LTI.

5.2 Change in bank lending due to the LTI mortgage measure

The bunching estimator implies that banks lent less due to the LTI mortgage measure. In this subsection, I quantify the contribution of mortgages at the LTI limit to the overall impact of the mortgage measures. However, the LTI measure has other impacts which are not measured by the estimator. For example, by stabilising expected future property prices, the measures can reduce speculative demand based on unsustainable credit expansions. Some borrowers may also defer purchases due to the measures.

Lending reductions to borrowers settling for lower LTI can be measured by assigning hypothetical LTI values to the 16 per cent of borrowers in the bunch in 2018, and multiplying these by household income. Three per cent of borrowers are assigned their existing LTI, to match the estimate of true demand for contracts at 3.5 LTI. For the other 13 per cent of borrowers in the bunch, new target LTI ratios are assigned proportionately to the counter-factual distribution of ratios above 3.5. Two alternative scenarios describe a plausible range of desired LTIs. Technical details are contained in the Appendix.

The outcome is that the total amount of credit extended to borrowers at 3.5 LTI was lower by between €40 million and €100 million in 2018, due to the mortgage measures. These values correspond to between 0.5 and 1.1 per cent of new mortgage lending in Ireland.⁴

⁴ €8.7 billion in 2018. Source: *Mortgage Drawdowns*, Banking and Payments Federation Ireland.

6 Characteristics of borrowers at different loan-to-income ratios

Borrowers who receive LTI allowances differ systematically from others, as shown in Table 1. We can describe these differences as:

1. Differences that arise *generally* from higher LTI ratios due to debt service preferences;
2. Differences that arise *specifically* from the selection of borrowers into LTI ratios above 3.5, due to the macroprudential rule.

For example, borrowers with higher LTI ratios tend to have larger loans. However, borrowers with an allowance have an average loan size that is larger than would be expected if one projected forward the trend among borrowers without an allowance. In other words, loan size is higher due to both the general trend of larger loans at higher debt service ratios, and a specific difference in size of loans above 3.5 LTI when compared to loans below the limit.

In Figures 4 to 8, I compare the characteristics of new mortgages in 2018 and 2019H1 across borrowers with different LTI ratios. Each point depicts a band of LTI ratios of width 0.05, covering mortgages with LTI ratios between 2 and 4.5, which equates to 86 per cent of new mortgages. Borrowers bunching at 3.5 LTI are shown to have many characteristics that deviate from general trends associated with LTI and debt service preferences. These are due neither to chance, as the bunch is the most numerous LTI band by far, nor to differences in age, region or previous property ownership.

Borrowers bunched just below 3.5 LTI earn less income than any other group in the sample, albeit still above the average Irish household income. In particular, their incomes are €10,000 lower on average than among borrowers with high-LTI allowances, even though LTI ratios and incomes generally move in opposite directions (Figure 4). Households at the limit have lower average incomes for two main reasons. First, they are more likely to be single applicants than other borrowers below the threshold, particularly if they are first-time buyers. Second, their individual incomes are the lowest in the sample. The main earners in households with LTI ratios just below 3.5 LTI earn €6,000 less than those in households with allowances.

This evidence on borrower incomes has implications for the assessment of mortgage credit risk at banks. In the United States, Mian and Sufi (2009) show that a shift in mortgage lending toward low-income, subprime zip codes contributed significantly to mortgage defaults. In Ireland, low-income workers have been more likely to endure more job losses than others, especially during economic contractions (Nolan and Voitchovsky, 2016). As for numbers of applicants, supervisory loan-level data show that the non-performing loan ratio on Irish owner-occupier mortgages was three percentage points higher among single applicants than multiple applicants at the end of 2013, prior to banks' deployment of widespread restructuring and forbearance.

Constrained borrowers access slightly less credit than other, higher-income, conforming borrowers (Figure 5). When first-time buyers are credit-limited, they borrow less, but do not buy properties of significantly lower price, compared to borrowers at slightly lower LTI ratios. By contrast, second-time and subsequent borrowers at the LTI limit rely more on housing equity and pay less for properties. Figure 5 shows that buyers with allowances draw down more credit and purchase more expensive homes than other borrowers, even though their incomes tend to be lower.

How then do constrained households reach lower LTIs and achieve home purchases? They resort to less leverage and more housing equity than they could have chosen if they had been able to choose a higher LTI (Figure 6). One can distinguish between first-time buyers, who rely on liquid assets to raise a deposit, and borrowers who already own housing and can contribute its equity to a new purchase. Buyers at the LTI limit have lower LTVs than other buyers with similar debt-service ratios, but first-time buyers are more affected, with a typical LTV ratio of 77 per cent, compared to 84 per cent among borrowers with slightly lower LTI. This means the average deposit at the LTI limit is approximately €20,000 larger than those of borrowers at similar, but lower, LTI levels.

Because borrowers just below the limit have lower incomes, their deposit-to-income ratios are much larger. A first-time buyer who is just below the limit provides 15 months of gross income as an average deposit, compared to 9 months among borrowers with lower LTIs and 11 months among borrowers with allowances. Among SSBs, whose deposits may arise from housing equity, only some of the highest-LTI borrowers come close to the deposit-to-income ratio of the constrained group.

In some cases, mortgage records show how borrowers raised their deposits. Reporting quality varies by bank and is on a best-efforts basis. At three banks, which are representative of the other lenders, it is possible to categorise the deposit sources in two consistent groups. The first, “earned” category of deposit includes borrower savings and “Help to Buy” tax refunds from the Exchequer. Help to Buy repays taxes on income and interest, which are linked to the borrower’s recent income. The second, “unearned” category includes all other unspecified sources of cash, three-quarters of which are reported as gifts. These are less obviously linked to borrower income. Gifts, in particular, are more likely to arise from the income or wealth of family or friends.

Households at the LTI limit put a similar amount of savings and tax refunds toward their deposits compared to borrowers with similar debt service profiles, whether those with allowances or without (Figure 7). They do so, despite having the lowest incomes in the sample, by providing an average €15,000 more from gifts and other non-earned sources of income, compared to borrowers below 3.4 LTI. The difference suggests that borrowers at the limit achieve home purchases by using other finance to partially replace the credit that they forego. However, large gifts are also common among borrowers who receive allowances, so it is evident that some households receive gifts for reasons other than meeting a target LTI.

Finally, in Figure 8, I show other characteristics of buyers that are associated with credit supply and demand. I find that these do not deviate from trend at the 3.5 LTI limit. Term to maturity rises consistently with LTI, whereas borrower age falls. This is because a substantial share of borrowers, regardless of LTI ratio, seeks to reduce monthly repayment obligations by extending loan term as far as their banks will allow. Large loans with higher LTIs are most likely to be offered to first-time buyers. High-value loans are also more common in the expensive Dublin region. Constrained borrowers’ previous ownership likelihood and choices of region are in line with the trends among other borrowers below the LTI limit.

7 Conclusion

I use loan-level evidence from mortgage originations to estimate the impact of LTI regulation on borrowers who take mortgages at the limit. I find that to satisfy Ireland’s mortgage measures, lenders change their allocations of credit at high LTI ratios. Higher-risk borrowers in particular take on less debt than they would have otherwise received. Those borrowers reduce their leverage by relying disproportionately on unearned wealth, relative to buyers at other LTI ratios.

The methodology in this paper offers an assessment of the intensive margin of the LTI measure only: that is, owner-occupiers who reduce their leverage. Identifying borrower selection at the extensive margin, and the effect of macroprudential regulation on price expectations, would complement the treatment of the intensive margin effect, to fully describe the adaptations of bank and borrower behaviour to macroprudential mortgage measures.

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Appendix

The two scenarios described below delineate a plausible range of target LTIs among borrowers in the bunch, used in calculating the change to bank lending as a result of the mortgage measures.

In the first scenario, assume that borrowers with desired LTI close to 3.5 settled for a smaller mortgage, whereas other borrowers deferred purchases. The estimator finds that 17 per cent of all borrowers would have taken LTIs between 3.5 and 3.85, compared to 4 per cent in the data. The difference of 13 per cent equals the number of borrowers in the bunch who wanted higher LTI. Therefore, the first scenario assigns these borrowers to higher LTIs randomly drawn from the segment of the counter-factual distribution between 3.5 and 3.85.

In the second scenario, assume that borrowers with desired LTI above 3.5 randomly choose to settle for a smaller mortgage. This simple assumption implies that households with different levels of satisfaction with the final mortgage contract are equally happy to accept the final offer. For this reason, it is unlikely that any assumption that leads to higher LTIs than this scenario would embody plausible patterns of borrower behaviour. In this scenario, the segment of the counter-factual distribution from which LTI assignments are drawn begins at 3.5 and ends at 4.7.

Tables and Figures

Table 1: Summary statistics of owner-occupier mortgages for purchases

LTI bracket	All	0 to 3.45	3.45 to 3.5	Over 3.5
LTI rule status		Conforming	Conforming	Allowances
Property value	332,816	322,379	332,362	411,952
Loan	242,648	231,089	246,488	322,955
Deposit	90,168	91,290	85,875	88,997
Gross income: Household	87,253	91,824	70,747	80,816
Gross income: Highest earner	62,848	65,830	52,342	58,205
Deposit-to-income ratio	1.11	1.06	1.34	1.11
Mean LTI	2.90	2.61	3.49	4.02
Mean LTV, per cent	76	75	76	81
First-time buyer share, per cent	65	59	80	82
Dublin property share, per cent	34	28	43	67
Single applicant share, per cent	25	22	34	34
Interest rate, per cent	3.0	3.0	3.0	3.0
Age of oldest applicant	37	38	35	34
Mortgage term (years)	27	26	30	31
Mortgages	43,403	31,958	7,189	4,256
Share of mortgages, per cent	100	74	17	10

Figure 1: Shares of new borrowers in each LTI band below 4.75 per year

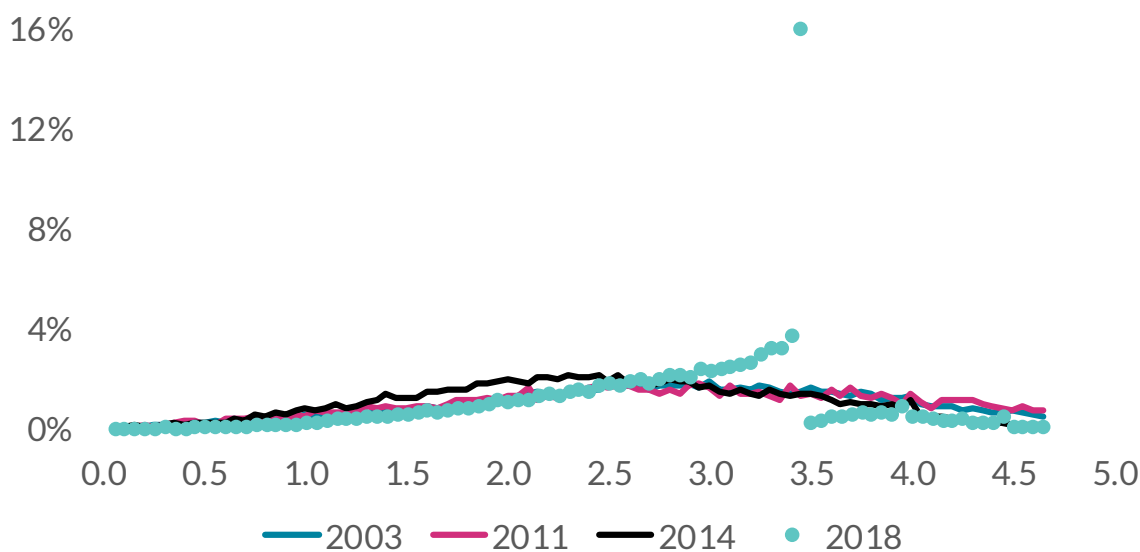
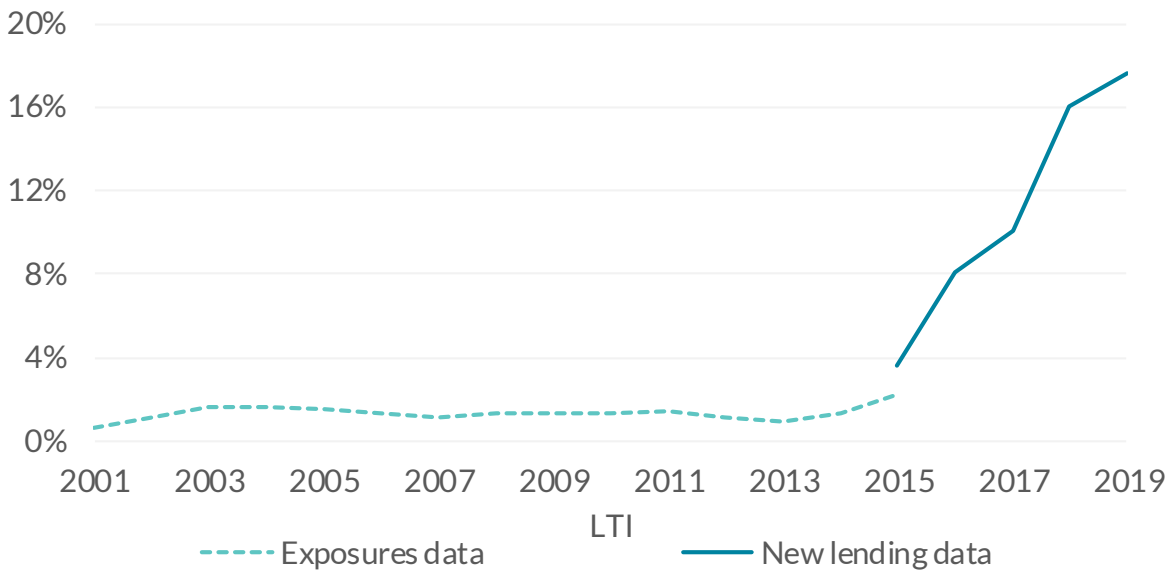


Figure 2: Shares of loans issued between 3.45–3.5 LTI in each origination year



Notes: Owner-occupier mortgages for purchases only. “Exposure” shares are calculated from supervisory data on loan-level exposures since 2011 and do not include loans that expired before 2011 or borrowers for whom income is not reported. “New lending” shares are calculated from mortgage measures supervisory returns. 2019 records describe January to June only. Shares in 2015 differ due to more comprehensive evidence in new lending data.

Figure 3: LTI distribution and counter-factual without LTI limits

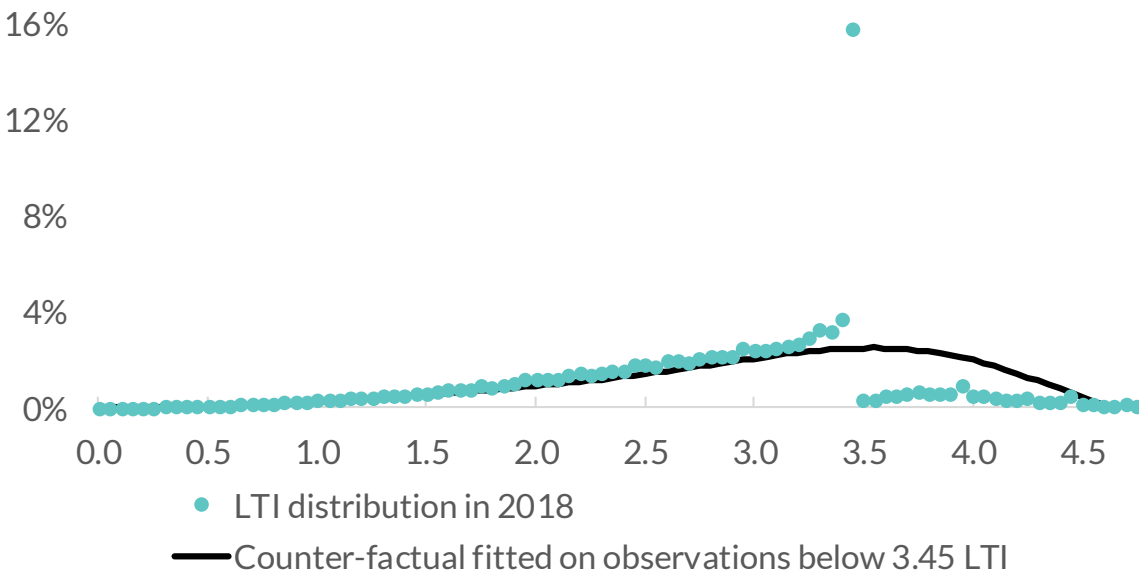


Figure 4: Incomes and single applicant status per LTI category

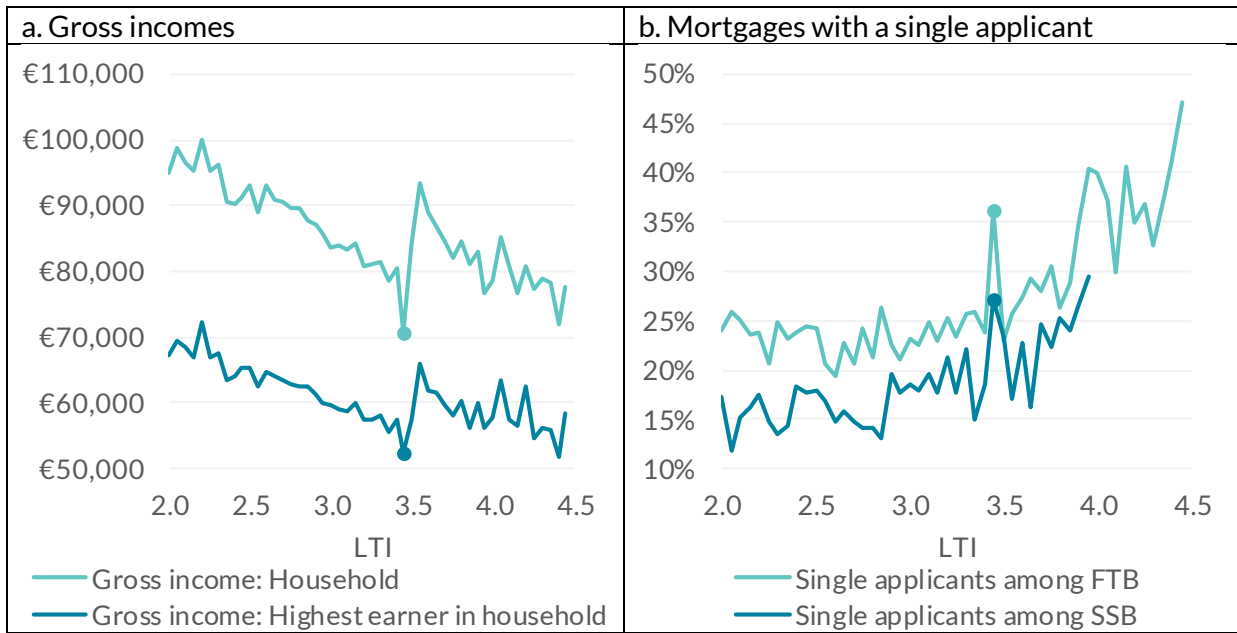


Figure 5: Property purchase prices and loan size per LTI category

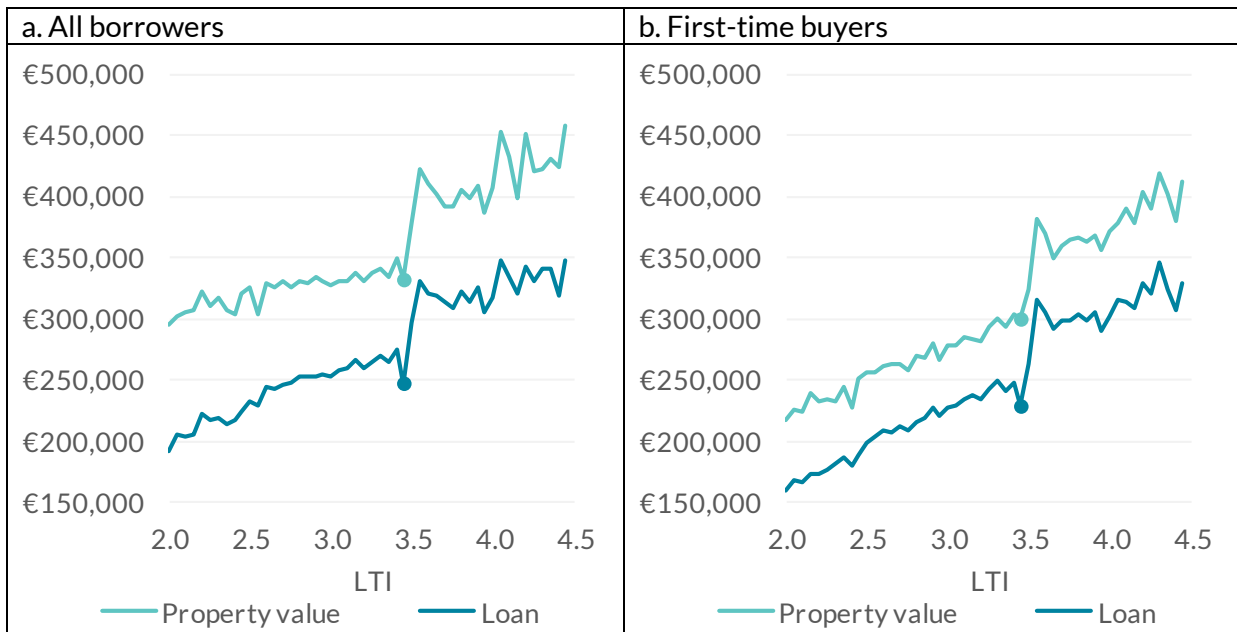


Figure 6: LTV and deposit-to-income ratios per LTI category

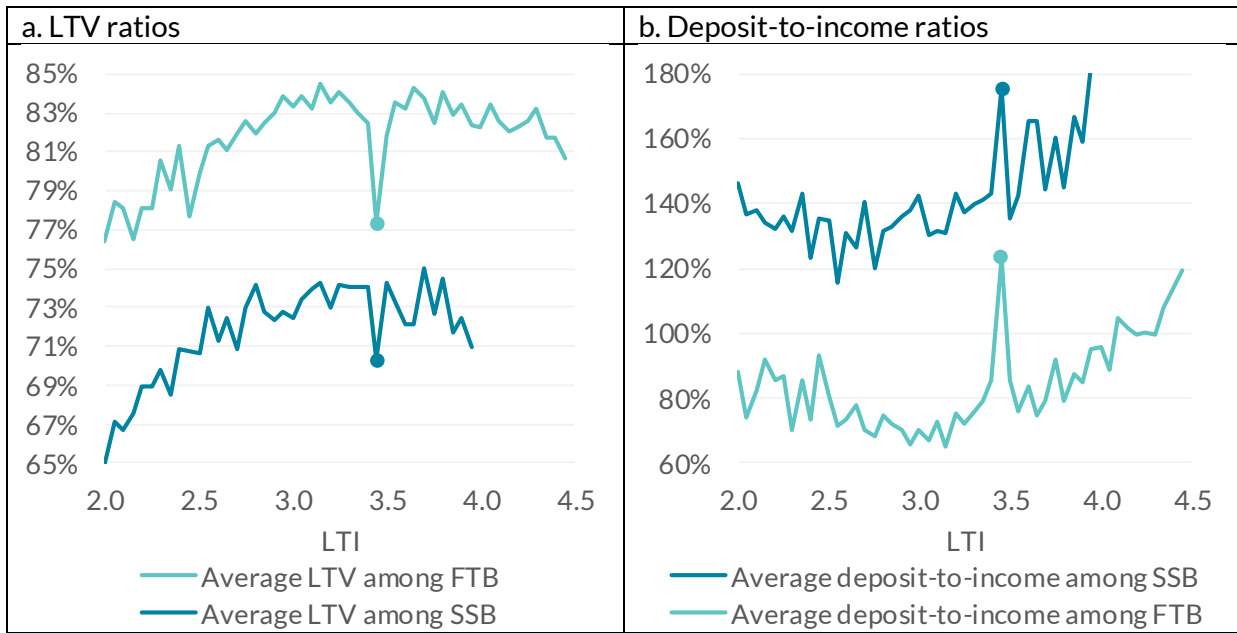


Figure 7: First-time buyer deposits and their sources, per LTI category

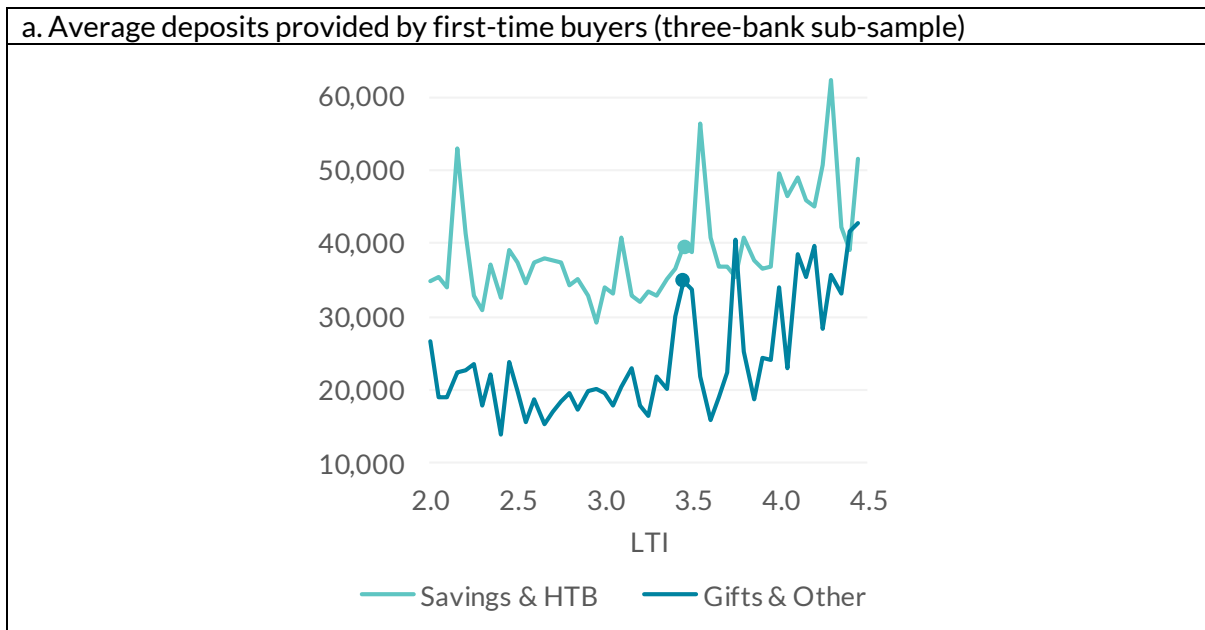
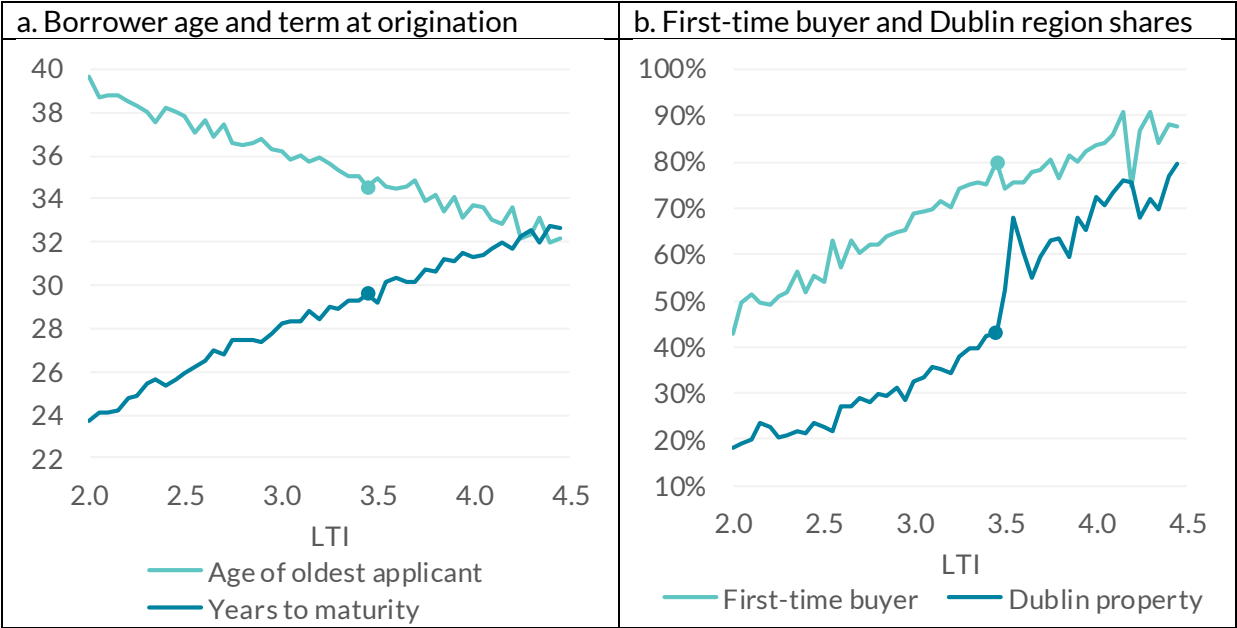


Figure 8: Other borrower characteristics per LTI category



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