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Originating Loan to Value ratios and the resilience of mortgage portfolios

Fergal McCann and Ellen Ryan[1]

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Abstract

It is widely acknowledged that mortgage lending with lower Loan to Value (LTV) ratios is expected to have a lower probability of default, which will increase the resilience of a bank's mortgage portfolio to adverse events. This Letter focuses on another channel through which lower-LTV lending can lead to improvements in bank balance sheet resilience: the lowering of losses in the event of a default (Loss Given Liquidation, LGL). Using data from three major mortgage lenders in Ireland on loans for property purchase, we focus on originating LTVs on mortgages issued between 2003 and 2016 to make a number of observations on the evolution of mortgage portfolio resilience. Firstly, aggregate hypothetical losses experienced in the event of a common shock are at the lowest level since 2003 among the cohorts of loans issued since the introduction of recent Central Bank of Ireland mortgage market regulations. Secondly, the correlation between originating LTV and loan size has been falling steadily since 2006, reflecting a decreased tendency for banks to make their largest loans also their most highly leveraged, which leads directly to improvements in portfolio-level resilience. Finally, we show that improvements in the resilience of mortgages to adverse house price shocks are most pronounced at the right tail of the LTV distribution, where the highest-risk lending has reduced significantly over the 2008-2016 period.

1 Introduction

The resilience of a bank loan book to adverse shocks is heavily influenced by the originating features of its underlying loans. The amount that a bank is likely to lose on a loan portfolio, commonly referred to as Expected Loss (EL), is calculated as the product of the Probability of loan Default (PD), the size of the Exposure at Default (EAD) and the magnitude of the loss experienced in the event of a default (Loss Given Default, or LGD).

The factors which explain mortgage PD in Ireland have been examined extensively since the onset of the financial crisis. Research from Kelly and O'Malley (2016) shows that the debt service burden, current loan to value ratio (CLTV), current interest rate, First Time Buyer (FTB) status, interest rate types, loan age, house price changes and regional unemployment are all significant predictors of the transition into default for Irish mortgages. McCarthy (2014) shows that current affordability metrics such as income, the debt service burden and unemployment are also important factors. The role of originating loan characteristics in mortgage PD has also been studied by Kelly, O'Malley and O'Toole (2014) who show that

[1] E-mail: fergal.mccann@centralbank.ie. We thank Mark Cassidy, Gabriel Fagan, Philip Lane and Yvonne McCarthy for comments. The views presented in this paper are those of the authors alone and do not represent the official views of the Central Bank of Ireland or the European System of Central Banks. Any remaining errors are our own.

higher levels of the *originating* LTV and Loan to Income ratio (LTI) are both associated with subsequently higher PDs.

While the PD component of Expected Loss is well understood in the Irish mortgage market, the two other components, EAD and LGD, are less studied. The interaction between all three components is most important in understanding likely bank losses. For example, in cases where banks issue a portfolio of high-PD loans, the impact on portfolio Expected Loss can be lowered by issuing the high PD loans with relatively low balances (EAD), or by ensuring the high-PD loans are well-collateralised (low Loss Given Liquidation, LGL).[1] Joyce and McCann (2016) show that during the pre-crisis period, PD and EAD were highly correlated at origination, with the loans in the largest 10 per cent of the loan size distribution having PDs at origination that were almost double those in the bottom 10 per cent. They show however that since 2014, this correlation has broken down, with higher-value loans no longer being those issued with the highest PD. Above and beyond the obvious financial stability benefits from loans being issued with lower PDs, this reduced PD-EAD correlation will have additional beneficial effects on loan book resilience.

The aim of the *Letter* is to show how resilient in terms of potential LGL each year's pool of newly issued mortgages appeared at the point of origination. By analysing the originating features of pools of mortgages issued since 2003, we allow comparisons between the pools of loans issued since the introduction by the Central Bank of Ireland of macroprudential housing market regulations (henceforth the regulations) for the Irish mortgage market in February 2015, and earlier cohorts. The regulations aim to increase the resilience of Irish borrowers and lenders and to decrease the probability of future house price spirals (Cassidy and Hallissey, 2016) by placing explicit limits on LTV and LTI at origination. Given our focus on loan origination, the LGL figures provided here cannot be compared to LGL estimates from stress testing exercises. The latter are carried out using current loan characteristics as of the date of the stress test. In the case of LTV, there will be a marked difference between current values and those at origination for certain loan cohorts due to the severe housing market downturn that has pushed many mortgages issued in 2005 to 2007 into negative equity. The figures presented in this paper are hypothetical estimates of hypothetical LGL in the case where a loan defaults without paying down any of its originated balance under a range of house price shocks. While this abstracts from the reality that some amortization has generally taken place before a default occurs, it allows for a more meaningful comparison across loans issued in the years 2003 to 2016.

A number of key findings emerge from our analysis. Firstly, across two definitions of hypothetical loss severity in the event of a default, we show that the aggregate resilience of annual cohorts of new loans has been improving steadily from 2008 to 2016 across most scenarios. In all scenarios, aggregate hypothetical loss severity among loans issued within the scope of the regulations in 2015 and 2016 is lower than in any previous year since 2003. Secondly, we study in detail the correlation between loan size at origination (EAD in stress testing parlance) and originating LTV (which directly impacts LGD). We show that, in every year since 2006, the correlation between loan size and OLTV has been falling in the Irish mortgage market. This has important aggregate implications for the longer-term resilience of Irish mortgage portfolios as it implies that loans with the highest LGL are less likely to be the largest loans. Finally, we calculate breakeven house price changes for all loans and show through another lens that buffers protecting banks from experiencing losses in the event of a real estate downturn are greater now in the period since the regulations than previously.

The *Letter* continues as follows: Section 2 describes our data; Section 3 provides estimates of aggregate loss severity; Section 4 calculates breakeven house price growth rates for all loans; Section 5 concludes.

2 Data

Our analysis uses two data sources provided to the Central Bank by Ireland's large domestic mortgage

[1] Loss Given Default is often seen to be composed of two components: firstly the probability of loan cure must be factored in before determining how much of the Exposure at Default will actually be remaining due at the point of repossession; secondly, the Loss Given Liquidation refers to the differential between the EAD that remains after loan cure and the repossessed valuation of the collateral. For the remainder of the paper, we will abstract from loan cures and refer only to the LGL component of LGD.

lenders. The first source, the Loan Level Data (LLD), was first collected as part of the Financial Measures Programme 2011 and has subsequently been updated at six-monthly intervals. From this source we examine all relevant loans outstanding as of end-December 2014. These data contain micro-level information on the current status of each loan as well as originating terms. The second source is collected from lenders using the "SI 47 Monitoring Template" with the aim of monitoring compliance with the regulations. Institutions are required to detail all loans covered by the regulations reporting, for example, borrower characteristics, terms at origination and the use of exemptions to the regulations. The usage of Monitoring Template data allows the analysis to be extended to June 2016. To increase comparability of loan cohorts over time, we restrict analysis to loans for property purchase only (First Time Buyer, Second and Subsequent Purchase, Buy to Let) and remove loans for equity release and refinancing (which typically have lower OLTV by their nature). Due to data availability restraints, all figures in this paper come from data covering three large mortgage lenders, representing around two thirds of the mortgage market in Ireland. Combining these sources and applying the above restrictions allows us to analyse the originating features of 370,465 loans. We focus in all cases on the originating characteristics of each loan namely, originating size, LTV and house price value.

For the purpose of our analysis we examine loans made between the beginning of 2003 and the end of the first half of 2016. As the regulations came into effect on February 9th 2015, loans made in 2015 are divided into those not covered by the regulations (loans drawn down in 2015 which were approved prior to February 9th 2015 and loans subject to exemptions) and loans which are covered (loans drawn down in 2015 which originated after February 9th 2015).

3 Evolution of aggregate loss measures

3.1 Approach

While the likelihood of a lender's loans defaulting is obviously central to any analysis of its resilience, the size of loss incurred in the event of default is also of great importance as this has the potential to limit or amplify the effect of any given level of PD on portfolio Expected Loss. Our analysis focuses on losses that would be experienced by a lender in the event of a default, abstracting from both the probability of default (PD) and its drivers.

In this *Letter* we focus on instances where after default, a loan enters foreclosure and the collateral is eventually repossessed. For this reason, it is more accurate to refer to calculations in this section as representing Loss Given Liquidation (LGL), rather than Loss Given Default (LGD), which also incorporates the possibility of loan cure and modification. Prior to undertaking our analysis, a number of assumptions are made regarding sale costs;

- **Legal and Administrative Costs:** Legal and administrative costs of repossession amount to 5 per cent of the price of a house at the time of its sale and;
- **Fire sale costs:** A liquidation haircut or fire sale discount of 20 per cent is also applied to acknowledge that properties in repossession may be subject to additional price cuts that result from reduced demand for repossessed properties, potential for value reduction due to lack of investment in property upkeep during the foreclosure and externalities arising from the sale of many properties of a similar nature in a downturn.

Hypothetical loss magnitude is then calculated for each loan under negative house price shocks ranging from zero to twenty per cent. Loss occurs when the recovery value of collateral (the property) is less than the originating value of the corresponding loan. Given cost assumptions, recovery value can be calculated as

$$Recovery\,Value = (Original\,Property\,Value) \times (1 - Price\,Shock) \times (1 - Costs)$$

Hypothetical loss size can then be calculated as the difference between loan size and recovery value.

$$Loss = Max(0, Original\,Loan\,Size - Recovery\,Value)$$

At this point it is important to acknowledge the deterministic role of originating LTV in the size of loss. For a given house price and a given house price shock (and as a result a given recovery value), the originating LTV (through its two components, the original loan size and original property value) is the only loan characteristic that exerts an influence on LGL.

3.2 Cyclicality of Aggregate Loss Measures

To examine the implications of lending behaviour for bank resilience we compare the magnitude of hypothetical losses likely to be experienced under various house price scenarios across years of origination. We construct an aggregate yearly measure of bank loss by aggregating potential losses among all loans issued within a given year. We express this measure as a ratio to total new mortgage lending in the same year and refer to it as the *magnitude of loss*.

$$Magnitude\,of\,Loss = \frac{Total\,Losses}{Total\,Lending}$$

In the above calculation, in cases where the recovery value is greater than the outstanding loan amount, a loss value of zero is applied. This metric is interpreted as calculating the loss severity across a whole portfolio, in the event that all loans had an equal probability of default.

To create an aggregate measure closer to the typical loan level approach to LGL, we create a second measure which divides losses by the total size of loans which experience loss for a given year. We refer to this as aggregate LGL.

$$Aggregate\,LGL = \frac{Total\,Losses}{Total\,Lending\,Where\,Loss\,Occurs}$$

As can be seen in Figures 1a and 1b both measures display clearly cyclical behaviour, peaking prior to 2007 before falling. In both cases the impact of the regulations can be seen. In Figure 1a we see that, relative to the total size of loans issued in a year, the magnitude of possible losses under each house price scenario rose steadily from 2003 to 2006. There has been a downward trend or stabilisation between 2007 and 2013, depending on the house price shock chosen. In all cases, an increase between 2014 and 2015 loans not within the scope of the regulations ("2015-N") may suggest a certain amount of front-loading in advance of the regulations, where lenders and borrowers aware of the potential for future LTV limits originated high LTV loans at high balances prior to their introduction. Following "2015-N" there is a substantial drop in loss severity implying that since the regulations, in the event of default, these loans will pose a lesser threat to bank stability through portfolio level Expected Loss.

Figure 1b shows the aggregate LGL measure described above under a number of house price shock scenarios. The picture is similar to Figure 1a, although in this case there is a clearer trend downwards over the entire period 2008 to 2016, with the cohorts issued following the introduction of the regulations appearing in this case to be a continuation of an already-established pattern of increasing mortgage portfolio resilience.

3.3 OLTV and loan size

Figure 1b has shown that total losses among those loans experiencing a loss was increasing prior to the crisis and that this result holds across a number of house price shocks. This suggests that bigger proportionate losses were made on bigger loans, implying an increasingly positive relationship between originating loan size (EAD) and originating LTV (LGL). To test this formally, we run a set of simple linear regressions of the log of originating loan size on originating LTV for each year. Figure 2 shows the slope coefficients from this regression along with their 95 per cent confidence intervals.

A positive relationship is found across all years. In the years 2003 to 2006, a one percentage point increase in OLTV was associated with a 1.75 per cent increase in originating loan size. This coefficient of correlation has steadily decreased in every year from 2008 to 2015, to the point where a one percentage point increase in OLTV is associated with a 1.1 per cent increase in originating loan size in the 2015 and 2016 cohorts.

The implication of the results of Figure 2 is that the interaction of OLTV and loan size has been evolving favourably from a financial stability perspective since 2008. If this pattern continues, the breakdown in the correlation between Exposure at Default and Loss Given Default will mean, all other things equal, that loss severity on Irish banks' mortgage books will reduce relative to levels seen in previous years. Combined with evidence from Joyce and McCann (2016) on the reduced correlation between Probability of Default at origination and loan size, this depicts a mortgage market in which lenders are becoming increasingly resilient to adverse shocks, as per the stated aims of the recent regulations.

4 Sensitivity to house price change

4.1 Approach

As shown in Section 3, lending at higher LTV ratios can result in higher losses for a given house price shock. Another way of stating this is that the LTV level will also affect the house price change required for the bank to experience a loss in the event of default. We measure this sensitivity to house price movements by calculating the house price change at which the lender breaks even on a loan as the house price change at which the recovery value is equal to originating loan size. We impose the same assumptions regarding sale costs as laid out in Section 3.1) and calculate the measure as follows:

$$Breakeven = 100\times \left(\left(\frac{Original\ Loan\ Size}{(Original\ Property\ Value)\times(1-Costs)}\right)-1\right)$$

4.2 Full book

Figure 3 shows the distribution of breakeven values across the full mortgage book of the three banks examined for a selection of origination periods. Most notable is the concentration in the twenty to forty per cent region for 2006 lending; this shows a concentration in lending which would require up to a forty per cent house price increase for the lender to break even based on originating loan characteristics and cost assumptions.[2] Modal points then shift to the left for later years, implying the loan book is less vulnerable to adverse house price changes, although breakeven values remain high for a large share of loans. Interestingly there is a marked difference between the distributions of 2015 loans covered and not covered by the measures (2015-Y and 2015-N), with the former group concentrated at a lower break even value and thus displaying a lower level of market sensitivity and higher degree of resilience across the whole distribution.

4.3 Right tail

Figure 3 has shown the distribution of breakeven values for all loans in a given year. However the right tails of these distributions are of greatest importance from a financial stability perspective, as they cover the most highly leveraged loans and as such those that are most vulnerable to negative market developments. Figure 4 therefore provides more detail on these loans by showing the 75th, 85th, 90th and 95th percentile breakeven values for a selection of loan cohorts. For example, in 2003 a 21 per cent house price increase was required for banks not to make a loss on the top ten per cent of their loans, should they default at drawdown. The corresponding required growth was 32 per cent in 2006, 21 per cent in 2015 for loans not covered by the regulations and 18 per cent for loans which were covered by the regulations. While breakeven values at the right tail of the OLTV distribution have clearly reduced significantly since the financial crisis, it is interesting to note that the 75th percentile value increases prior to the crisis but does not fall afterward. This suggests that, while the extremely high-leverage loans that characterised the most excessive risk-taking of the pre-crisis period have been absent from Irish mortgage lending since 2008, for the less risky three quarters of the mortgage book there has been very little change over the 2003 to 2016 period.

5 Conclusion

The aim of this *Letter* is to study the distribution of originating LTV ratios in Irish mortgage lending from the perspective of Loss Given Default and its relationship with bank balance sheet resilience. Our analysis shows clear cyclical behaviour in high LTV lending by Irish banks. From a resilience perspective this resulted in larger possible losses in the event of default and a higher degree of sensitivity to negative developments in the real estate market over the years preceding the financial crisis. Detailed examination of these patterns uncovers a cyclical pattern in the correlation between originating LTV and loan size: in recent years, larger loans are less likely to also be the highest-risk loans than in the 2003-2008 period. From the perspective of

[2] While it may initially seem counter-intuitive that a bank would make a loss with positive house price growth, it must be remembered that in the pre-2008 period, mortgages in excess in 100 OLTV were relatively common. Further, even when loans are issued below 100 OLTV, it will be the case that the bank can make a loss with positive house price growth due to our assumptions about the additional costs of repossession.

aggregate bank losses, lower correlations between Exposure at Default and Loss Given Default are beneficial.

Finally, we show that across all annual cohorts of mortgages issued between 2003 and 2016, loans issued since the introduction of recent Central Bank of Ireland regulations are the most resilient in terms of the severity of losses in the event of default.

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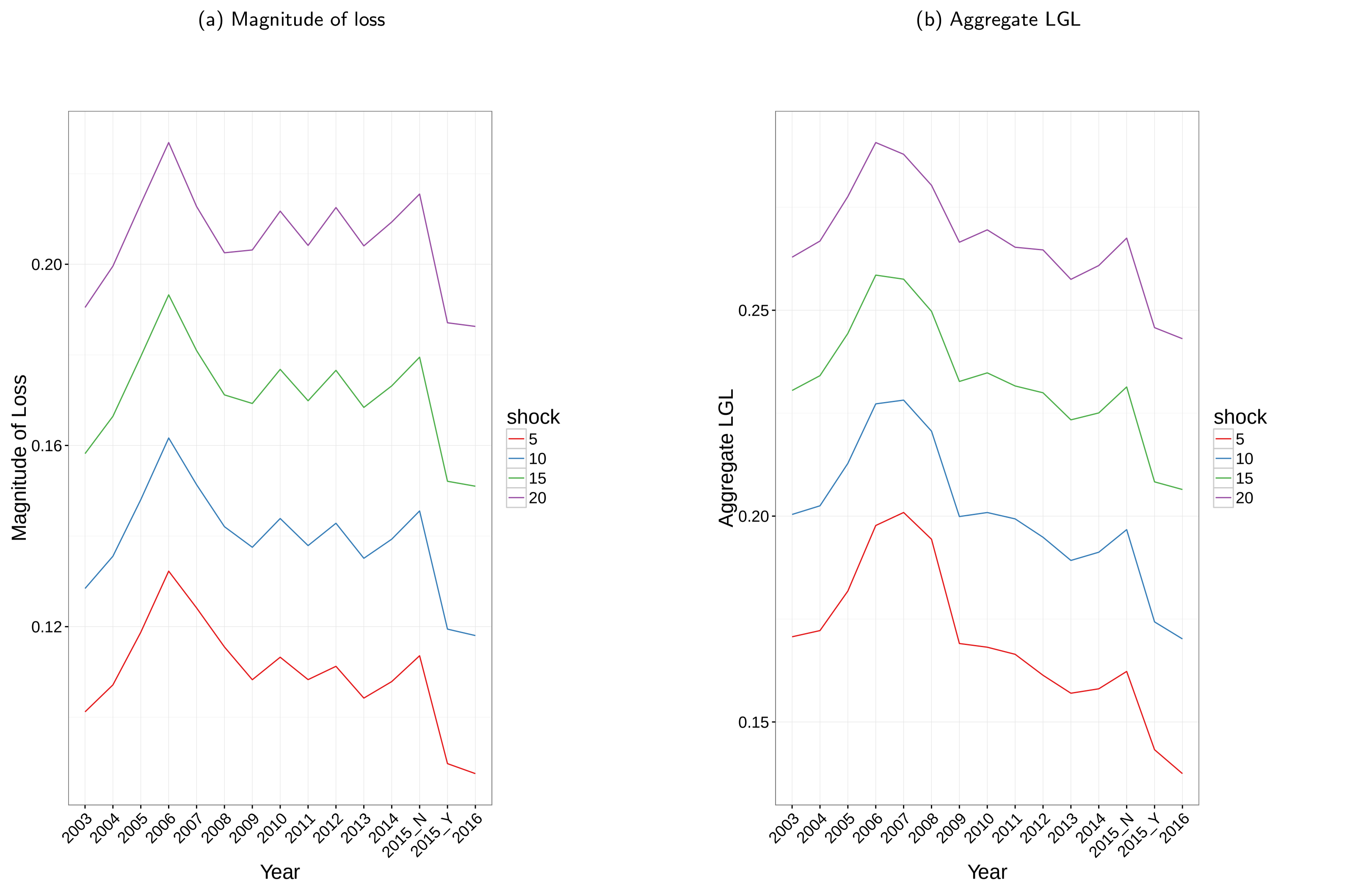
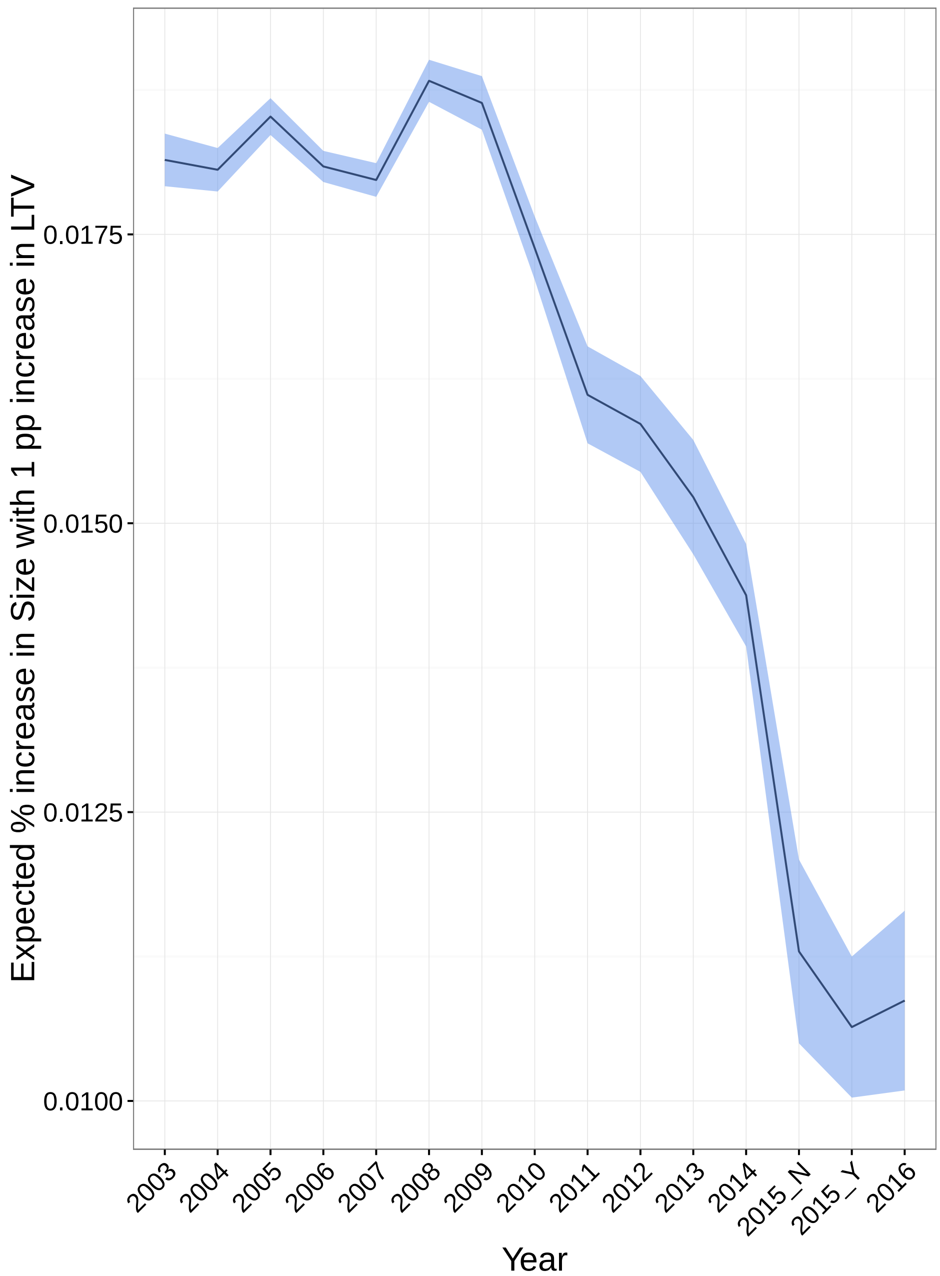
Figures

Figure 1: Aggregate loss measures



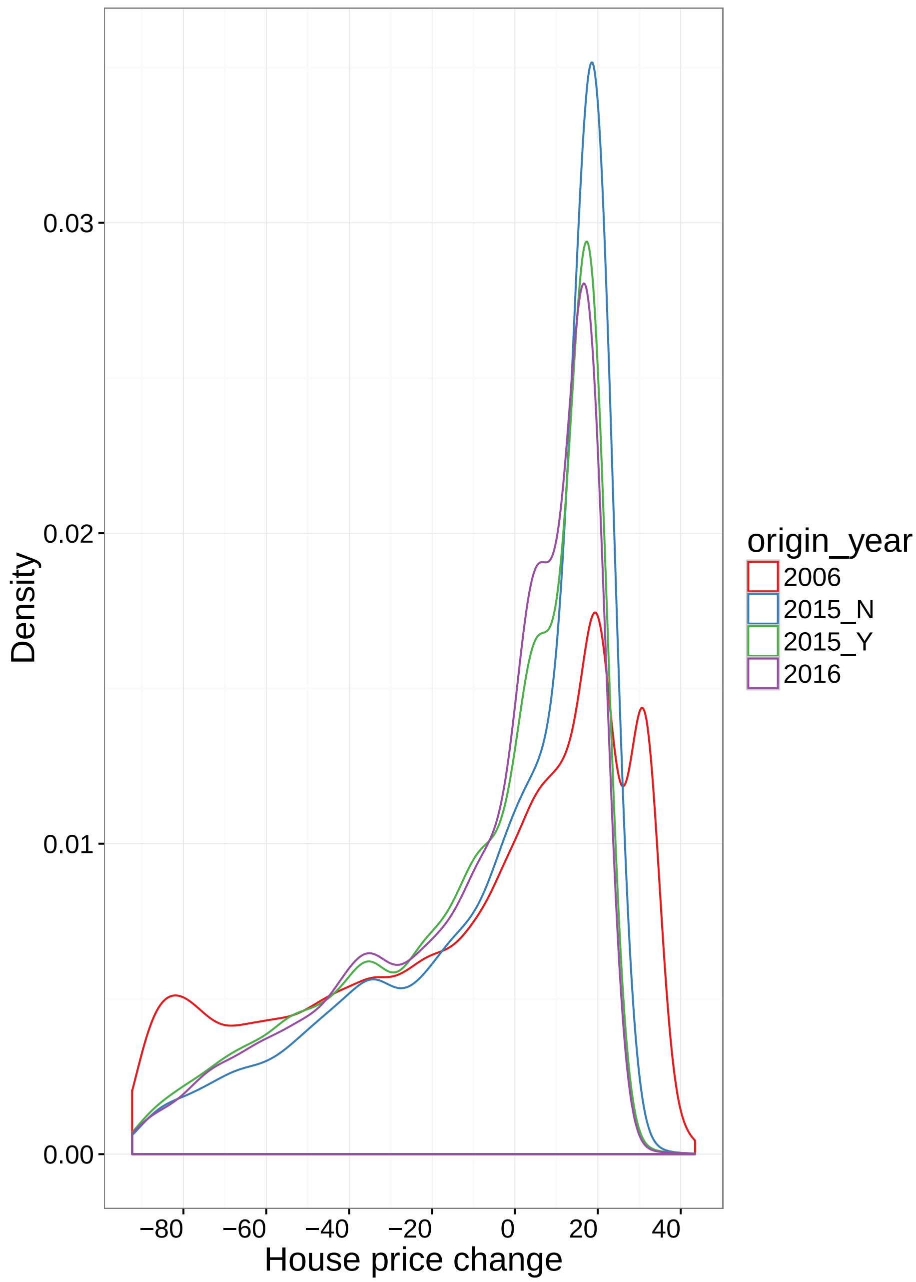
Each point on the graph refers to the aggregate hypothetical losses that would be experienced in the event of a default under different shock scenarios for all loans issued within a given year. In Panel (a) the denominator is the total drawn loan balance among mortgages issued in each year. In Panel (b) the denominator is the total loan balance in each cohort for loans that experience a loss in the hypothetical scenario. 2015-Out refers to loans drawn down in 2015 which are not within the scope of the Central Bank of Ireland's mortgage regulations. 2015-Reg refers to loans issued in 2015 and within the scope of the regulations.

Figure 2: Cohort-specific correlation between OLTV and originating loan size



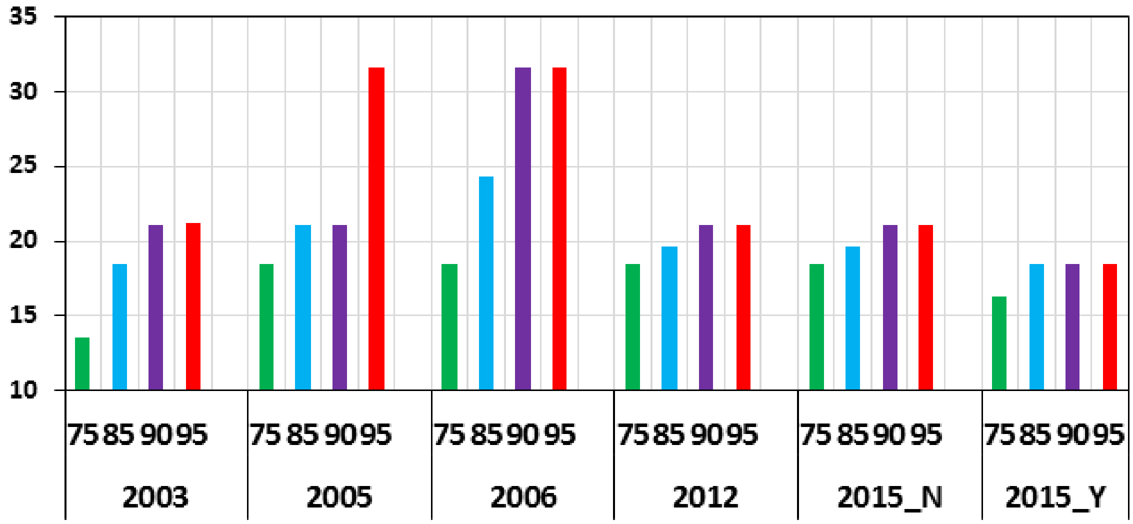
Each point on the graph is the coefficient from a cohort-specific linear regression of originating LTV on the natural log of originating drawn loan balance. 95 per cent confidence intervals are represented by the shaded area.

Figure 3: Density plot of distribution of breakeven values by loan cohort



Breakeven values are calculated for every loan in the data as the house price growth rate below which a bank will make a loss on a loan, given the originating LTV and a set of assumptions on repossession costs and fire sale discounts.

Figure 4: Right tail break-even points across cohorts
Percentile values



Breakeven values are calculated for every loan in the data as the house price growth rate below which a bank will make a loss on a loan, given the originating LTV and a set of assumptions on repossession costs and fire sale discounts. Higher percentile values indicate loans for which more favourable house price growth is required for a bank to avoid making a loss, i.e. loans originated with higher LTVs.