



# Have the LVR restrictions improved the resilience of the banking system?

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## NON-TECHNICAL SUMMARY

As part of sound regulatory practice, the Reserve Bank wants to further its understanding, and the public's understanding, of how the policy has influenced financial stability. This paper contributes to this objective by developing a modelling framework that quantifies the extent that the loan-to-value ratio (LVR) policy has improved the resilience of the banking system to a severe downturn in house prices.

We find that the LVR restrictions have significantly improved the resilience of the banking system. The LVR policy has reduced the scale of mortgage defaults and credit losses that would occur in a housing downturn, due to a reduction in risky loans on bank balance sheets and the mitigation of a potential house price decline. This resilience benefit has been partly offset by a fall in capital requirements that results from lower credit risk, reducing the banks' buffer for absorbing credit losses. Nevertheless, the LVR policy is estimated to have reduced mortgage losses – as a share of the capital banks hold against their housing loans – by 12 percentage points. The policy is found to have mitigated about half of the deterioration in bank resilience from 2013 that would have occurred in the absence of the policy.

Our estimates are sensitive to judgements on key variables and inputs. The resilience benefit of the LVR policy is contingent on the level of housing market risk that would exist without the policy. This suggests a stronger case to deploy the LVR tool when the risk of a house price decline is high. We were unable to model the resilience benefit of restricting property investor lending with confidence, although a provisional estimate suggests that the benefit may be large. Therefore, the headline estimate may understate the resilience benefit of the LVR intervention. A comprehensive assessment of the policy's efficacy needs to consider the cost of the policy, which is outside the scope of this paper.

### 1. Introduction

A mortgage loan-to-value ratio (LVR) is a measure of the size of a borrower's loan, relative to the value of the property collateralised against the loan, often expressed as a percentage. LVR restrictions operate by requiring banks to limit their lending to borrowers with a high LVR, as defined by the policy, to below a specified proportion of their new lending (the speed limit).<sup>1</sup> The Reserve Bank introduced the LVR policy in October 2013 in response to rising financial stability risks. Lu (2019) provides a detailed overview of the Reserve Bank's motivation for deploying and adjusting the LVR restrictions since 2013, including a greater focus over time on high-LVR property investor lending.

LVR restrictions are intended to reduce the scale of mortgage losses for banks in a severe house price fall, and to mitigate extremes in the credit cycle that can amplify the magnitude of an economic downturn. To help both the Reserve Bank and the public understand how the LVR policy has influenced one of its key objectives, this paper assesses the extent the policy has improved the resilience of the banking system to a severe house price correction, relative to a counterfactual scenario where the Reserve Bank has not deployed a LVR instrument. The paper also supports the Reserve Bank's review of its experience with the policy, by utilising a quantitative model to estimate its

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<sup>1</sup> The **speed limit** is the maximum share of new mortgages loans that can be approved by a bank above the specified regulatory LVR threshold, and is generally expressed as a percentage.

resilience impact. The model incorporates the impact from all adjustments to the LVR policy to date, including the policy tightening in the earlier years and the easing in more recent years.

The remainder of the paper proceeds as follows. Section 2 outlines three transmission channels through which the LVR policy may influence bank resilience. Sections 3 to 5 explains the methodology for assessing each of the transmission channels, and provide an estimate of their impact. Section 6 presents the headline estimate for the aggregate impact on bank resilience from the LVR policy. Section 7 presents a sensitivity analysis of the model output to key assumptions and an extension to the headline result. Section 8 concludes.

## 2. Theory

A severe downturn in the housing market can undermine the banking system if losses on mortgage loans are sufficiently large relative to the capital (loss-absorbing capacity) of the banking system. The headline measure of bank resilience in this paper is the percentage share of banks' housing capital requirement that would be consumed to cover mortgage defaults for a given magnitude of house price correction. LVR restrictions may influence the resilience of the system through at least three transmission channels.

- **Asset quality effect:** LVR restrictions can reduce the share of new mortgage commitments with a relatively high LVR, and shift the LVR distribution of the mortgage portfolio lower. All else equal, a higher LVR makes it more probable that a house price fall will result in negative equity for the borrower. If a borrower is unable to service their mortgage, negative equity generally means that a borrower cannot sell their house to fully repay a mortgage, and consequently increases the *probability of default*. A higher LVR also implies greater borrower leverage, which increases the debt burden of borrowers and the probability of default.<sup>2</sup> Additionally, a higher LVR boosts the size of any negative equity given a house price fall, and increases the *loss given default*. Therefore, a downward shift in the LVR distribution will reduce credit risks and the expected mortgage losses in the banking system given a stress event.<sup>3</sup>
- **Risk weight effect:** The LVR restrictions can reduce the minimum level of capital that banks are required to use to fund their mortgage loans. A significant decline in the LVR distribution on the mortgage book of the banking system will lead to a fall in the average mortgage risk weight, which

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<sup>2</sup> Shaar (2018) finds that the share of owner-occupiers with an elevated debt-to-income ratio has declined in the post-LVR period in New Zealand, as borrower LVRs have declined.

<sup>3</sup> Lydon and McCarthy (2013) found a strong relationship between LVRs and mortgage defaults in Ireland between 2009 and 2011, when house prices fell more than 40 percent. Kelly (2012) also using Irish data found a strong non-linear relationship between LVRs and the probability of default. Herkenoff (2012) studying US data found that an unemployed person is much more likely to default if they have negative housing equity. The LVR policy can also constrain the overall flow of new lending, which will reduce mortgage losses in a stress event. Brunnermeier et al. (2019) studied the relationship between bank characteristics and their contribution to financial stability risks under an asset price bubble, and found that bank asset size and loan growth were among the most important determinants of systemic risk.

is intended to reflect the credit risk of mortgage assets.<sup>4</sup> A fall in the mortgage risk weight will reduce the volume of risk-weighted assets for banks, which would dampen the amount of capital banks are required to hold against their housing assets. When viewed in isolation, this effect of the LVR policy is negative for banking system resilience, as it reduces the capital buffer available for banks to absorb loan losses in a stress event.

- **Indirect feedback effect:** The LVR policy can mitigate the potential magnitude of a house price correction in a stress scenario. First, the LVR policy can reduce the prevalence of distressed house sales, through reducing the likelihood of borrowers experiencing serviceability difficulty. A reduction in the share of investor lending as a result of the policy, particularly to those with high LVRs, will also limit their contribution to the number of houses available for sale in a housing downturn. Second, the LVR policy can dampen the scale of house price overvaluation leading up to the house price correction, bringing prices more in line with economic fundamentals. This helps to make house prices more durable to changing economic drivers of the housing market. All else equal, a smaller scale of a house price correction helps to maintain the value of the housing collateral, and therefore will reduce mortgage losses.

Our modelling framework will quantify each of these transmission channels. Following that, we will combine all three effects to estimate an aggregate impact of the LVR policy on system resilience.

### 3. Asset quality effect

The first step in the modelling framework is to estimate the asset quality effect of the LVR restrictions. The estimation methodology essentially answers two questions:

1. How did the LVR restrictions policy affect the LVR distribution of the mortgage portfolio?
2. How did any changes in the LVR distribution of the mortgage portfolio affect the sensitivity of housing defaults and credit losses to a house price downturn?

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<sup>4</sup> Within the capital framework, the risk weight of a loan is a function of the probability that the loan defaults (PD), the expected loss on that loan if a default occurs in a severe downturn (LGD), and whether default of that loan is likely to be correlated with defaults of other loans in that portfolio (correlation).

Figure 1: LVR distribution of the mortgage stock, 2014 to 2018

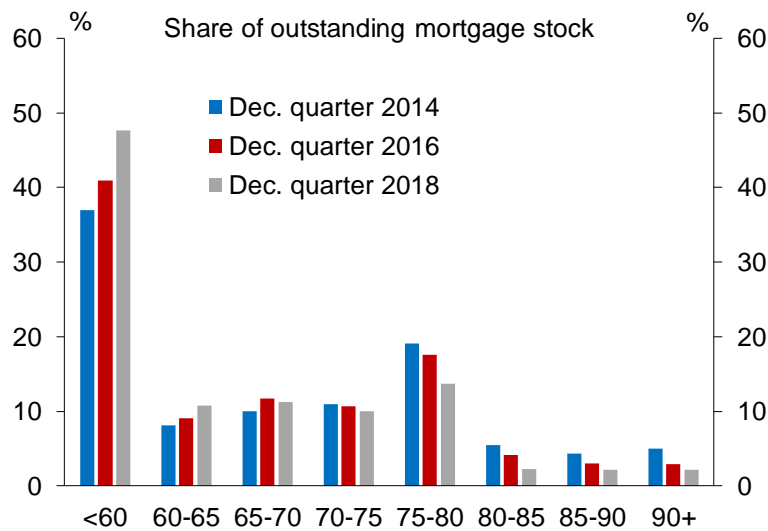
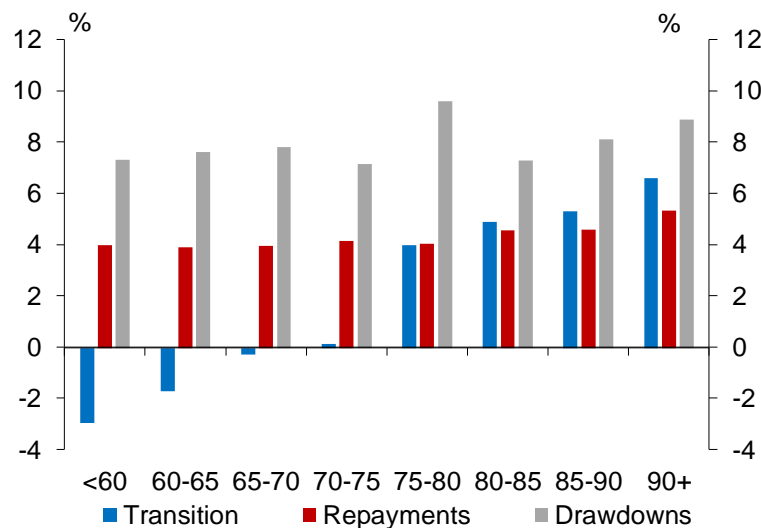


Figure 2: Actual rates of transition, repayment and drawdown by LVR, 2014 to 2018 average



To answer the first question, we model the LVR distribution in a counterfactual scenario where the Reserve Bank had not implemented the LVR restrictions, and compare the output to the current LVR distribution. To do this, we use the Reserve Bank's *LVR Lending Positions Survey*, which tracks the stock and flows of mortgage lending split by LVR buckets. Each LVR bucket contains all mortgage values within a specified LVR range of 5 percentage points (figure 1).

The value of mortgage stock in any LVR bucket at time  $t$  can be expressed as

$$Stock_t = Stock_{t-1} - Repayments_t - Transitions_t + Drawdowns_t$$

Repayments captures both full and partial repayment of principal, and drawdowns captures the flow of new mortgage lending. Transitions captures the effect of loan LVRs changing over time, either due to loan amortisation or changes in property values being recognised. A limitation of the underlying data is that it only records the net transition of loans into and out of each LVR bucket. For simplicity and

tractability, we assume that all transitioning loans shift down by one LVR bucket from its original LVR bucket to estimate the full transition matrix.

From September 2014 onward, the LVR Lending Position Survey provides data on each of these categories of flows (Figure 2). Prior to that date we have information on new mortgage commitments (conceptually similar to drawdowns). To model the counterfactual scenario, we require an estimate of the LVR distribution when LVR restrictions were first introduced in October 2013. To accomplish this, we start with the LVR distribution for September quarter 2014, the first period the LVR Lending Position Survey is available. We then backcast the mortgage portfolio back to the September quarter 2013, using the new mortgage commitments to approximate the drawdowns between the two dates.<sup>5</sup>

The next step is to forecast how the LVR distribution would have evolved from this baseline in the absence of the LVR restrictions. To do this, we assume:

- 35 percent of drawdowns would be at LVRs of above 80 percent - similar to the share in early 2013.<sup>6</sup>
- That the level of mortgage drawdowns would be a little higher in the counterfactual scenario to reflect Reserve Bank estimates that the LVR restrictions policy have restrained housing credit growth by 5 percentage points cumulatively.<sup>7</sup>
- That repayment rates and transition between LVR buckets have not been affected by LVR restrictions, so averages over 2013-2018 can be used to construct the counterfactual case.

Based on the above methodology, the LVR distribution of mortgage portfolios would have edged slightly higher in the counterfactual scenario after September 2013, in contrast to the actual LVR data that showed a large fall in the LVR distribution (figure 3). The share of the mortgage stock with a LVR of above 80 percent would have increased from 20.7 percent in September 2013, to a share of 24.3 percent by December 2018 in the counterfactual scenario, in contrast to the decline observed in the actual data to 6.8 percent in December 2018 (figure 4).

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<sup>5</sup> To test the robustness of our estimate for the pre-policy LVR distribution of mortgages, we compared them against a limited pre-LVR dataset with less granularity in its LVR buckets (compared to the lending positions survey) and covering only part of the banking sector. The share of mortgages with a LVR of above 80 percent from our estimate broadly matches the dataset, which corroborates our approach.

<sup>6</sup> The LVR distribution of drawdowns above the high-LVR threshold are assumed to match the pre-policy pattern in the counterfactual scenario, and the distribution of drawdowns below the high-LVR threshold are assumed to be unaffected by the policy and matches their actual distribution.

<sup>7</sup> The 2013 introduction of the policy, as well as the 2016 tightening of the investor restrictions, were followed by slowing growth in household debts. Price (2014) estimated that the introduction of the LVRs in 2013 had lowered housing credit growth by 1 percentage point. An internal study found that the third LVR tightening reduced housing credit growth by 3 percentage points, using the framework outlined by the Bank of International Settlements in Gambacorta and Murcia (2018).

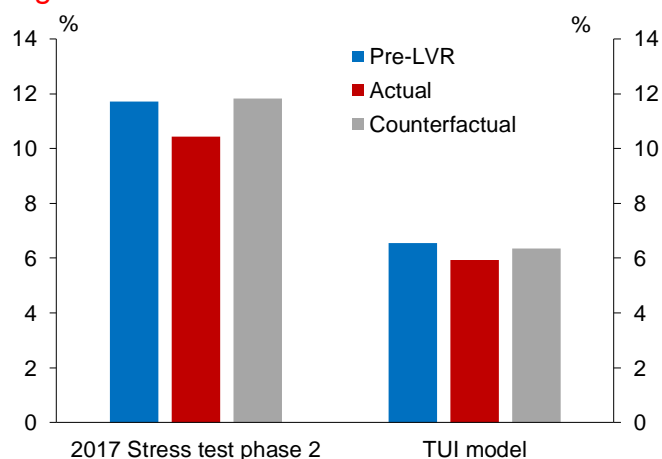


depends on LVR. We run the TUI model using similar assumptions to the 2017 stress test.<sup>8</sup>

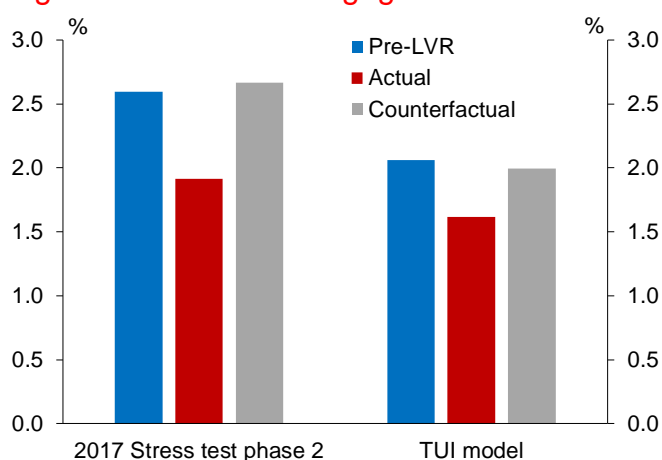
We use the information on PDs and LGDs to estimate the mortgage loss rate of the banking system in a stress scenario, under the current LVR distribution, the counterfactual LVR distribution, and the initial LVR distribution prior to the LVR policy respectively. The stress test assumptions and the TUI model output do not produce the same default and loss rate, mainly given differences in methodology (figures 5 and 6). The estimated mortgage losses are higher under the PD and LGD specified in the 2017 stress test than those from the TUI model (figure 6).

However, the stress test assumptions and the TUI model produce similar results in terms of the proportional reduction in expected mortgage losses as a result of the LVR policy. Both estimates suggest that LVR restrictions have reduced mortgage loss rate in a given housing market downturn by 25 to 28 percent relative to the counterfactual scenario (figure 6).<sup>9</sup>

**Figure 5: Stressed default rate**



**Figure 6: Stressed mortgage loss rate**



<sup>8</sup> See Lilly (2018) on the stress scenario calibrated for phase 1 of the 2017 major bank stress test, and Harrison and Mathew (2008) for a summary of the TUI model.

<sup>9</sup> These results are stronger than previous estimates of the policy impact on loss rates. Prior to introducing the first LVR restrictions, Bloor and MacDonald (2013) estimated that loss rates would be around 10 to 15 percent lower if a downturn occurred two years after the introduction.



























