

Bulletin

Outcomes of the 2021 Bank Stress Test.

Chris McDonald, Ken Nicholls, Cuong Nguyen, Roanna McLeod,
Bruce Lu

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Reserve Bank of New Zealand
PO Box 2498
Wellington
NEW ZEALAND

www.rbnz.govt.nz

What did we do in 2021?

- The annual Bank Stress Test programme at the Reserve Bank of New Zealand - Te Pūtea Matua enables us to investigate and understand the implications of current and emerging risks to financial stability; assess the resilience of participating banks to severe but plausible stress scenarios; and support improvements in the use of stress tests by banks to identify and manage the risks facing their business. Stress tests provide a forward-looking lens on financial stability risks. Over the past two years we have used scenarios to understand risks posed to the financial system by the COVID-19 pandemic.
- We conducted two industry stress tests for banks we supervise in 2021. We conducted our regular 'Solvency Stress Test' which tests the resilience of banks' capital to a severe but plausible scenario. This year we also sought to test banks' liquidity and funding resilience through a 'Liquidity Stress Test' in the lead up to our upcoming Liquidity Policy Review, due to commence in 2022. The Solvency Stress Test involved the five largest banks and the Liquidity Stress Test involved the ten largest locally incorporated banks.
- These two risks – liquidity and capital – can be correlated. For example, deterioration in a bank's capital position may affect its credit rating which can lead to a liquidity stress. It is important for banks to maintain both strong capital and liquidity positions. In that sense, we see these two tests as complementary whilst allowing us to focus on each risk individually. It should be noted that the scenarios are hypothetical and do not represent our view of the most likely future path for financial stability risks.

Summary and key findings – Solvency Stress Test

- The Solvency Stress Test consisted of one scenario which assessed the resilience of New Zealand's largest banks and overall financial stability to a hypothetical global COVID-19 resurgence, which results in widespread lockdowns and an economic downturn. In this scenario, the unemployment rate rises to 11.8 percent, house prices fall by 39 percent, and the Official Cash Rate (OCR) is cut to -0.50 percent in response to the worsening economic conditions. A prolonged drought in the North Island is also included in the scenario, curtailing agricultural production. The scenario is assessed as a one-in-50 to one-in-75 year event, similar to the 'Pessimistic Baseline' scenario (PBS) in last year's stress test but less severe than the 'Very Severe' scenario.
- This year for the first time the Solvency Stress Test was split into two stages, where banks were required to choose mitigating actions and submit their results after the first year of the shock (stage one), without knowledge of the length or severity of the shock, which was provided in stage two. This prevented banks gaining perfect foresight of the scenario and allowed them to exercise greater consideration when selecting their mitigating actions. It also allowed us to incorporate the health of the banking sector after year one of the exercise for stage two of the scenario design.
- The aggregate CET1 capital ratio of the five banks fell by 3.6 percentage points from 12.9 percent at the start of the stress test to a minimum of 9.3 percent. This is well above the current regulatory bank minimum of 4.5 percent and shows that banks are sufficiently well capitalised to manage a COVID-19 induced economic downturn and continue to support demand for lending during such a scenario. The results also showed banks to be more resilient than in last year's Pessimistic Baseline scenario due to an increase in their capital buffers, assisted by improved profitability and dividend restrictions, and consistent with the forthcoming implementation of the Capital Review.

- However, the 2021 stress test results also indicate that a major stress event would make it difficult for banks to meet higher capital requirements in the lead up to full implementation of the new standards in 2028. These results reinforce the need for banks to continue to build capital and replace non-complying Tier 2 instruments, which will cease to be compliant under the new rules. Our annual Solvency Stress Tests and banks internal stress testing can be used to monitor this transition risk.

Summary and key findings – Liquidity Stress Test

- The Liquidity Stress Test consisted of an 'Adverse' and a 'Very Severe' scenario to assess the resilience of banks to a bank-specific event. The liquidity stress test was conducted for the ten largest locally incorporated banks. Disruptions included a cyber-attack, IT systems disruption, or fraud which leads to reputational damage, and a significant share of the bank's funding being withdrawn or no longer available in a short space of time.
- The scenarios included a set of weekly outflow and other assumptions over a six month period, longer than our usual liquidity requirements. Banks applied these assumptions to their March 2021 balance sheet to determine their weekly net cash outflows and liquid asset balances (i.e. cash or assets that can be readily converted to cash) and the survival horizon (the number of weeks before liquid assets can no longer meet their net cash outflows). The Very Severe scenario assumptions were designed to test the limits of bank's liquid asset balances in meeting cash outflows without mitigating actions.
- The results showed that four (of the ten) banks in the Adverse scenario and only one bank in the Very Severe scenario had a survival horizon more than six months. The scenario had a greater effect on the larger banks' customer withdrawals, leading to these banks having a shorter survival horizon than the smaller banks.
- Banks were permitted to use mitigating actions to improve their survival horizon, so long as the actions were already contained within their contingency funding plan¹. The most common actions taken by banks were to reduce the growth of new business, in some cases stopping lending altogether, use parent bank support, and increase deposit pricing in order to reduce outflows or attract new deposits.
- This Liquidity Stress Test was our first banking industry test focused on liquidity since 2003, and highlighted areas for improvement in banks' internal stress testing capability. We believe there are benefits in repeating this exercise on a more regular basis to monitor longer periods of stress to complement our current prudential requirements – which focuses on banks holding sufficient liquid assets to survive stress over one week and one month. This exercise will be used as an input into our forthcoming Liquidity Policy Review.

¹ The contingent funding plan is a pre-determined and agreed set of actions which a bank will use in times of stress.

Section 1 – Solvency Stress Test

Background and Summary

Our 2021 Solvency Stress Test, launched in March before the recent Delta outbreak, assessed the banking system's resilience to a severe but plausible scenario featuring a further COVID-19 outbreak. The scenario is hypothetical and does not reflect our view of a most likely outcome.

In order to assist banks in improving their stress test capability and identification of mitigating actions, which has previously been highlighted as an area of weakness, we adopted for the first time a two-stage process for this stress test. In stage one, banks were only provided the first 12 months of the scenario. Banks were then asked to submit their results and choose mitigating actions for year one before being provided with the rest of the scenario in stage two (which contained years two to four). This approach forced banks to think more carefully about their mitigating actions without the aid of perfect foresight and allowed us to include a feedback loop from bank actions in year one on the scenario parameters we provided in stage two.

This stress test involved co-ordinating a process in which the five largest banks used their own models to estimate the effect of the stress scenario on their capital. Banks had three to four months to submit their results. We then made adjustments to the submissions where their modelling generated inconsistent outcomes compared to their peers, our modelling and experience, and previous stress tests. There was minimal difference between the capital outcomes of the banks' submissions and our desktop model at the aggregate level. However, there were more significant changes at the individual bank level which we discussed with banks.

Bank resilience and financial performance have generally improved since the March quarter 2021, with no indication of an increase in loan defaults or other stress. This suggests that, despite the economic impacts of the recent restrictions aimed at containing the COVID-19 outbreak, banks are not under a level of pressure that is comparable to the stress test.

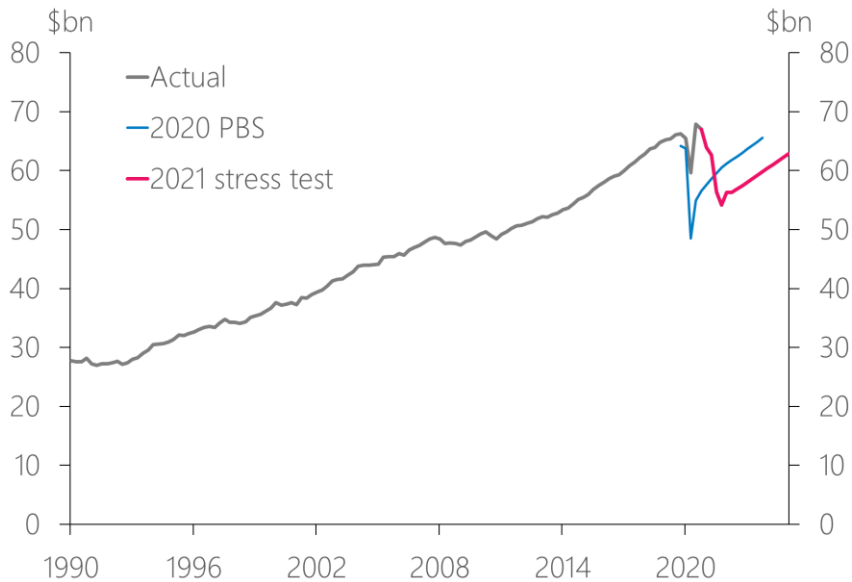
Scenario Design

The 2021 Solvency Stress Test features another COVID-19 health crisis that causes a large disruption to the New Zealand economy. Health outcomes both within New Zealand and around the world are worse than anticipated, resulting in movements between various targeted lockdowns and regional restrictions to contain the outbreak. These containment measures eventually work but also have a dampening effect on economic activity. At the same time, the North Island of New Zealand battles a drought for the first two years of the scenario.

In stage one (year one) of the stress test, the New Zealand economy experiences a severe recession for the first six months. Economic activity is dragged down by sustained border restrictions both in New Zealand and abroad, domestic lockdowns and social distancing measures, persistent economic uncertainty, subdued consumer and business confidence, and weaker global demand for New Zealand's exports. The containment measures heavily affect the retail, tourism and hospitality sectors in particular. Additionally, a drought strikes the whole of the North Island in the 2021-2022 season. This drought affects both dairy farms and the remainder of the agriculture sector in the North Island. In response, milk production by North Island dairy farms is reduced by 7 percent from the previous season, while a greater reliance on purchased feed and supplements increases their expenses by 9 percent.

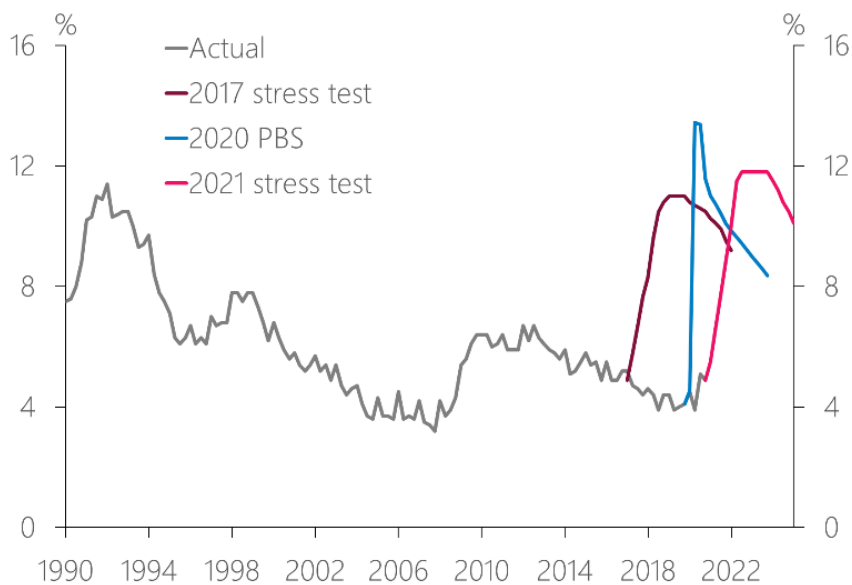
During year one, house prices fall by 20 percent, commercial property prices fall by 26 percent, New Zealand's real gross domestic product (GDP) contracts by 8 percent on average (figure 1) and the unemployment rate reaches 10 percent (figure 2). Credit spreads widen due to the increased global uncertainty, which increases overall bank funding costs. Government and Reserve Bank policy responses include a large fiscal support package albeit slightly less than that in 2020, cutting the OCR to -0.50 percent, and additional purchases of government bonds up to \$100 billion as part of our large scale asset purchase programme.

Figure 1: Quarterly GDP



Source: Stats NZ.

Figure 2: Unemployment rate



Source: Stats NZ.

In stage two (years two to four) health outcomes improve but the New Zealand economy remains in recession, weighed down by slow relaxation of border restrictions, increased loan defaults and the extension of the drought into its second year. Overseas demand for milk remains weak and prices fall to \$5.50 per kilogram of milk solids.

By the end of year two, GDP falls 0.4 percent and the unemployment rate peaks at 11.8 percent (table 1). After year two, borders gradually reopen, economy begins to recover and the drought ends. GDP increases by 4 percent per annum in years three and four. The unemployment rate falls but remains above 10 percent. House prices initially continue to fall in stage two, decreasing by 39 percent in total, and commercial property reaches its trough after a 45 percent fall. The OCR remains at -0.50 percent.

The 2021 stress test scenario is judged to be similar in overall severity to our 2020 PBS, i.e. a one-in-50 to one-in-75 year scenario, with lesser peak stress but a slower recovery. The unemployment rate profile is similar to our 2017 scenario but with a higher peak.

Table 1: Key macroeconomic variables in recent stress tests and historical episodes

	Unemployment		Real GDP	Residential property price	Commercial property price
Stress Scenarios	Peak level (%)	Increase (ppt.)	Peak-to-trough decline (%)		
Stress Tests					
RBNZ (2021)	11.8	6.3	12.6	39	45
RBNZ (2020 PBS)	13.4	9.3	12.2	37	37
RBNZ (2017)	11.0	6.1	3.6	35	39
IMF (2016 NZ FSAP)	10.2	4.9	3.4	35	30
APRA (2020)	13.0	n.a.	15.0	30	40
FOMC U-Shaped (2020)	15.6	12.1	13.8	28	35
Historical Episodes					
Finland 1990 – 1995	16.7	13.5	9.7	37	n.a.
Ireland 2007 – 2012	14.7	10.0	8.4	55	70
Sweden 1990 – 1995	11.2	8.9	3.9	20	53
NZ 1987 – 1992	11.2	7.1	2.2	3	60
NZ 2007 – 2011	6.7	3.4	2.6	10	28

Sources: RBNZ; Bank of England; US Federal Open Market Committee (FOMC); International Monetary Fund; Woods and O'Connell (2012), 'Ireland's financial crisis: a comparative context', Quarterly Bulletin, Central Bank of Ireland.

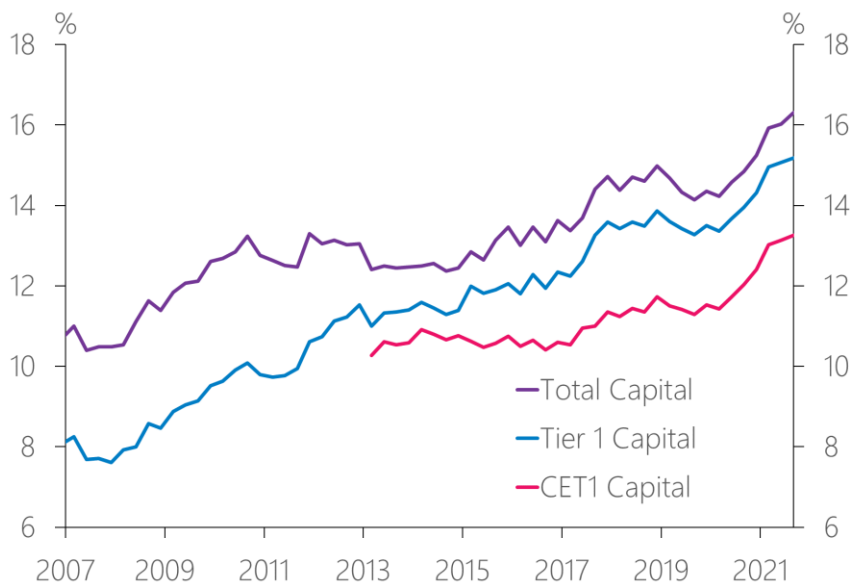
Results before Mitigating Actions

Stress tests assess how banks' loan impairments, net interest income, other income, operating expenses and risk-weighted assets (RWA) are likely to change during periods of stress, and how these changes could impact banks' capital outcomes under stressed scenarios. Banks' resilience in stress tests is measured by their capital ratios, which are assessed against minimum capital requirements. There are three capital ratios to assess: Common Equity Tier 1 (CET1), Tier 1 Capital, and Total Capital. All three forms of capital are available to absorb losses in times of stress. Capital requirements for banks are based on the riskiness of their loans, which is quantified by applying risk weights to banks' assets.

This stress test was conducted under the 'current' capital framework in place at the start of the test period, which requires banks to meet a minimum regulatory capital ratio of 4.5 percent for CET1, 6 percent for Tier 1 and 8 percent for Total Capital. There is an additional prudential capital buffer of 2.5 percent above these minimums, below which banks have to automatically cut CET1 distributions (mainly dividends). Given our recent move to the 'new' capital adequacy framework², delayed by COVID-19, we have also modelled a sensitivity of the stress test results based on these new capital requirements.

Banks have continued to increase their capital ratios since our 2020 stress test was conducted. As shown in figure 3, for all locally incorporated banks this provides additional support for banks in this stress test compared to last year's.

Figure 3: Aggregate capital ratios of locally incorporated banks (% of RWA)



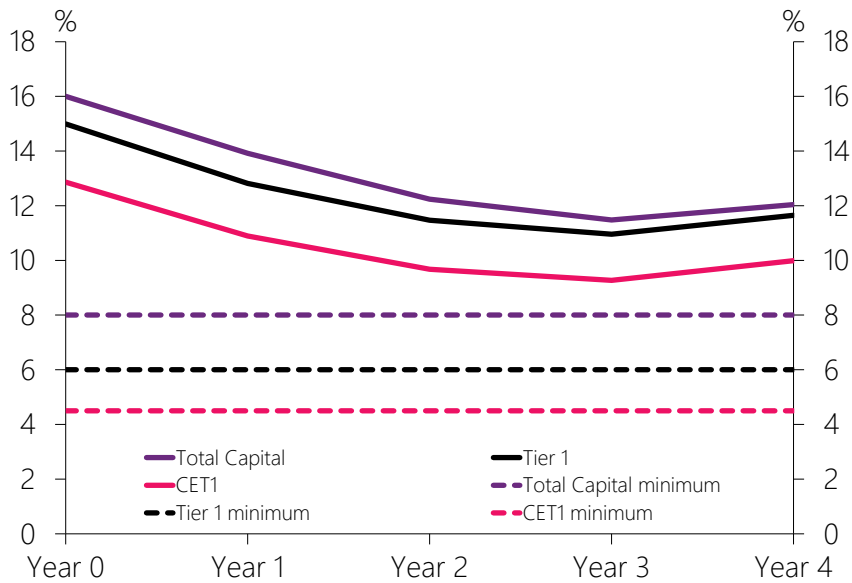
Source: Banks' General Disclosure Statements, RBNZ Capital satellite survey.

The 2021 stress test shows that banks are resilient to a severe economic downturn, combined with a sustained drought. The aggregate CET1 capital ratio fell by 3.6 percentage points to a minimum of 9.3 percent. The aggregate Total Capital ratio fell by 4.5 percentage points to a trough of 11.5 percent. All three aggregate capital ratios remain well above the regulatory minima (figure 4). The results are also well above the trough reached by the 2020 PBS capital ratios (7.7 percent CET1)

² rbnz.govt.nz/regulation-and-supervision/banks/prudential-requirements/information-relating-to-the-capital-adequacy-framework-in-new-zealand

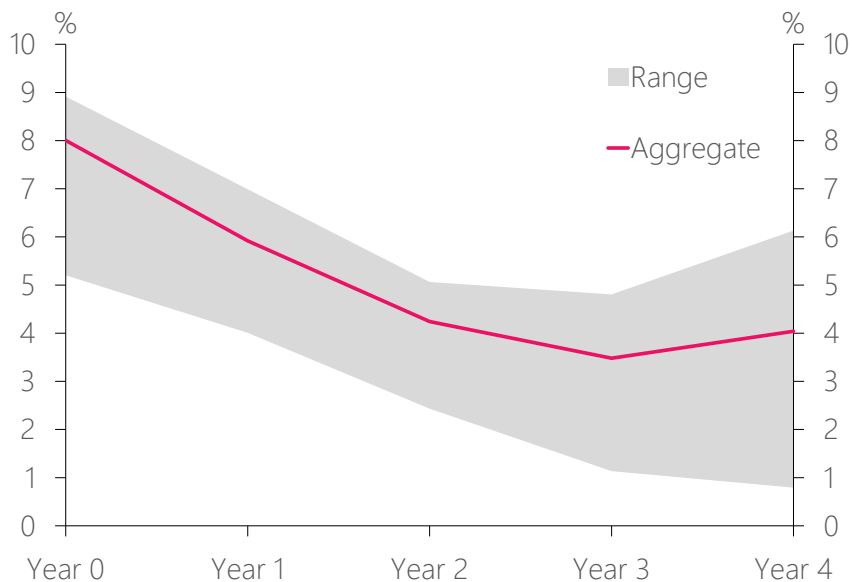
despite a similar decline. The increase in resilience since the last stress test is due to the build-up in capital over the past 12 months.

Figure 4: Aggregate capital ratios and regulatory minima (% of RWA)



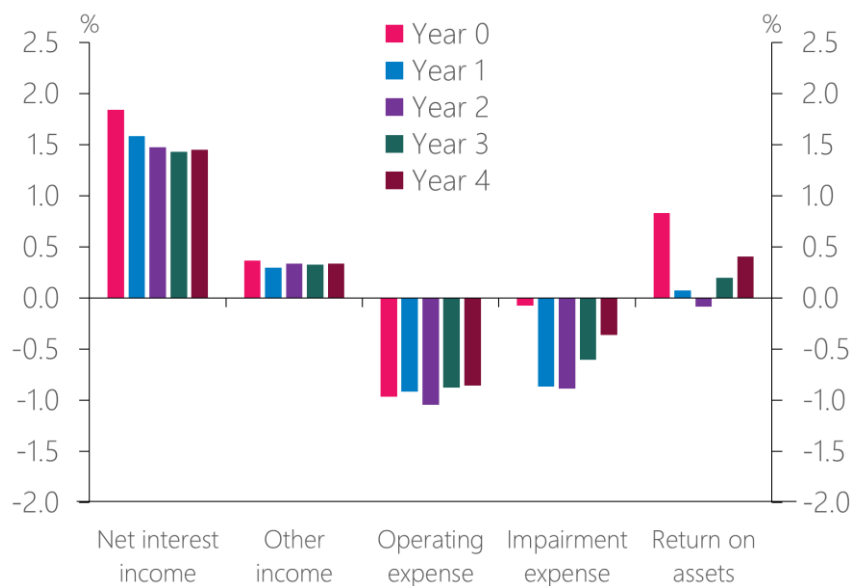
This leaves banks well placed to support the economy by meeting any demand for lending during a period of stress. The range of the capital outcomes varies due to differences in each bank's starting capital position, underlying profitability, and the mix of businesses in their loan portfolio which attract different loss rates (figure 5).

Figure 5: Buffer above current minimum capital ratios (% of RWA)



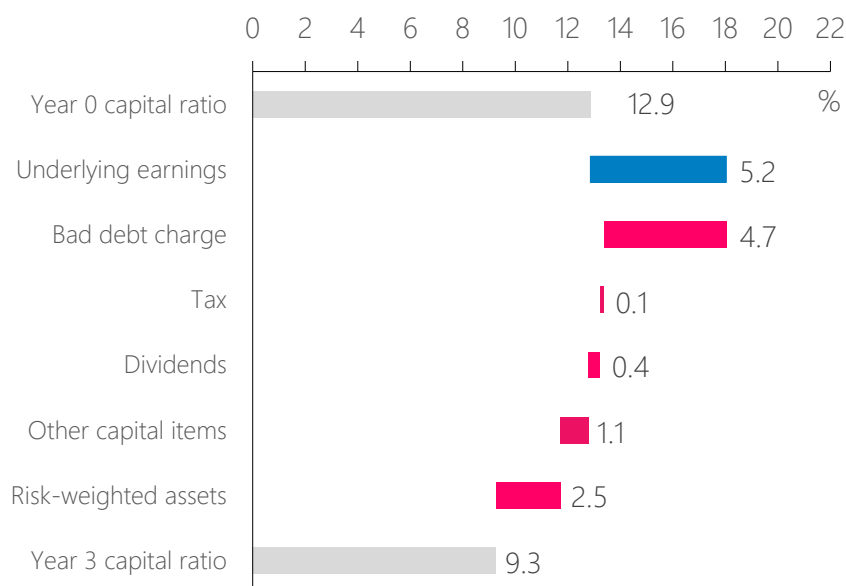
Banks' aggregate net profit fell from \$4.5 billion in the year prior to the stress test (Y0) to \$0.4 billion in year one of the stress test and a loss of \$0.5 billion in year two. Aggregate profits were positive in year three and four but still well below pre-stress levels (figure 6).

Figure 6: Decomposition of banks' profitability (% of assets)



The main drivers of the deterioration in the capital ratios from March 2021 to the minimum in year three were increases in both impairment expenses (bad debt charge) and RWA (figure 7). These two factors cumulatively reduced the aggregate CET1 capital ratio by 7.2 percentage points. Banks underlying earnings (revenue less operating expenses) contributed a significant benefit, despite a fall in the net interest margin (NIM), i.e. interest income less expense as a percentage of interest earning assets. The aggregate NIM fell from 2.0 percent in year zero to a trough of 1.5 percent year three – a fall of 47 basis points (bps). This was larger than the 35 bps fall in the PBS.

Figure 7: Decomposition of changes in Aggregate CET1 by year three (% of RWA)



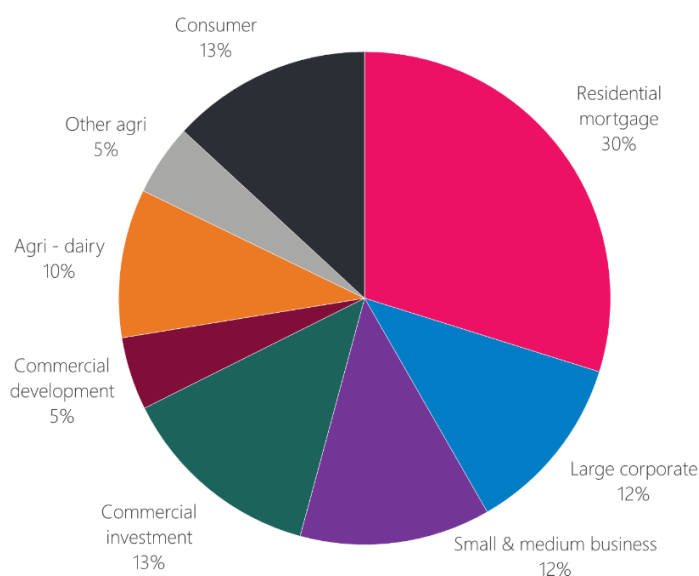
Impairment Expenses

The aggregate overall loss rate (total impairment expenses as a percentage of credit balance) was 3.2 percent.³ This was lower than the 2020 PBS loss rate of 4.0 percent, due to the banks' lower loss rates on mortgages and smaller business portfolios in 2021 (table 2). The collateral for mortgages, and potentially for smaller businesses, has recently strengthened due to the increase in asset prices and stronger balance sheets heading into this year's stress test (see chapter 2 of the November 2021 *Financial Stability Report*).

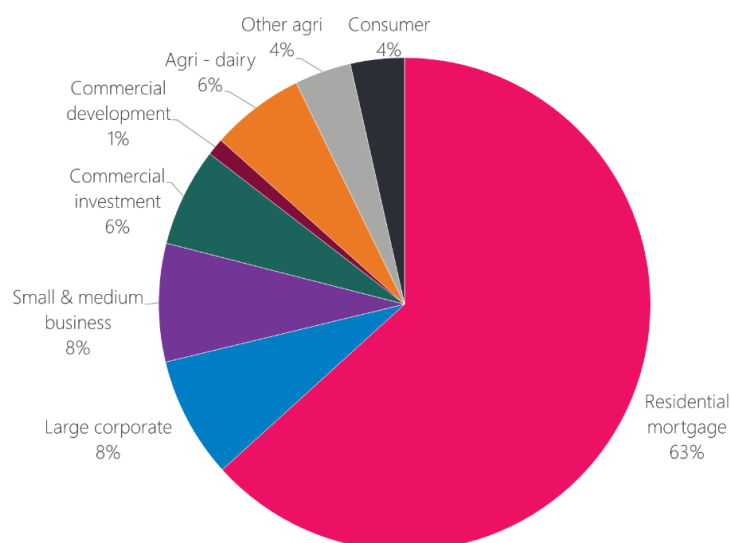
Impairment expenses contributed a 4.7 percentage point reduction to the change in the aggregate Total Capital ratio:

- Residential mortgages made up 30 percent of total impairments (figure 8), despite comprising 63 percent of credit exposures (figure 9). The residential mortgage loss rate of 1.5 percent is lower than other portfolios (table 2) as consumers continue making mortgage payments for as long as possible during stress periods, even when they are unable to pay other loans. The loan-to-value ratio restrictions, and an increase in the equity of home-owning households from house price growth in recent years, contribute to reduced losses for banks on defaulted loans.
- Lending to large corporates and small & medium businesses contributed one quarter of total impairments. Loans to smaller businesses suffered higher default rates than larger businesses, as smaller businesses were more likely to be in the sectors most affected by the pandemic – hospitality, tourism and retail.
- Commercial property, which contributed 18 percent of total impairments, was the sector most impacted in this stress test with the highest portfolio loss rate.
- Dairy lending contributed 10 percent of total impairments. Our dairy farm modelling sensitivity attributed nearly one-third of the defaulted dairy farms to the drought component of the scenario. It was found that the drought on its own did not cause undue stress. However, when combined with an economic downturn the drought increased the level of defaults.

Figure 8: Share of impairment expense over four years



³ This total loss rate figure excludes lending to financial institutions, sovereign and government, and other credit exposures. The PBS total loss rate cited in the same paragraph also excludes these exposure classes.

Figure 9: Opening exposure share**Table 2: Stress test four-year loan default and loss rates by lending type**

Portfolio	Exposure (\$B)	Cumulative default rate (%) ^[1]			Cumulative loss rate (%) ^[2]		
		2017 ^[3]	PBS	2021	2017	PBS	2021
Residential mortgages	314.2	10.5	11.3	9.1	2.0	2.1	1.5
Large Corporate business	39.5	6.6	9.4	10.0	3.8	4.8	4.7
Small & Medium business ^[4]	38.2	16.7	23.3	19.4	6.0	8.2	5.2
Commercial property		24.3	27.5		6.9	8.0	
Investment	32.3			27.4			6.5
Development	5.6			42.0			13.5
Farm		23.9	12.4		8.4	3.1	
Dairy	29.8			23.7			5.1
Non-dairy	18.4			24.9			4.0
Consumer	18.0	13.9	17.5	11.4	12.0	14.3	11.8
Total^[5]	495.5	13.5	13.7	13.1	4.2	4.0	3.2

[1] The default rate equals the cumulative defaulted exposures over four years (year 1-4 of 2017) as a proportion of the opening exposures.

[2] The loss rate equals the cumulative impairment expense over four years (year 1-4 of 2017) as a proportion of the opening exposure.

[3] The 2017 stress test covered the four largest banks that account for over 85 percent of total bank loans.

[4] The difference between large corporate and lending to small and medium-sized businesses is based on revenue.

[5] Total exclude financial institutions, sovereign and government, and other exposures to ensure comparability across the stress test outcomes.

Adjustment to Bank Submissions

Loss rates were the main focus of our adjustments to the bank submissions. For example, for the loss rate on mortgages we took the bank submissions as a starting point. For each year of the stress test we collected portfolio data by important segment characteristics: investor and owner-occupier; newly originated business (written over the 12 months prior to the stress test); and different loan-to-valuation rates. We then compared the default rates and loss rates both for these segments and the total portfolio across the banks. Banks were measured against historical episodes of stress and against previous stress tests, adjusted for the different paths of key variables in the scenario – particularly unemployment and house prices in the case of mortgage loss rates. Where the analysis indicated a material difference, we adjusted the loss rates and reflected this in the capital ratios.

In this stress test, the other main driver we adjusted was the NIM. Banks generally estimated a larger decline in the NIM for this stress test than in previous years, due to the effect of the negative cash rate and a decision not to charge customers for holding deposits. Under a negative OCR, banks are charged for holding deposits with the Reserve Bank, and in this case the size of these deposits increased in line with the strong growth in long-term asset purchases. There was a wide range of NIM estimates from the banks, which reflected different pricing decisions in response to the negative cash rate. Pricing under a negative OCR was an area we wanted to explore in this stress test, so we were less prescriptive in our instructions this year than compared to previous years. However, for the final results, we applied more consistent NIM assumptions across the banks, closer to the median pricing assumptions. We then modelled the impact of this on the capital ratios.

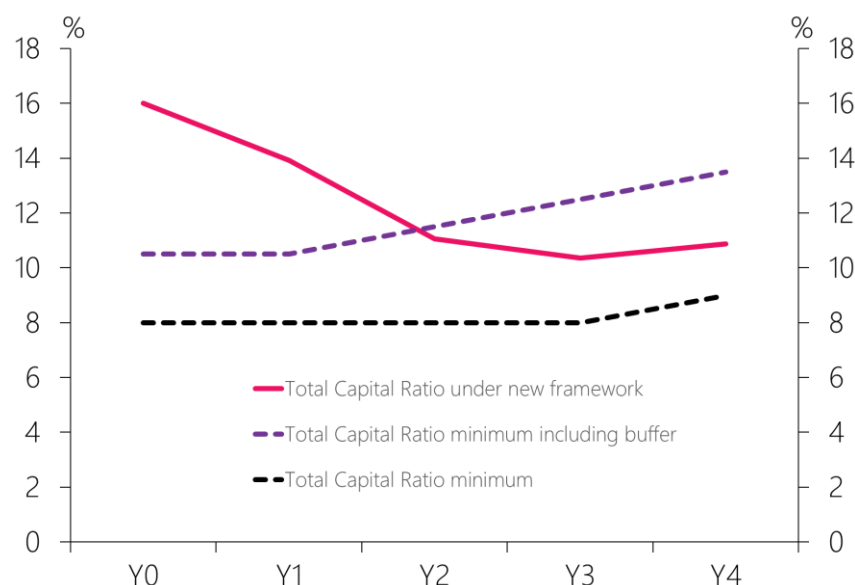
Sensitivity of Results to New Capital Standards

The 2021 Solvency Stress Test was based on the current capital framework, and as such did not incorporate the future implementation of our Capital Review decisions. We conducted a sensitivity analysis on the stress test results pertaining to the new capital framework, scheduled for implementation during 2022. Figure 10 on page 12 shows the sensitivity of our results to this change, which occurs from year two onwards⁴.

The main impacts were from the higher risk weights, which reduced the capital ratios, and the higher prudential capital requirements. The average risk weights increased by approximately 10 percent from year two. Our sensitivity reduced the aggregate Total Capital ratio by 1.2 percentage points to 10.3 percent in year three. This is well into the prudential capital buffer under the new capital standards (the results are slightly less severe for CET1 and Tier 1 capital ratios). The results demonstrate that whilst progress in meeting the new capital standards has increased banks' resilience to a severe economic downturn, additional capital increases over time will be needed to meet the new standards in full.

⁴ The IRB scalar for credit RWA increases from 1.06 to 1.20 in 2022 under the Capital Review.

Figure 10: Sensitivity of stress test result to the new capital framework



Note: Capital buffer includes buffer increases for Domestic Systemically Important Banks under the Capital Review implementation.

Mitigating Actions

Banks provided feedback that the two-stage process made them think more deeply about the mitigating actions in the absence of perfect foresight. Stage two of the scenario was generally perceived as being more severe than expected, causing some banks to change their pricing and introduce more significant mitigants in year two. We believe the two-stage process accomplished the desired result to make banks consider mitigating actions more carefully.

Banks' mitigating actions increased the aggregate trough CET1 capital ratio by 61 bps, due to:

- expense savings - reducing discretionary spending;
- tightening lending standards to reduce riskier lending such as high loan-to-value mortgages and new lending for commercial property development; and
- charging wholesale customers for transaction deposits, i.e. negative deposit rates.

Conclusion

The results of this stress test show that New Zealand's banking system has a stronger level of resilience than a year ago, and is well placed to support the economy through severe downturns. However, the current capital levels still lead to banks' capital ratios falling to well within the prudential capital buffer under the new capital framework for a scenario calibrated to a one-in-50 to a one-in-75 year event. More work needs to be done to ensure banks could withstand a one-in-200 year event, the benchmark for our capital standards by 2028.

Section 2 – Liquidity Stress Test

Background

Our stress testing of banks over recent years has focused on their credit risk exposure to an economic downturn and the effect on capital, as per Section 1. This year we also conducted an industry stress test focused on liquidity, our first since 2003.⁵ This stress test involved the 10 largest locally incorporated banks – the five banks in the Solvency Stress Test, plus Co-operative Bank, Rabobank New Zealand Limited, Heartland, SBS and TSB.

Whilst the Solvency Stress Test focused on longer-term capital risk, the purpose of the Liquidity Stress Test was to assess the resilience of a bank's liquidity and funding to severe, but plausible liquidity shocks, test the viability of banks' mitigating actions and inform our Liquidity Policy Review.

Our liquidity policy requires banks to hold a sufficient stock of liquid assets to be able to meet a net cash outflow under specific stress conditions. In particular, the prudential requirements focus on periods of one week and one month⁶. The Liquidity Stress Test considered an outflow over a longer period of up to six months for two scenarios. The most severe scenario was designed to test the limits of a bank's ability to meet customer withdrawals under stress, similar to a reverse stress test, and the effectiveness of the mitigating actions that banks have identified in their contingency funding plan.

Scenario Design

We developed assumptions for two scenarios: an 'Adverse' scenario including a one-notch ratings downgrade and a 'Very Severe' scenario including a three-notch ratings downgrade. The scenarios were idiosyncratic and caused by a firm specific event such as cyber-attack, IT systems disruption or fraud which leads to reputational damage, resulting in a significant outflow of deposits and limits on new funding. The scenarios assumed there was no systemic stress and any off-shore parent bank was unaffected.

The cashflow scenarios were designed for a six month period. This is shorter than standard solvency focused scenarios, recognising that liquidity risks can materialise more quickly than risks to capital, but could be more prolonged than our one-week and one-month mismatch ratios (MMR).

The assumptions were benchmarked against the Reserve Bank's one-month MMR calculation⁷, the two scenarios contained in the 2019 The European Central Bank (ECB) Liquidity Stress Test⁸, as well as historical experience and were discussed with Australian Prudential Regulation Authority. We held a workshop with participating banks early in the year to discuss and provide feedback on the templates, instructions and scenarios before they were finalised.

The assumptions were specified on a weekly basis and applied to each bank's March 2021 balance sheet. For the most part, the cash outflows were calculated in a mechanical fashion by multiplying the prescribed outflow rates by the opening balance in the case of at-call deposits, or the maturities, in the case of term deposits or wholesale funding. Banks also calculated additional outflows for the effect of the ratings downgrade, drawdown on committed facilities, new business

⁵ As part of their 2016 Financial System Assessment Programme, the International Monetary Fund performed a top-down liquidity stress test of New Zealand's banks based on their spreadsheet modelling and approach and without significant industry engagement.

⁶ rbnz.govt.nz/regulation-and-supervision/banks/prudential-requirements/liquidity-policy

⁷ Refer to BS13 Liquidity Policy, page 7.

⁸ Refer to Sensitivity Analysis of Liquidity Risk – 2019 stress test.

lending and derivatives. There were some offsetting inflows from profits and contractual loan repayments.

Table 3 below summarises our funding outflow assumptions over the full six months of the stress test. In general, we expect that larger deposit holders and more sophisticated investors would withdraw their funds more quickly, hence attracting a higher outflow rate in our assumptions. For example, 19 percent of at-call deposits of less than \$100k run off over six months in the Adverse scenario, compared to 70 percent of deposits over \$50 million.

The assumptions were similar to those used by the ECB⁹. The ECB's lower outflow rate for smaller deposits reflects the benefit of deposit insurance in Europe. The other major difference, not shown in the table, is that the ECB's weekly outflow rates were constant whereas we had higher weekly outflow rates in the first month. The Very Severe scenario's assumptions for the first month were set close to those prescribed in our regulatory MMR calculations.

Table 3: Scenario assumptions provided to banks

6-month outflow rate assumptions by funding type		Reserve Bank		ECB 2019	
		Adverse	Very Severe	Adverse	Extreme
At-Call deposits	≤100k	19%	24%	12%	18%
	100k to 5m	23%	29%	37-48%	42-61%
	5m to 10m	36%	35%		
	10m to 20m	47%	51%		
	20m to 50m	62%	67%	58-100%	74-100%
	>50m	70%	84%		
Term deposits [1]	≤100k	5%	20%	18%	27%
	100k to 5m	10%	25%	39%	48%
	5m to 10m	15%	30%		
	10m to 20m	30%	40%		
	20m to 50m	40%	60%	52-100%	76-100%
	>50m	60%	80%		
Secured Mkt Funding [1,2]	Reserve Bank	0%	0%	100%	100%
	Other	50/40%	100/50%		
Unsecured Mkt Funding [1,2]	Programme debt	100/50%	100%	100%	100%
	Other domestic	60%	100%		
	Other offshore	80/60%	100%		

[1] Outflow rate for contractual maturities; [2] Some rates lower after week 12 as the source of stress become apparent, e.g. other secured market funding maturities is at 50 percent in the first 12 weeks and 40 percent thereafter.

⁹ The comparison for deposit outflow rates is on a best endeavours basis as the ECB used a different definition for deposits, e.g. stable and unstable, in line with European regulatory definitions whereas we specify outflow in terms of the size of deposits in line with our MMR.

Liquidity Stress Test Results before Mitigating Actions

Banks applied the assumptions to their March 2021 balance sheet to determine their weekly net cashflow and cash balance. The survival horizon is the number of weeks before their liquid assets can no longer meet their net cash outflows. Please refer to Appendix A for a stylised example of how this was calculated.

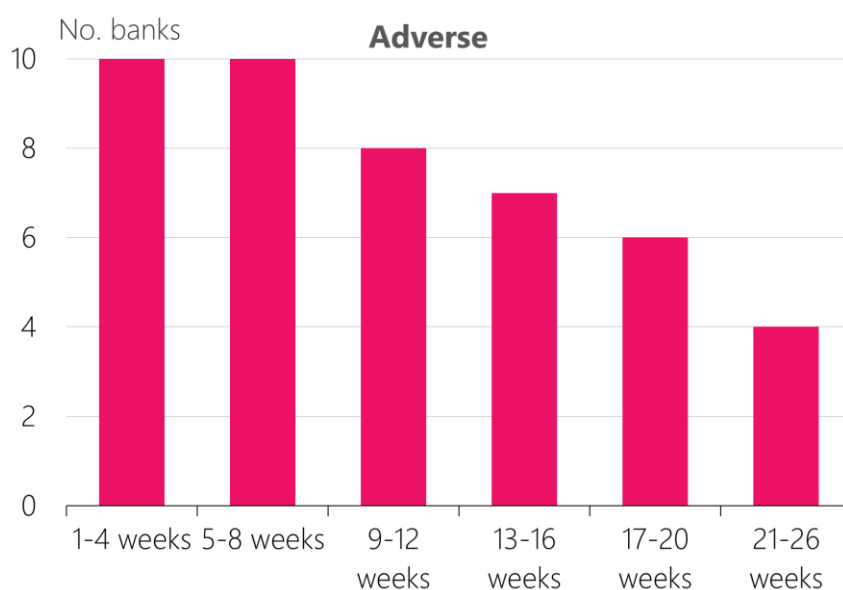
The determinants of the survival horizon were driven by a bank's opening liquid assets and its funding composition. A bank's survival horizon would be longer if they held;

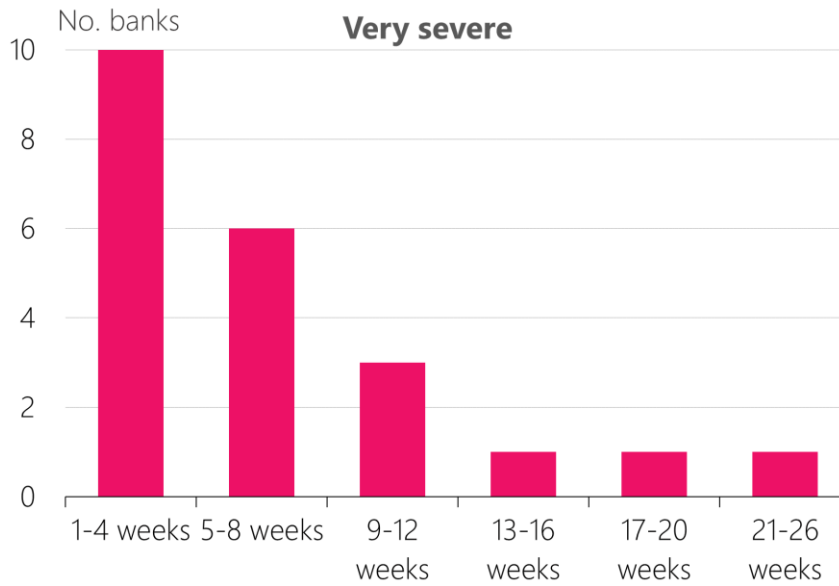
- a higher level of liquid assets which provides a stronger buffer to offset outflows;
- a higher proportion of smaller depositors which have a lower outflow rate assumptions than larger depositors (the assumption being that larger depositors are likely to move banks in stress);
- more fixed-term funding and of longer maturity (there are no outflows for deposits maturing over six months in the stress test); and
- a larger proportion of secured than unsecured wholesale funding.

The chart below shows at four-weekly intervals how many banks were able to meet customer withdrawals. In the Adverse scenario four banks could meet withdrawals for the full six months, while in the Very Severe scenario only one bank could meet withdrawals for the full six months.

The median bank survival horizon is 21 weeks in the Adverse Scenario and 11 weeks in the Very Severe scenario. This compared to the ECB exercise of 25 weeks for their Adverse scenario and 17 weeks for their Extreme Shock scenario. The shorter duration experienced in our test was due to a combination of the starting position of banks and the stress assumptions, especially our higher outflow assumptions in the first month of our test which would deplete banks' liquid assets more quickly.

Figure 11 & 12: Banks' survival horizon

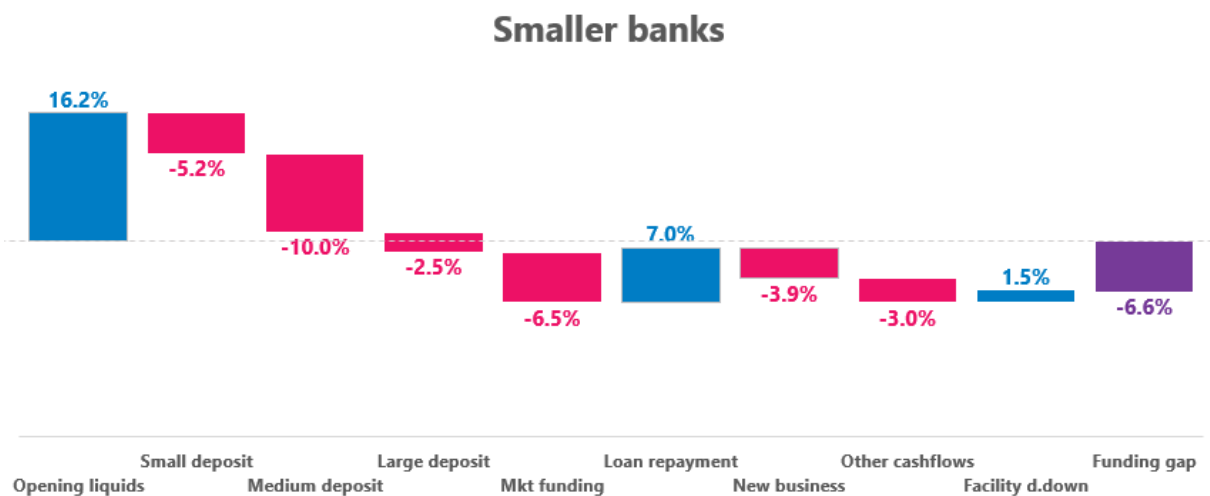




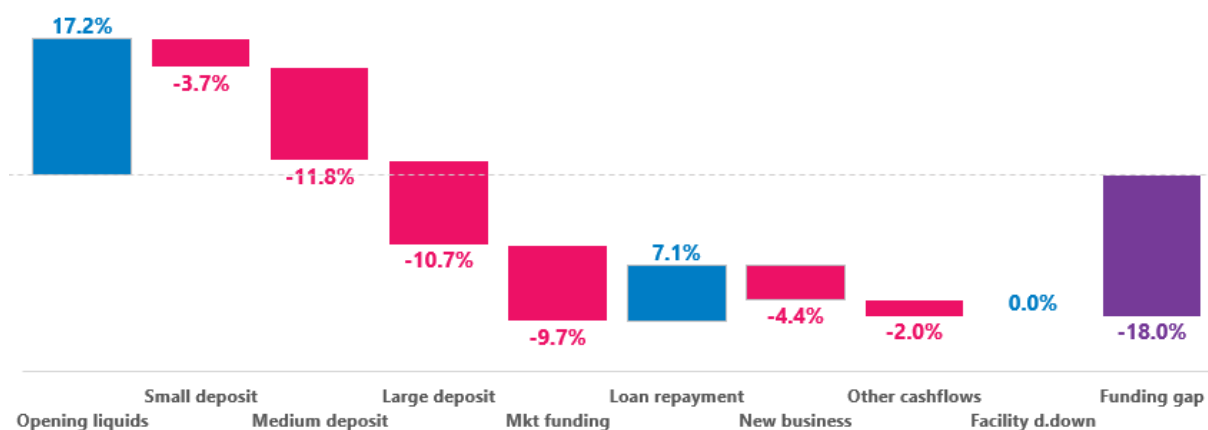
Larger banks had a much shorter survival horizon in both scenarios than the cohort of smaller banks. In the Very Severe scenario some of the largest banks fell into deficit fairly quickly following the one-month period of our mismatch ratio. The driver of the difference in outcomes between the large and small banks was the difference in funding compositions. This was also consistent with the ECB finding that 'Global systemically important banks are in general hit hardest by the 2019 shocks owing to higher reliance on less stable deposit types and wholesale funding'.

The average large banks' share of market funding plus large deposits, which attract the highest outflow rates, was 25 percent of total funding, compared to only 10 percent for smaller banks. The charts below show that the liquidity outflow of these two funding sources was equivalent to 21 percent of opening funding for large banks and only 9 percent for smaller banks. Larger banks had a slightly higher buffer of opening liquids which was much less than the difference in outflows. The net effect left large banks with a much higher deficit than the smaller banks at the end of the six months.

Figure 13 & 14: Key drivers of net cash flow (as a percentage of opening funding) – Very Severe scenario



Large 5 banks



Notes: Deposit includes at-call and term; 'Large deposit' – deposits with value higher than \$5 million, 'Medium deposit' – deposits with value less than \$5 million but higher than \$100k and 'Small deposit' – deposits with value less than \$100k. 'Mkt funding' includes secured and unsecured. 'Loan repayment' are contractual principle repayment flows and interest. 'New business' contains the assumed new lending. 'Other cashflows' includes cash outflows from ratings downgrade, derivatives net cashflows, other contractual cash flows, other cash profits and maturing liquid assets. 'Facility drawdown' is the bank drawdown of undrawn committed lines. 'Funding gap' is the liquidity shortfall/surplus at the end period.

Mitigating Actions

Banks were permitted to use mitigating actions to address their liquidity deficit so long as these were already contained within their contingency funding plan. The charts below show the size of mitigating actions as a percentage of average opening funding amounts for large and smaller banks. There is a surplus of liquidity after mitigating actions. However, this assumes all the mitigating actions identified by banks are effective. The main mitigating actions included:

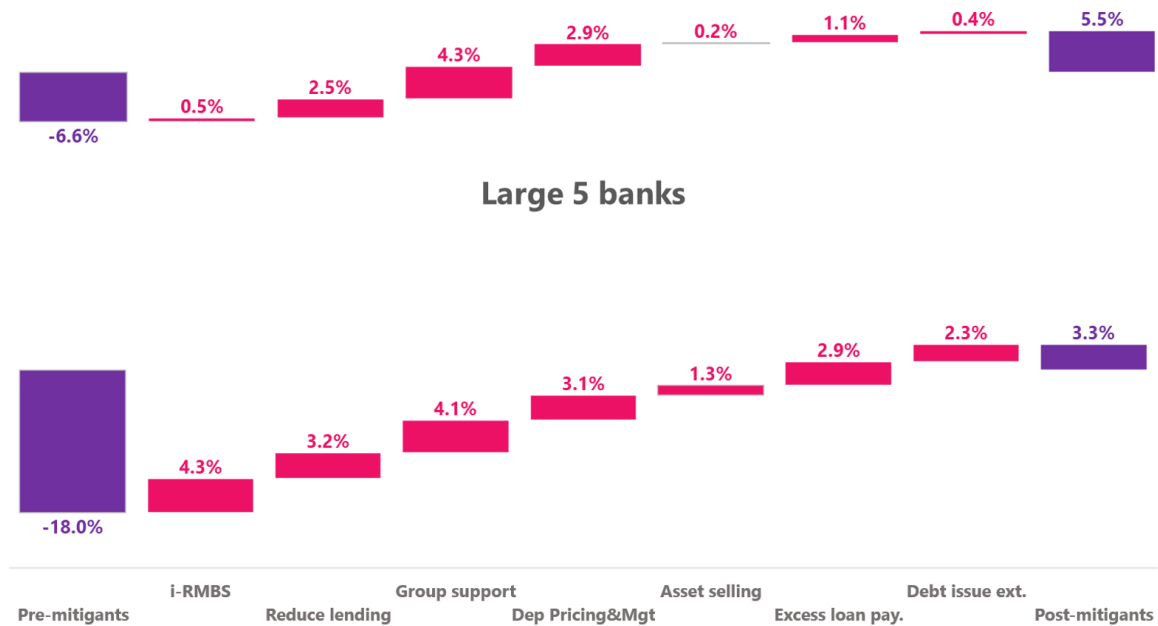
- a reduction in new lending, which was identified by nearly all banks with some halting lending altogether. This could lead to a spill-over effect to the economy if the stress was more systemic in nature or if it was one of the large banks in trouble;
- large group support, either through borrowing from their parent bank or capital injections. This may not be as clear cut if the parent's rating is also downgraded;
- raising deposit rates in order to reduce outflow (and even attract new deposits from competitors). However, we have concerns that this would not be effective at attracting deposits in an idiosyncratic stress and may actually alert the public that the bank is under stress; and
- increasing the bank's capacity to borrow from the Reserve Bank via extending the internal Residential Mortgage-Backed Securities (i-RMBS).¹⁰

The order of the bars indicate the approximate timing of mitigating actions, with the actions initiated first being the first bars in the charts. Banks were quick to reduce lending in the Very Severe scenario to offset the liquidity outflow.

¹⁰ We can provide liquidity support for a bank provided the bank offers collateral securitised by AAA rated residential mortgages as securities i.e. i-RMBS.

Banks' actions, both in timing and size, were guided by their management's liquidity buffers, market appetite, assumed customer behaviour and the prudential requirements, both here (i.e. the MMR) and in Australia for the Australian-owned banks. Large banks identified a greater range and size of mitigating actions.

Figure 15: Mitigating cash inflows as percentage of opening funding – Very Severe scenario
Smaller banks



Notes: 'Pre-mitigants' is the liquidity shortfall/surplus after the stress period, prior to any mitigating actions. 'Dep Pricing&Mgt' is where banks increase both call and term deposit pricing, providing an incentive to maintain deposit. 'Asset selling' is where banks sell their liquid asset portfolio to the market. 'Excess loan pay.' is the excess payments and pre-payments from banks' customers. 'Debt issue ext.' is option to issue covered bonds externally. 'Post-mitigants' is the liquidity level at the end of the stress period and after the mitigating actions.

Conclusion

The Liquidity Stress Test provided useful insights into the resilience of banks to liquidity shocks over a longer period than our one-month MMR. We will work with the banks to update this analysis on a regular basis to monitor their resilience to this type of shock. The exercise has also provided insights to the Liquidity Policy Review which is due to commence in 2022.

Banks commented that the exercise worked well, notwithstanding some data collection difficulties, and there were a number of benefits they gained for their internal stress testing. The exercise provided a cross check of their internal stress test assumptions; additional scenarios to use; confirmation and testing of their contingency funding plans; use of the more granular data from the Liquidity Stress Test for their internal stress testing; and expansion of their liquidity stress beyond shorter focused time horizons.

Appendix A

Figure A.1 provides a stylised example for a hypothetical bank's weekly stressed net cashflow, and their liquidity position (liquid assets less the net cumulative cash outflows) at the end of each week. The amount of liquid assets is also expressed as a percentage of total opening funding (as at March 2021). In this example, the bank's survival horizon is 11 weeks (when the liquid assets less cumulative net cashflows falls below zero). From week 11 onward, the bank has a liquidity shortfall before mitigating actions, which grows to \$70 million by the end of six months – shown on the left-hand side (the equivalent of 7 percent of opening funding – on the right-hand side).

Figure A.1: Example of a hypothetical bank's weekly cashflows and liquid asset position

