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Summary of the dairy portfolio stress testing exercise

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In late 2015, the five largest dairy lenders participated in a stress test featuring sustained low milk prices and sharp falls in dairy land values. This article summarises key insights from the test. Banks report expansion in dairy lending, at least in the near term, as they support existing borrowers facing negative cash flow. Consistent with earlier work, the scenarios generate significant increases in loss rates that are manageable for the banking system as a whole. There is a risk that the time taken to resolve stressed dairy exposures could be longer than reported in the tests, creating an ongoing source of uncertainty for banks.

1 Introduction

Low global milk prices are putting significant financial pressure on dairy farms, with about half of the sector experiencing a second consecutive season of operating losses. As discussed in Dunstan *et al* (2015), the number of non-performing loans in the dairy sector could rise significantly if milk prices are slow to recover from their current lows.

Given this environment, the Reserve Bank requested in late 2015 that the five largest dairy lenders undertake a stress test of their dairy portfolios. This paper draws insights from these tests for how the banks' dairy sector asset quality could evolve under stress scenarios, and the likely responses of the banks to a rapid rise in dairy sector defaults. Box A discusses the implications of the stress test results for individual banks, which is not the focus of this article.

Section 2 outlines the scenarios and instructions given to banks for the exercise. We then explore banks' assessment of the riskiness of dairy loans and portfolio growth (section 3), and trace through the eventual increase in loan losses (section 4). Section 5 concludes and briefly outlines plans for future work related to stress testing.

1 The author would like to thank the stress testing teams at participating banks; Chris Bloor and Daniel Wills for developing the stress test template and instructions; and David Hargreaves for guidance with the analysis.

Box A

Implications of the stress test for individual institutions

The Reserve Bank views stress testing as an important component of its prudential framework. There are two main objectives of stress testing exercises. First, stress tests help the Reserve Bank to identify and assess financial system risks. Second, stress tests can play a useful role in identifying and managing risks to an individual bank's capital or liquidity buffers.

After a stress test, senior management of participating banks are expected to discuss the implications of the results for the bank's business strategy. The outcomes of these meetings are then discussed with bank supervisors. For example, bank supervisors could require a bank to raise capital if a test seriously called into question the prudential safety of a bank (and the bank was not taking other appropriate actions to mitigate this risk).

However, the Reserve Bank considers stress tests are best used as guidance for a bank about its safety rather than a mechanistic pass/fail test. Firstly, this recognises the inherent uncertainty in projecting loss rates in severe hypothetical scenarios. Secondly, because banks are asked to produce stress test estimates themselves, direct linking to capital outcomes could encourage banks to under-report losses. Other regulators use stress tests to more directly indicate individual bank capital adequacy, but this requires a much more substantial role for the regulator in gathering detailed data and determining results.[2]

There is substantial variation in some of the reported results across banks in the dairy portfolio stress test. Two aspects of the dairy stress test have likely contributed to this dispersion: (i) several banks adopted a new approach to modelling losses for this test and (ii) there was no 'second round' (where loss rates are standardised across banks). The spread in outcomes across banks consequently reflects methodological differences as well as differences in the underlying vulnerability of portfolios.

Senior management of participating banks are currently considering the insights and potential consequent actions that might be taken from the dairy portfolio exercise. The stress tests will also form an input into supervisory discussions with the Reserve Bank. In addition to the reported results, these discussions will be informed by the Reserve Bank's own modelling of dairy risks, insights from the results of other participating banks, and ongoing monitoring of prudential data.

2 For example, both the US and Europe have run stress tests after the GFC that were specifically designed to identify capital shortfalls at participating banks, and have required capital raisings linked to stress test results.

2 Methodology and scenarios

Between late August and early November 2015, the five largest lenders to the dairy sector – together comprising more than 98 percent of bank lending to dairy farms – were asked to undertake a stress test of their dairy portfolios. As shown in table 1, the test featured two hypothetical stress scenarios. In the first scenario, the payout remains below $5.25 per kilogram of milk solids (kgMS) until the 2018-19 season and land values fall by 20 percent. The more severe second scenario features the payout remaining below $5 until the 2019-20 season, and land values falling by 40 percent. Banks were not asked to assess the implications of the scenarios for other portfolios, including other agricultural sectors, dairy processing, and firms servicing dairy farms..

The focus of the dairy portfolio test was somewhat different to a typical macroeconomic stress testing exercise. Whereas typical stress tests are designed to gauge the resilience of an institution's capital buffer to several portfolios coming under stress simultaneously, the dairy stress test focused on providing granular insights into one specific risk. This different focus was reflected in:

- The design of the stress test template: Banks were asked to trace through in much more detail the evolution of loans that become non-performing or impaired. While the test did not include detailed modelling of the profit and loss account, banks were asked to draw out the direct impacts of impaired dairy loans on profits and risk weighted assets.

- Modelling approach: Banks were encouraged to use customer financial statement data in their modelling to allow for more granular insights into their portfolios. For example, all banks forecast balance sheets at the customer level to account for working capital borrowing and changes in asset values.

Table 1
Stress scenarios for milk payout and dairy land price

	Fonterra payout *($ per kgMS)*		Dairy land price *(% change)*	
	Scenario 1	**Scenario 2**	**Scenario 1**	**Scenario 2**
2015-16	**3.75**	**3.00**	**-15**	**-20**
2016-17	**4.75**	**4.00**	**-10**	**-15**
2017-18	**5.25**	**4.50**	**0**	**-10**
2018-19	**5.75**	**5.00**	**0**	**0**
2019-20	**6.00**	**5.50**	**0**	**0**

Source: RBNZ assumptions.

The Reserve Bank had a number of benchmarks available to compare against individual bank results. Firstly, banks have provided loss estimates on the dairy portfolio as part of previous macro stress tests. Secondly, earlier joint work between DairyNZ and the Reserve Bank produced estimates of loss rates under very similar scenarios (Dunstan *et al* (2015)). Finally, banks were also asked to supply a categorisation of their current portfolio by break-even payout and loan-to-value ratio (LVR). Based on this data, it was possible to estimate losses by applying a similar methodology to the earlier Reserve Bank/DairyNZ work.

Table 2 shows that there were differences in reported portfolios across banks, which are likely to reflect methodological differences in how

Table 2
Comparison of bank portfolio and DairyNZ portfolio data

	DairyNZ	Average bank	Low banks	High banks
Loan-to-value ratios (LVR)				
Average *(%)*	43	48	46	50
% > 70	18	13	5	22
Break-even payout (BE)				
Average *($ per kgMS)*	5.3	5.0	4.7	5.2
% > $5.5	41	25	19	30
Joint distribution of BE and LVR *(% of lending)*				
BE > 5 & LVR >50	43	41	28	53
BE > 5.5 & LVR >70	11	4	3	5

Source: DairyNZ, Reporting banks.

Note: Low (high) banks refers to the average of the two banks with the lowest (highest) value for the variable in question.

break-even and loan-to-value ratios were computed. There are also material methodological differences between the DairyNZ and bank portfolio data, although the central tendency is broadly comparable. The most material difference is a smaller proportion of farms with break-even payouts of above $5.50, possibly because banks may have been in a better position to strip out the impact of one-off cost expenses in the buoyant 2013-14 season. This may suggest that the resilience of the sector to a lower payout is somewhat higher than reported by Dunstan *et al* (2015).

3 Dairy portfolio risk

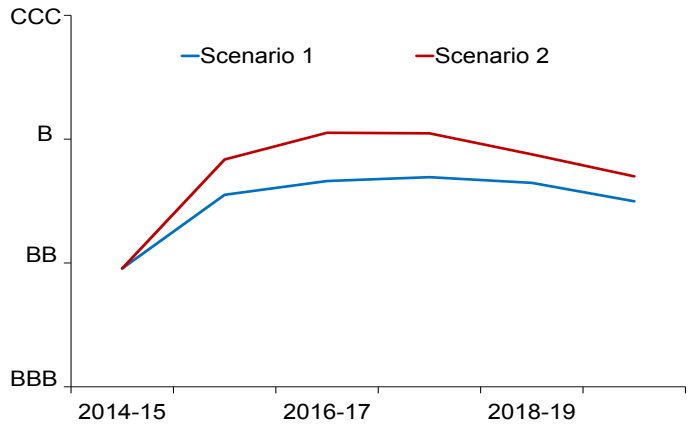
The portfolio data provided by banks helps to gauge the vulnerability of dairy customers to the stress scenarios. Banks report that, on average, about 40 percent of debt is held by farmers who have a break-even payout of $5 or higher and a current LVR exceeding 50 percent (table 2). Based on the assumed payout and decline in farm values, these farms would be expected to come under stress early in scenario 2 (due to persistent cash losses and LVRs near or above 100). The tail of more vulnerable farmers with a break-even payout of above $5.50 and an LVR exceeding 70 percent is reported to be about 5 percent on average.

Each of the participating banks assigns customers a rating ranging from AAA (typically indicating extremely strong capacity to meet repayments) to CCC (weak and depending on favourable financial conditions) to D (default). These rating grades are updated throughout the scenario, based on customer information such as loan-to-value ratio, cash flow, management expertise, and expert judgement. In line with the likely deterioration in key financial statement indicators, there is a decline in portfolio quality during both scenarios. The average risk grade of dairy customers declines during the early years of both scenarios, before improving somewhat in later years. The average rating deteriorates from BB to B during scenario 2, and about half that in scenario 1 (figure 1).

Most reporting banks are IRB (internal rating based) banks. This means that customer rating grades are used to determine the risk weights for individual loans, which in turn govern the amount of capital allocated to the dairy portfolio.[3] Broadly consistent with the deterioration in average

3 Under the standardised framework, banks instead apply a constant risk weight to all non-defaulted dairy exposures, and a higher risk weight for defaulted dairy exposures in most cases.

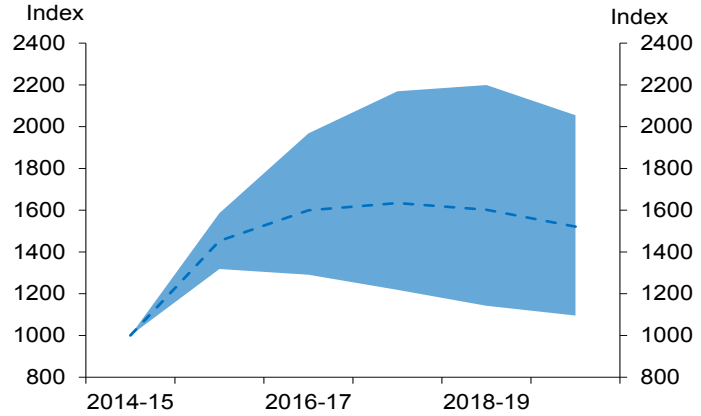
Figure 1
Average risk grade of dairy sector exposures



risk grade, risk weights increase during scenario 1 (figure 2) and scenario 2. The risk weight of the average bank in scenario 1 increases by about 50 percent during 2015-16, from about 75 to 115. Risk weights then settle at a higher level, although there is a small improvement in later years. There is significant variation across banks, with the two banks with the largest peak increase reporting that risk weights eventually reach more than double their initial level.

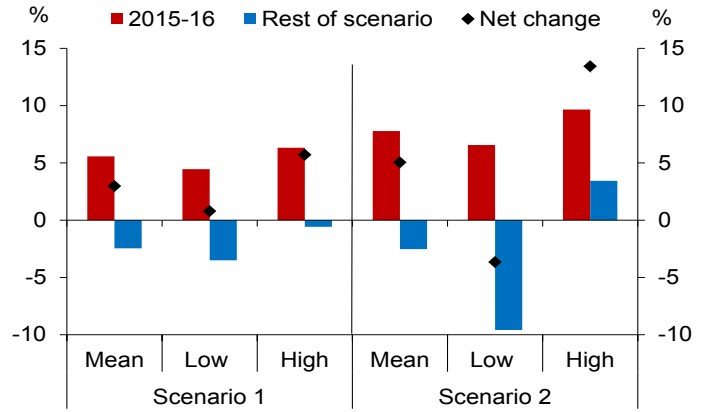
Despite the increased risk weights on dairy lending, the results are consistent with banks continuing to support customers facing short-term cash flow difficulties. Banks report significant expansion of dairy lending during 2015-16, in line with the expected rise in working capital demand. The average reported growth in dairy lending during 2015-16 was 5.5 percent in scenario 1 and 8 percent in scenario 2 (figure 3). This compares to growth of about 10 percent during the year to June 2015 due to rising working capital demand. Portfolio growth rates then taper off, as the payout recovers modestly (especially in scenario 1), and foreclosed assets are written off (especially towards the end of scenario 2, discussed in the next section).

Figure 2
Average risk weight for dairy portfolio during scenario 1
(2014-15 = 1000)



Note: The dotted line is the average across banks. The top (bottom) of the shaded region represents the average risk weight of the two banks with the largest (smallest) peak increase in risk weights.

Figure 3
Growth in total dairy exposure



Note: Low (high) refers to the average of the two banks with the smallest (largest) growth in exposure at default throughout the scenario.

Total dairy exposure increases on average throughout both scenarios. When combined with rising risk weights, this implies some downward pressure on capital ratios. All else equal (before any mitigating actions), increased risk-weighted assets would see the Tier 1 capital ratio of the

average bank fall from 11.6 percent to 10.6 percent under scenario 1, and to 10.2 percent in scenario 2. The two banks with the largest increase in risk weighted assets report results that imply, all else equal, that their capital ratio would fall by 1.7 percentage points in scenario 1 and 2 percentage points in scenario 2. This reflects that these banks reported a larger increase in both risk weights and total dairy exposure.

4 Stressed assets and bank losses

All participating banks report a detailed break-down of how stressed assets evolve throughout the scenarios. While the specific terms used varied across banks, we can identify three broad stages in the evolution of problem loans:

- **Ratings downgrade**: As noted above, all banks assign a risk grade to customers. A material deterioration in average customer risk grade would likely result in an increase in expected loss on currently performing loans. This in turn would lead to a collective provisions being set aside for expected loss over a set timeframe (with the exact period in question depending on accounting procedures in place at each institution).

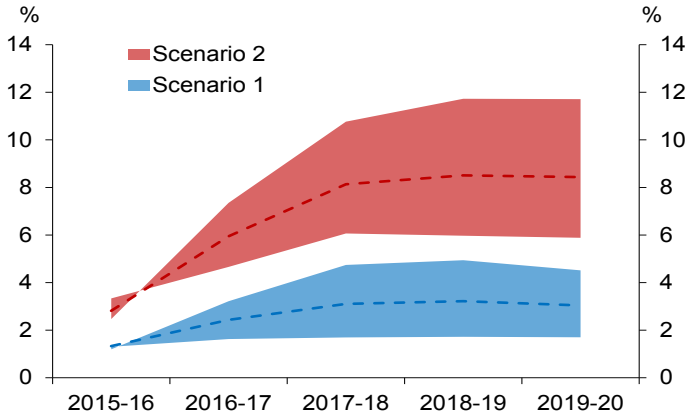
- **Default**: there is a material breach of the loan agreement, which is typically quantified as a failure to make interest or loan repayments for more than 90 days. Default results in specific provisions being set aside for possible losses on the loan and a related charge in the profit and loss account. In the stress test, common factors that banks used to quantify defaults included a persistent demand for working captal and an elevated loan-to-value ratio.

- **Write-off**: in cases where the borrower remains un-viable, the loan is resolved by selling the underlying collateral. The write-off process could be a voluntary outcome of negotiations with the borrower, or the result of a formal foreclosure process. Write-off results in the asset being transferred off the bank's balance sheet, and an adjustment in its profit and loss account if the actual losses differ from the amount provisioned. Quantifying write-offs under a stress scenario is particularly difficult, with most banks using a combination of length of time in default, loan-to-value ratio, and expert judgement.

As the financial situation of a stressed borrower deteriorates, there will generally be (i) increasing levels of bank oversight and (ii) ongoing negotiations between the bank and the farmer about possible options to improve long-term viability. For example, a breach of the initial loan agreement will often lead to the bank providing working capital, subject to the farm meeting targets for operating costs in subsequent seasons. In more serious cases, options to improve viability include selling part of the farm, injecting capital, and/or renegotiating other loan terms. These measures may lead to the stressed farm returning to performing status over time, particularly if market conditions improve.

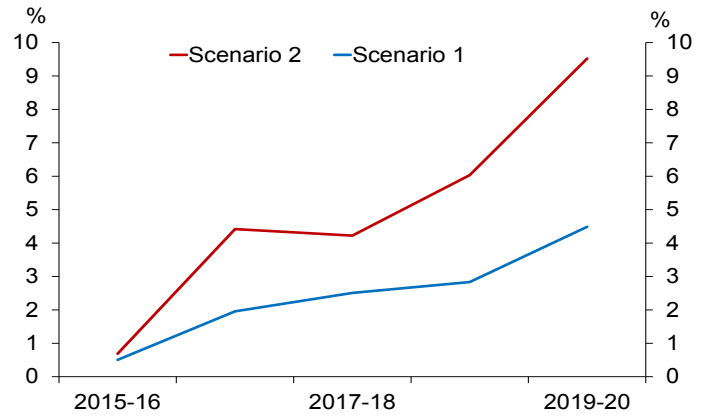
The decline in portfolio quality discussed in section 3 led banks to report significant bad debt charges throughout both scenarios. The main driver of the bad debt expense was an increase in specific provisions related to rising defaults. The amount provisioned depended on factors such as lost interest income, loan-to-value ratio, and various costs that would be associated with write-off. Banks also set aside collective provisions throughout the scenarios, due to a deterioration in average risk grade for non-defaulted customers.

Figure 4
Cumulative bad debt expense
(% of initial exposure)



Note: The dotted line is the average across banks. The top (bottom) of the shaded region represents the average of the two banks with the largest (smallest) cumulative bad debt expense.

Figure 5
Flow of loans written off
(% of initial exposure)



Most of the impact on profitability is expected to occur in the first three years of the scenarios, when default rates rise sharply (figure 4). Throughout the entire scenario, the average bank reports a cumulative bad debt expense equivalent to about 8 percent of initial dairy exposures in scenario 2, and 3 percent of exposures in scenario 1. Although there is significant variation in loss rates across banks, the range of loss rates seems broadly consistent with other evidence, given the significant uncertainties involved. Under the assumption that all non-performing loans are written off, Dunstan *et al* (2015) estimated a loss rate of 14 percent in scenario 2 and 6 percent in scenario 1 using DairyNZ data. Similar modelling using the banks' reported portfolios resulted in loss rates of about 11 and 4 percent respectively, which is quite similar to the average results produced by the banks in figure 4.

Given the severe nature of the scenarios, a significant proportion of defaults do not return to performing status. The number of loans written off steadily increases as the scenarios progress, as banks gradually move to resolve unviable exposures. The average bank reported writing off about 25 percent of initial dairy exposures during scenario 2, and 12 percent during scenario 1.[4] The variation in reported write-offs across banks was significantly lower than for loss rates, suggesting that the estimated loss to resolve stressed assets was a key driver of differing loss rates.

Figure 5 shows the flow of loans that the average bank reports writing off over time (as distinct from losses on written off loans, where the proceeds made from sale are accounted for). As there are significant lags involved in executing the sale of a stressed asset, most write-offs occur in the final two years of the scenarios. The flow of loans written off peaks at about 9 percent of initial exposures in the final year of scenario 2, and about 4.5 percent in the final year of scenario 1.

4 Note a smaller difference between the scenarios for write-off rates than for loss rates. This is because the sharper fall in asset prices in scenario 2 implies that losses are higher for a given number of write-offs.

The scale of loans written off would likely result in very challenging conditions in the market for dairy farms, particularly in the last two years of the scenario. Indicative data on the number of farm listings due to write-offs suggests that they would exceed typical sales volumes by a large margin in the last two years of the scenario (and sales volumes are likely to be well below average during stress scenarios). The resulting downward pressure on land values is intended to be captured in the severe price falls assumed for the test. However, it is questionable whether sufficient buyer capital would be present to absorb the large rise in listings, especially during a period where buyer demand may be limited by several years of low dairy payouts.

This analysis suggests that banks should plan for the possibility that the time taken to write off stressed dairy exposures could be significantly longer than assumed in the tests. Under these circumstances, banks could be left needing to manage a large portfolio of foreclosed assets for an extended period of time. This would mean that uncertainty about the scale of eventual write downs would persist for longer, potentially requiring the banks to hold additional capital to boost confidence. Losses on written-off loans could also increase if ongoing management costs and forgeone interest income are larger than initially provisioned for (possibly offset by any growth in dairy land values that occurs in the interim).

5 Conclusion

This article summarises aggregate results from a recent stress test designed to assess risks associated with dairy lending. Simulating the effects of two stress scenarios, banks reported a material deterioration in the credit quality of dairy customers, and an implied increase in provisions and capital allocated to dairy loans. Consistent with earlier work, the scenarios generate significant increases in loss rates that are manageable for the banking system as a whole. However, there is a risk that the lags involved in resolving stressed dairy assets are larger than reported, potentially creating an ongoing source of uncertainty for banks.

The Reserve Bank views stress testing as a critical input to banks' risk management frameworks, as well as to its own identification of vulnerabilities in the financial system. Over the past year, the Reserve Bank has developed a set of best practice guidelines for the stress testing frameworks of the largest five banks. The guidelines are currently being discussed with these banks. An article outlining the New Zealand stress testing framework and the guidelines for best practice will be released in due course.

References

Dunstan, A, H Skilling, M Newman and Z Mounsey (2015) 'An updated assessment of dairy sector vulnerabilities', Reserve Bank of New Zealand *Bulletin*, 78(8).