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An updated assessment of dairy sector vulnerabilities

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Low global milk prices are placing dairy farmers under significant cash flow pressure. This article investigates the severity of these cash flow pressures, and the potential financial stability implications if the payout remains low for an extended period. Most farmers are estimated to make cash losses in the current season, compounding cash flow pressures experienced in the later part of the 2014-15 season. Despite some farms with high debts facing considerable difficulties, most farms are expected to remain viable over the medium term. Losses for the banking system as a whole are estimated to be manageable even under a severe stress scenario for the dairy sector.

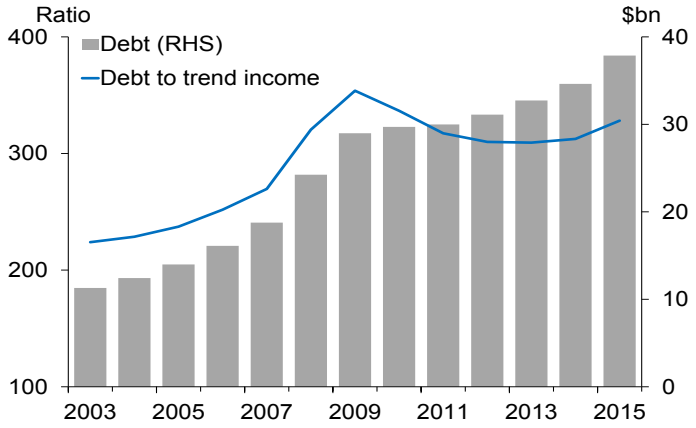
Introduction

Dairy sector debt increased from $11.3 billion to $29 billion between 2003 and 2009, due to rapid increases in land prices, a flurry of dairy conversions and significant on-farm investment. This rise in debt left highly leveraged farmers exposed when milk and land prices fell sharply in 2009. A swift recovery in global milk prices subsequently helped to limit the degree of financial stress, although non-performing loans increased to a peak of around 4 percent of sectoral debt.

This experience has resulted in increased caution among dairy farmers and a slower rate of debt accumulation. However, debt levels remain at elevated levels of more than 300 percent of trend milk income (figure 1). As at June 2015, dairy debt reached $37.9 billion, representing around 10 percent of total bank lending. Developments in the dairy sector are therefore an important consideration in assessing financial system risks.

1 This article is the joint work of the Reserve Bank and DairyNZ, and expands on the analysis in box A of the November 2015 *Financial Stability Report*. Matthew Newman and Zach Mounsey are employees of DairyNZ. The authors would like to thank Chris Bloor, Bernard Hodgetts, and other staff of the Reserve Bank of New Zealand; and David McCall of DairyNZ for their comments.

Figure 1
Dairy sector debt



Source: RBNZ *Annual Agricultural Survey*, DairyNZ, RBNZ calculations.

Note: Dairy income is constructed using effective payout multiplied by milk production. Trend income is used to adjust for volatility in commodity prices and milk production, and is estimated using a Hodrick-Prescott filter with judgement imposed to ensure the trend payout is $6.25 per kilogram of milk solid (kgMS) in the 2015-16 season.

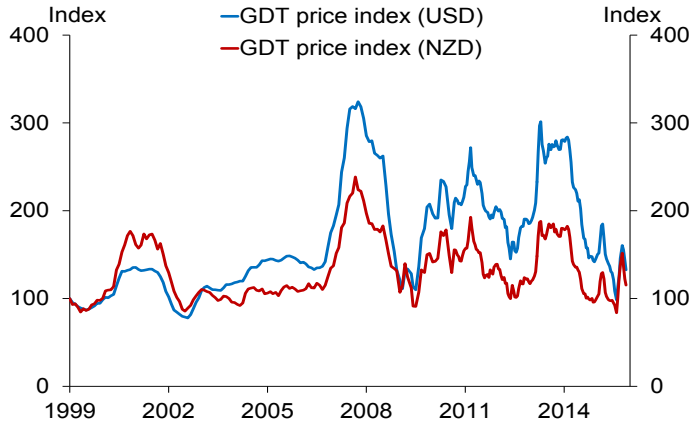
This paper investigates the significance of dairy-related financial stability concerns in the current market environment. Section 2 discusses recent developments in the dairy sector at the aggregate level. Section 3 provides an overview of the farm-level data used in the remainder of the paper, while section 4 examines the extent of cash flow pressures in the 2014-15 and 2015-16 seasons. Section 5 models the degree of financial stress that could occur in coming seasons under a range of hypothetical scenarios where lower incomes are sustained and land prices fall.

Recent developments in the dairy sector

Between February 2014 and August 2015, global dairy prices fell by more than 65 percent in US dollar terms (figure 2), due to increased global supply, sanctions on Russian imports, and reduced Chinese demand following a build-up of inventories during the 2013-14 season. Over this period, the exchange rate depreciated, dampening the fall in NZ dollar terms. Dairy prices have since increased from August lows, but recent outturns have not been favourable and prices remain well below their long-term average.

As a result of sustained lower milk prices, dairy farmers are currently facing significant cash flow pressures. Following a record 2013-14 season, Fonterra's payout fell considerably, and farmers are now expected to face consecutive sub-$5 payouts (per kgMS). The impact of the low payouts is amplified by an increase in average break-even

Figure 2
Global dairy prices
(January 1999 = 100)

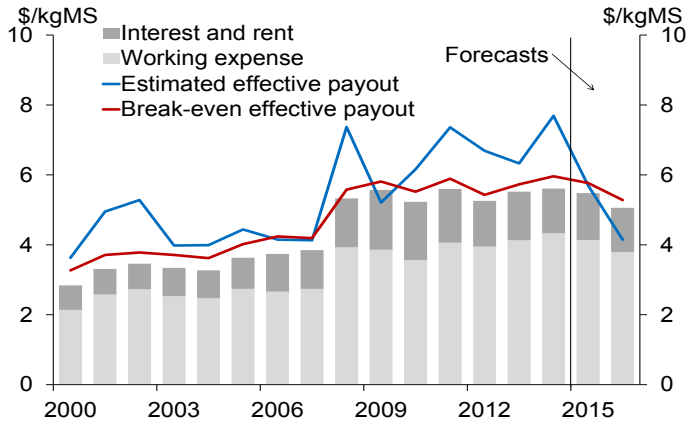


Source: GDT, Reuters.

payouts since the 2006-07 season, reflecting increases in debt levels and a shift to more cost-intensive operating structures (figure 3). The worst cash flow pressures are expected to emerge in the current season (2015-16), compounded by low retrospective payments from the 2014-15 season. The cash flow shortfall for the average dairy farmer is estimated to be more than $1 per kgMS (based on DairyNZ forecasts of $4.15 for effective milk revenue, taking into account the latest Fonterra forecast for the headline payout).

Despite the significant cash flow pressures facing the sector, dairy farm land values have been supported by low interest rates and a largely positive long-term outlook for the payout. The REINZ dairy price index continued to grow at about 10 percent per annum throughout the summer of 2014-15. However, land values have recently shown signs of weakening, on limited sales volumes. There is a risk that land values could fall if cash flow pressures persist, especially if confidence in the longer-term milk price outlook deteriorates. Downward price movements could be amplified by reduced liquidity in the farm market, if demand to purchase farms falls alongside the increased risk of rising stressed sales. The extent of financial system losses in this scenario hinges critically on how debt is distributed within the dairy sector.

Figure 3
Actual and break-even dairy payouts



Source: DairyNZ, Fonterra.

Note: The effective payout (cash income farmers receive from milk companies between 1 June and 31 May) includes deferred payments and dividends, and is net of dairy levies. Figures for 2014-15 and 2015-16 are based on DairyNZ forecasts. The break-even payout is farm working expenses plus interest and rent costs plus drawings, adjusted for livestock and other revenue.

Overview of micro-data

It is difficult to be definitive about a sector's vulnerability on the basis of aggregate data. The distributions of break-even cash flow and sectoral debt, as well as the correlation between the two would primarily determine the extent of farm and banking system stress during a severe downturn. The remainder of this paper therefore makes use of unit record data to provide a more nuanced assessment of vulnerabilities in the sector.

The data are sourced from DairyBase, a voluntary benchmarking tool for dairy farmers operated by DairyNZ. The core dataset contains all farms that supplied income statement and balance sheet information for the 2013-14 season, with data from the 2007-08 season also included for benchmarking purposes. The analysis focuses on owner-operator farms, given that they own land, livestock and dairy company shares, account for 65 percent of dairy herds in the population and the vast majority of sectoral debt,[2] and have the most complete balance sheet information. After removing outliers and observations with incomplete financial

2 Plausible estimates suggest that owner-operators account for around 85 percent of sectoral debt (based on the number of herds by farm type from the DairyNZ Production Survey, average debt levels of owner-operators and share-milkers from the DairyNZ Economic Survey, and average debt of owners of farms with share-milkers from indicative DairyBase data).

Table 1
Sample size by season and ownership structure

	2013-14		2007-08	
	Population	**DairyBase**	**Population**	**DairyBase**
Total	11,893	1,570	10,384	1,011
Owner-operators	7,812	906	7,197	594

Source: DairyNZ.

Note: Sample sizes are after removal of outliers and farms with incomplete financial statements.

statement information, the dataset contains approximately 900 owner-operator unit records in 2013-14, representing more than 10 percent of owner-operator farms (table 1).

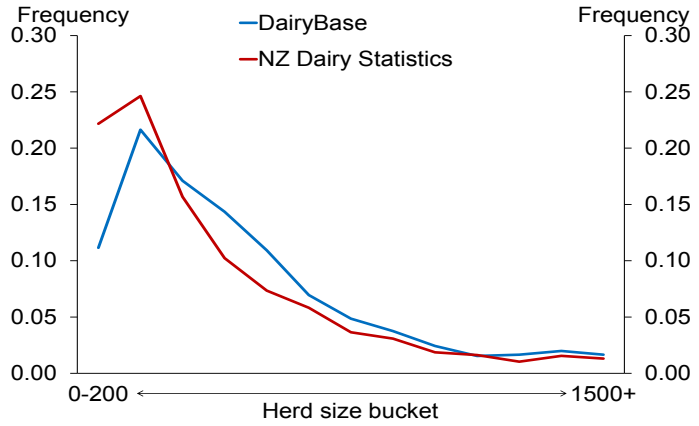
The DairyBase sample tends to under-represent small farms (<200 cows), over-represent medium-sized farms (300-800 cows), and broadly match the proportion of large farms (figure 4). To help mitigate this sample bias, the unit record data are weighted to match the population dairy herd distribution. We achieve this by placing each observation into one of 21 buckets according to herd size, and assigning observations within bucket *i* a weight equal to:

$$\text{Weight}_i = \frac{\text{Number of herds in population}_i}{\text{Number of herds in sample}_i}$$

Implied sectoral aggregates are computed by multiplying variables of interest by sample weights and summing across all observations.

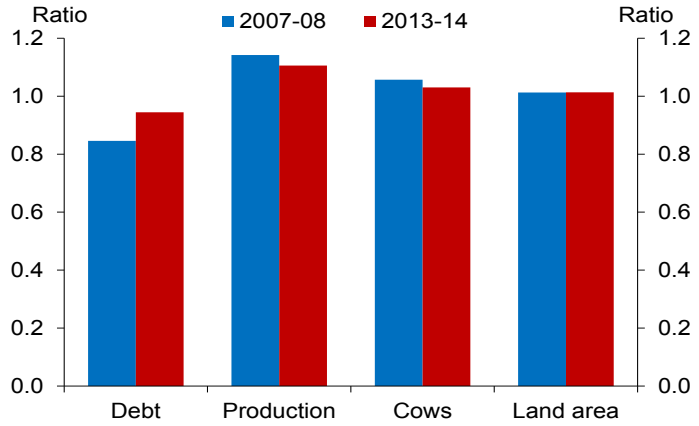
To test how representative the resulting DairyBase sample is, figure 5 compares weighted aggregates from the DairyBase sample against known population aggregates for sector debt, production, number of cows, and land area. The weighted sample for 2013-14 produces figures that are within 10 percent of the relevant sector aggregate, suggesting that the sample provides a reasonable picture of the sector as a whole.

Figure 4
Population and sample herd distributions



Source: DairyNZ.

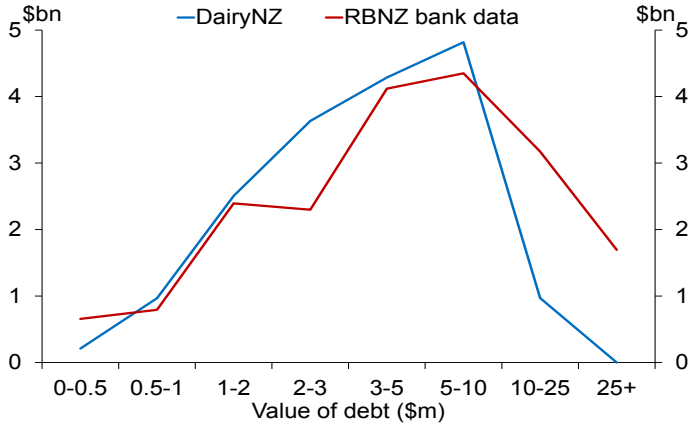
Figure 5
Weighted sample relative to population aggregates



Source: DairyNZ, Livestock Improvement Corporation, RBNZ *Annual Agricultural Survey*.

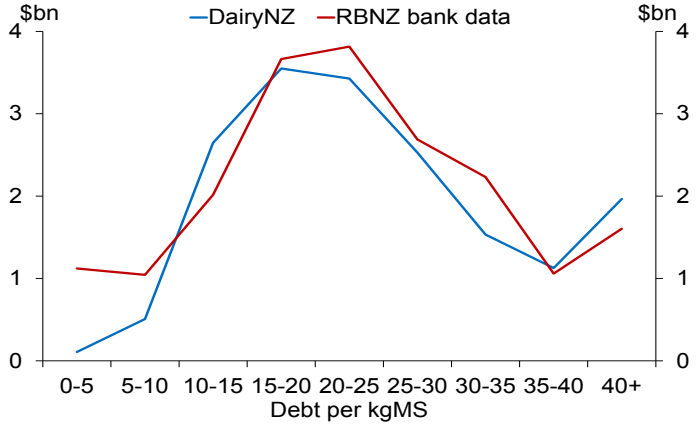
Note: Ratios refer to aggregates implied by the weighted sample relative to actual population aggregates. Debt value assumes that owner-operators account for 85 percent of sector debt.

Figure 6
Comparison of total debt by value of debt
(2007-08 season, weighted)



Source: DairyNZ, RBNZ.

Figure 7
Comparison of total debt by debt per kgMS
(2007-08 season, weighted)



Source: DairyNZ, RBNZ.

The largest errors are for production and debt. In the 2013-14 season, the weighted sample overstates production levels by 10 percent and understates debt levels by 5 percent. This suggests that the sample is somewhat biased towards more productive farms and may marginally understate risks in the sector.

The data for 2007-08 were also benchmarked against anonymised unit record data obtained from banks. These data were a stratified sample specifically designed to match figures for aggregate debt (Hargreaves and Williamson, 2011). Figures 6 and 7 compare the distributions of debt in the two datasets by dollar value and as a proportion of production, respectively. Although there are significantly fewer farmers in DairyBase with debt in excess of $10 million, the two datasets give a very similar distribution of debt per kgMS. This suggests that the DairyBase data accurately capture the amount of vulnerable debt on a per kgMS basis. DairyBase appears to understate the concentration of risk in the sector on a dollar value basis, possibly due to larger farms reporting to DairyBase at the herd level rather than as a consolidated business.[3]

A key area of uncertainty is the market valuation of land assets within the dataset. Land values in DairyBase are based on the Rateable Value (RV) if it has been updated in the current season. If the RV is out of date, DairyNZ use a combination of regional sales prices over the season and judgemental input from rural valuers to update land values. Applying this method results in an average increase in values of five percent since 2013-14. Although the average value of farms within DairyBase tends to lag transacted market values during periods where prices are changing rapidly, average values in DairyBase have increased by a similar amount to the REINZ dairy price index since 2000.

3 For example, the top 10 percent of most indebted farms account for 44 percent of debt in the RBNZ data compared with 33 percent in the DairyNZ data.

Cash flow pressures in recent seasons

This section makes use of the DairyBase data to estimate the extent of cash flow stress among dairy farms in the 2014-15 and 2015-16 seasons. Table 2 lists the assumptions used to update the 2013-14 unit records for the following two seasons, based largely on DairyNZ forecasts and sectoral expertise. First, milk revenues fall in line with DairyNZ forecasts for the effective payout. The effective payout for the current season is $4.15 per kgMS, including dividends. Second, farmers are assumed to reduce both working expenses and drawings, given that the lower payouts have been signalled well in advance. Finally, interest rates on term debt are assumed to fall in the 2015-16 season, and any negative cash flow in 2014-15 adds to current liabilities and interest costs in 2015-16. Farmers make an operating loss if effective milk and livestock revenue is lower than the sum of interest and rent costs, working expenses, and drawings.

Table 2
Assumptions for modelling cash flow in 2014-15 and 2015-16 seasons

Variable	Methodology
Effective milk revenue	$5.70 per kgMS in 2014-15 and $4.15 in 2015-16.
Working expenses	All farms reduce working expenses by 25 cents per kgMS in 2014-15 and 35 cents in 2015-16.
Drawings	All farms reduce drawings by 20 cents per kgMS in 2014-15 and 10 cents in 2015-16.
Interest costs	Remain constant in 2014-15. Interest rate on term debt drops by 50 basis points in 2015-16. Any increase in working capital costs 9%.
Working capital	Negative cash flow is assumed to add to liabilities and increase interest costs (see above). Positive cash flow farms are assumed to use 30 percent of the funds to repay liabilities.
Other	Other cash flows (livestock revenue and a milk quality adjustment) are assumed constant at 2013-14 levels.

Source: DairyNZ.

Based on these assumptions, the average break-even payout for the dairy sector is $5.77 per kgMS in 2014-15 and $5.28 in 2015-16 (table 3). There is, however, significant variation in the break-even payout across farms. The top 50 percent of farms by break-even payout had an estimated average break-even of $6.75 per kgMS in 2014-15, compared to $4.79 for the bottom 50 percent of farms. These higher break-even payouts reflect: significantly higher working expenses, higher interest and rent costs, more drawings, and less revenue for a given milk payout. Indebted farms also have a significantly higher break-even payout due to higher interest and rent costs.[4] Farms with debt of between $0 and $10 per kgMS have an average break-even of $5.19, compared to $6.51 for farms with debt in excess of $35 per kgMS.

We estimate that 49 percent of the sector was operating below break-even in the 2014-15 season.[5] Figure 8 highlights the degree of cash flow

4 We also investigated the variation in average break-even payouts by production system and dairying region. The most intensive production systems (DairyNZ system 4 and 5) had break-even payouts that were broadly comparable to the least intensive systems (DairyNZ system 1 and 2), with higher working expenses broadly offset by lower drawings. Average break-even payouts in 2015-16 varied from $4.80 to $5.70 across regions.

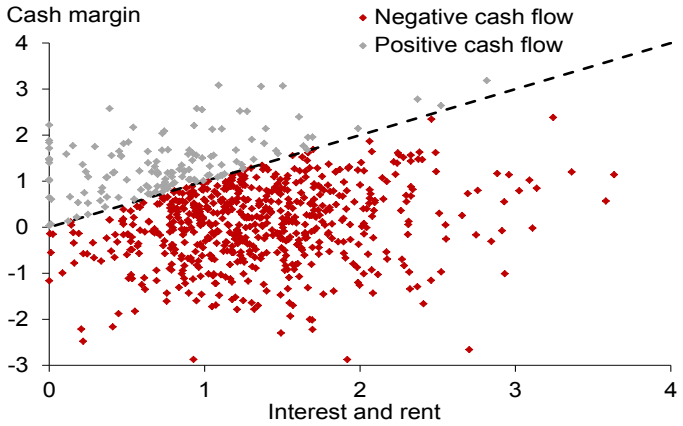
5 The Reserve Bank (2015) reported that 24 percent of farms were expected to experience negative cash flow in the 2014-15 season. The number reported here differs primarily due to the inclusion of drawings in the estimated break-even payout, which increases the average break-even by around 70 cents per kgMS in the 2014-15 season.

Table 3
Components of break-even payout for different farm groups (dollars per kgMS)

		Break-even payout		Debt per kgMS	
	Average	Lowest 50%	Highest 50%	$0-10	$35+
2014-15 season					
Working expense	4.14	3.75	4.53	4.10	4.02
Interest and rent	1.34	1.10	1.58	0.63	2.40
Drawings	0.76	0.57	0.94	0.85	0.69
Minus					
Deviation from mean milk revenue	0	0.05	-0.05	-0.05	0.04
Livestock/other revenue	0.46	0.57	0.35	0.45	0.57
= Break-even payout	**5.77**	**4.79**	**6.75**	**5.19**	**6.51**
Debt per kgMS	21.0	18.0	24.0	4.8	43.1
2015-16 season					
Working expense	3.79	3.40	4.18	3.75	3.67
Interest and rent	1.28	0.99	1.56	0.63	2.27
Drawings	0.67	0.49	0.85	0.77	0.60
Minus					
Deviation from mean milk revenue	0	0.05	-0.05	-0.05	0.04
Livestock/other revenue	0.46	0.57	0.35	0.45	0.57
= Break-even payout	**5.28**	**4.25**	**6.30**	**4.75**	**5.94**

Source: DairyNZ.

Figure 8
Estimated farm cash flows
(dollars per kgMS, 2015-16 season)



Source: DairyNZ.

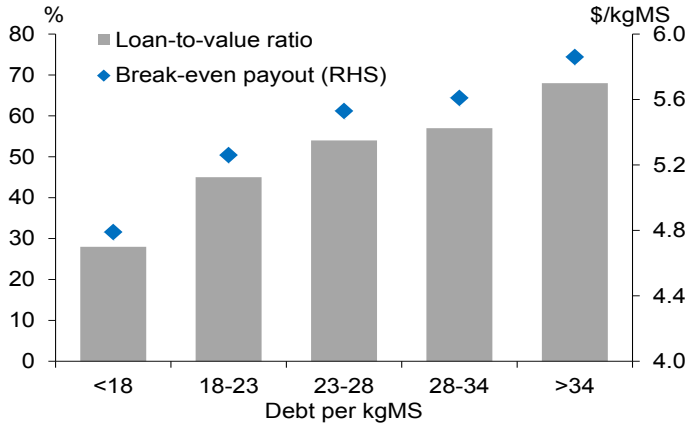
pressures that are likely to emerge in 2015-16. For each unit record in the dataset, the chart shows the estimated cash margin (defined as farm revenue minus working expenses and drawings) and interest and rent costs. Farms below the dotted 'break-even' line are unable to service interest and rent costs out of their cash margin. About 80 percent of farmers, representing almost 90 percent of sectoral debt, are expected to have negative cash flow on this basis. Assuming that all negative cash flow translates into working capital borrowing, debt would increase by an average of $1.15 per kgMS. However, actual working capital borrowing could be lower if a large proportion of farms use off-farm income or assets to support the farming business. In addition, Fonterra's offer of an interest free loan of up to 50 cents per kgMS for production between June and December 2015 will limit the degree of working capital demanded from banks.

We then examine the sensitivity of estimated cash flow pressures in the 2015-16 season to our underlying assumptions, given the uncertainties surrounding them at this stage of the season. We first vary the effective payout by 50 cents per kgMS either side of the central assumption ($3.65-4.65). This generates a range for the share of debt held by borrowers with negative cash flow of 75-95 percent, demonstrating that a large share of farms have a break-even between $4.15 and $4.65. We then examine the sensitivity to lower interest rates (75 basis points lower), further reductions in costs (25 cents lower), and increased livestock revenue (5 cents higher). Each of these changes reduces working capital borrowing by 5-25 cents per kgMS, but would have a relatively limited impact on the share of debt with negative cash flow (less than 5 percentage points).

Stress testing the dairy sector

With a large portion of the sector making cash losses in the 2014-15 and 2015-16 seasons, demand for working capital has increased markedly. Banks have supported the sector by expanding lending by more than 10 percent over the past year, on the basis that most farms are expected to be profitable over the medium-term. However, there is an increased risk of a rise in non-performing loans (NPLs) in the dairy sector. Highly indebted farms are particularly vulnerable, as they tend to have less equity and lower profitability (figure 9). For example, the 20 percent of debt with the highest debt per kgMS has an average loan-to-value ratio (LVR) of around 68 percent and an estimated break-even payout of $5.80 in 2015-16.

Figure 9
Average break-even payout and loan-to-value ratio by quintile of debt per kgMS



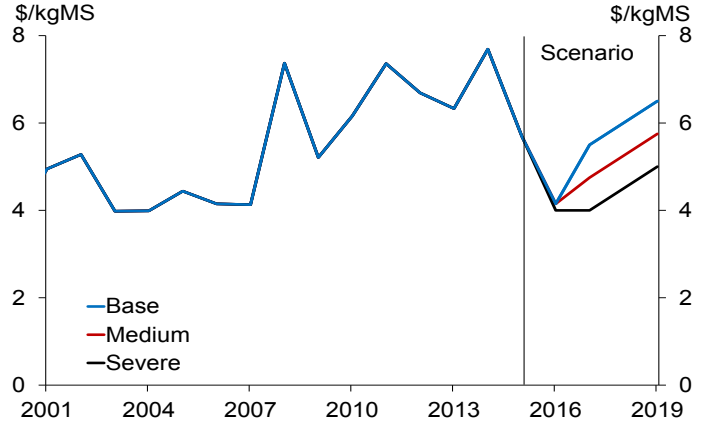
Source: DairyNZ.

Note: Each bucket contains 20 percent of sectoral debt.

To gauge the scale of this risk, this section applies a stress-testing model to the DairyBase dataset, similar to that developed by Hargreaves and Williamson (2011). This allows us to assess financial stress in the sector over a longer horizon, depending on different assumptions for the extent of the recovery in milk prices and decline in dairy farm values. Three hypothetical stress scenarios are investigated, covering the period from 2015-16 to 2018-19 (figures 10 and 11). These are not a central forecast for outcomes over the next few years.

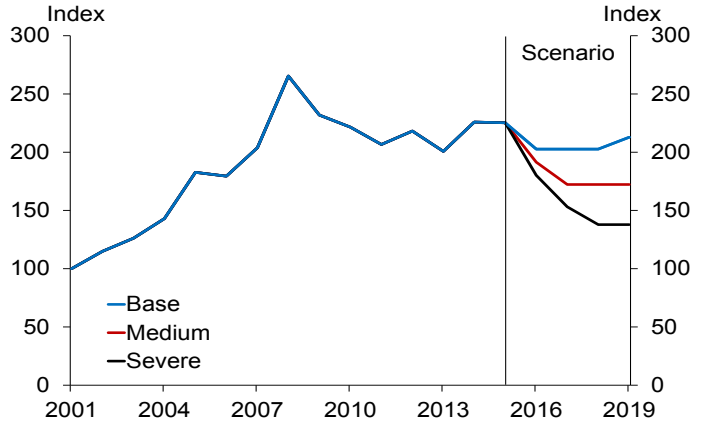
- Under the base scenario, the effective milk payout is $4.15 per kgMS in 2015-16 (the current DairyNZ forecast), recovers to $5.50 in 2016-17, and then increases by a further $0.50 per kgMS in the remaining seasons. In this scenario, farm prices fall by 10 percent in 2015-16 and remain flat until 2018-19, when they recover by 5 percent.

Figure 10
Stress test scenarios – effective milk payout



Source: DairyNZ, RBNZ assumptions.

Figure 11
Stress test scenarios – dairy land prices



Source: REINZ, RBNZ assumptions.

- Under the severe scenario, the milk payout is $4.00 in 2015-16 and 2016-17, and recovers very gradually thereafter (by $0.50 per kgMS per season). Farm prices are assumed to fall by around 40 percent by 2018-19, consistent with the persistently low milk prices

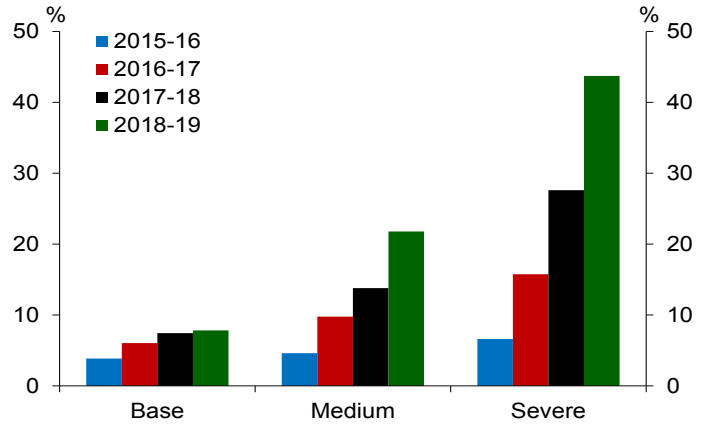
under the scenario and in line with the decline assumed in the joint APRA/RBNZ stress tests in 2014.

- The medium scenario represents the approximate midpoint of the base and severe scenarios. Under this scenario, farm prices fall by around 25 percent over the first two seasons, and are flat for the remainder of the scenario horizon.

The stress testing model applies these shocks directly to milk revenue and farm value at the unit record level. At the end of each season, farm balance sheets are updated to reflect (i) increased working capital to cover any negative cash flow throughout the season, or any pay-down in debt and (ii) the assumed farm value change.[6] Apart from varying the 2015-16 effective payout, all apply the same detailed cash flow assumptions for 2014-15 and 2015-16 outlined in table 2. The later years assume that working expenses and drawings vary in line with the assumed payout, and interest rates remain constant following their 50 basis point fall in 2015-16.[7]

To gauge the extent of stress in each scenario, we model NPLs based on a simple rule. The model assumes that a loan becomes non-performing whenever (i) the farm has an LVR greater than 90 percent (ii) cash flow in the current season is negative and (iii) cash flow would still be negative even under an assumed 'status quo', or medium-term, milk payout.[8] This latter requirement implies that banks would continue to lend to farms experiencing short-term cash flow pressures. This is consistent with

Figure 12
Modelled NPLs under stress scenarios *(percent of original exposures)*



Source: DairyNZ, RBNZ assumptions.

the fact that NPLs currently remain low despite considerable cash flow pressures. However, banks would re-evaluate lending decisions should a farm no longer be viable in the medium term. The status quo milk price is modelled as a moving average of the five previous payouts and forecasts for the next two seasons, and currently implies a status quo milk price of $6.25 per kgMS. The rule implicitly assumes that the farm does not have access to off-farm assets or income to support the business.

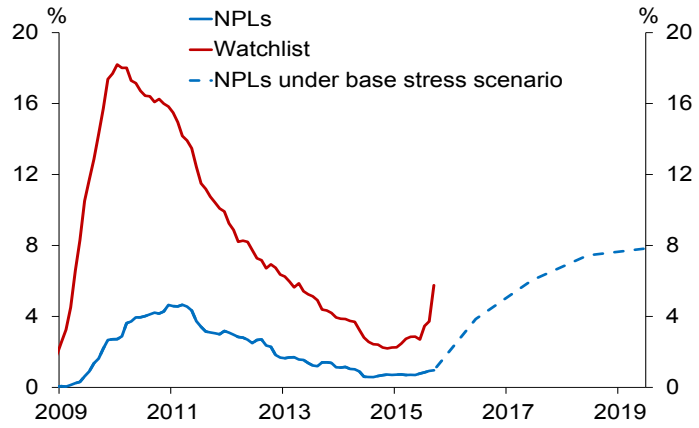
On the basis of this rule, NPLs by the end of the scenarios range between 4 and 25 percent of farmers, and 8 to 44 percent of initial sectoral debt (figure 12). In the base scenario, around half of these NPLs materialise in the 2015-16 season, reflecting the one-off decline in land values and the relatively quick recovery in the payout in subsequent years. The sharper and more prolonged rise in NPLs under the medium and severe scenarios reflects three main factors. Firstly, the marked decline in farm values pushes a large number of farmers above an LVR of 90 percent. Secondly, there is a sustained increase in working capital demand throughout the scenarios due to the muted recovery in the

6 The model assumes banks recognise only two-thirds of the change in market value of farms in any given year, and the remainder at the end of the scenario horizon. This reflects that valuations tend to lag market prices during periods of stress.

7 We also allow farms to take advantage of Fonterra's interest free loan, equating to around $0.30 per kgMS produced over the entire season. This has the effect of reducing interest expense over the period in which the loan remains interest free.

8 This extends the Hargreaves and Williamson (2011) model, which only features the first two conditions.

Figure 13
Dairy NPLs and watchlist loans
(percent of dairy exposures)



Source: DairyNZ, private reporting from 21 registered banks.

payout. Working capital demand is equivalent to 6 percent of average farm assets under the severe scenario, or 17 percent for farms that have an initial LVR exceeding 75. Finally, the model implies that banks gradually reduce the assumed medium term payout towards the end of the scenarios.

To provide some context around these results, figure 13 compares the base scenario estimate of NPLs to the experience in the wake of the GFC. The base scenario implies that NPLs peak at 7.8 percent, which is higher than the previous peak in early 2011. This is consistent with this scenario featuring a more marked and prolonged decline in farm income than was experienced in the post-GFC period. Watchlist loans provide some indication of how large NPLs may have become if the post-GFC dairy environment had deteriorated further. These peaked at 18.2 percent of sectoral exposures, suggesting that the NPLs are well within the plausible range of estimates given the scenario assumptions. The experience of the GFC highlights that it can take a significant period for NPLs to materialise, which is also consistent with the modelled scenarios.

The proportion of NPLs that will eventually result in loan defaults is highly uncertain. Under the assumption that all NPLs result in defaults, the stress testing model can be used to estimate an upper limit for banking system losses.[9] The results suggest that losses are manageable for the banking system as a whole, despite dairy lending now accounting for 10 percent of all bank lending. Loss rates for the banking system are estimated to be 2 percent of the system's dairy portfolio under the base scenario, and 14 percent under the severe scenario. These losses amount to around 2 to 18 percent of total before-tax profits of the five largest dairy lenders over a typical four year period (and a similar percentage of initial capital) suggesting that they are manageable for the system as a whole. It is also likely that capital ratios would come under pressure due to increases in risk-weighted assets.

As discussed in the November 2015 *Financial Stability Report*, the Reserve Bank supports the medium-term approach to assessing farm sustainability currently being adopted by banks. A significant tightening in lending standards could amplify the pressures facing the sector, create undesirable fire sale dynamics in the market for dairy farm land, and increase loan losses for the banking system. The Reserve Bank has also requested that the five largest dairy lenders undertake stress tests of their dairy portfolios, and is in discussions with banks to ensure that they are setting aside realistic provisions to reflect the expected rise in problem loans. The stress tests will provide a view of potential losses under similar scenarios and will be reported on in due course.

9 The model assumes that banks face significant costs of disposing of foreclosed assets due to transaction costs, a fire-sale discount, and delays in selling the farm. These assumptions imply banks make losses whenever they foreclose on a farm with an LVR above 75 percent.

Conclusion

This paper used unit record data from DairyBase to examine the potential stress in the dairy sector as a result of the sustained fall in the payout. In terms of cash flow pressures, we estimated that 49 percent of the sector had negative cash flow in the 2014-15 season. These cash flow pressures are expected to increase, with around 80 percent of farmers (representing almost 90 percent of sectoral debt) expected to have negative cash flow in the 2015-16 season. This is despite allowing for some reduction in farm working expenses, drawings, and interest rates.

We then applied a stress-testing model to assess the potential for a rise in dairy sector NPLs over a longer horizon. In line with our understanding of actual bank behaviour, the model assumes that banks continue to lend to farmers in negative cash flow unless the LVR is above 90 percent and future periods of positive cash flow appear unlikely. The vast majority of dairy farms remain viable under the base stress scenario, with NPLs rising to 7.8 percent of original exposures by 2018-19. The worst case scenario features a slow recovery in the payout and a sharp decline in land values, resulting in NPLs increasing to around 44 percent. While this scenario presents a highly challenging environment for the dairy sector, our results suggest that losses for the banking system as a whole would be manageable.

References

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