

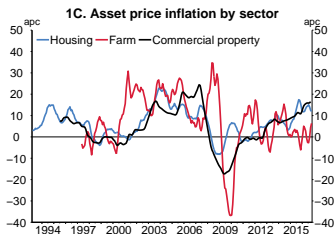
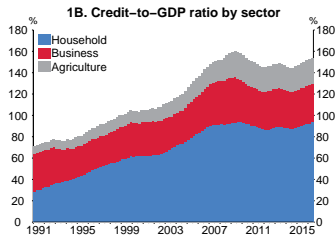
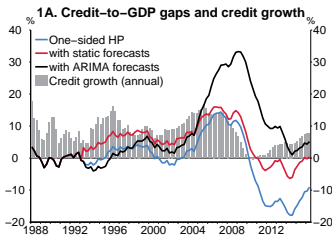
# Macro-prudential chartpack

Reserve Bank of New Zealand

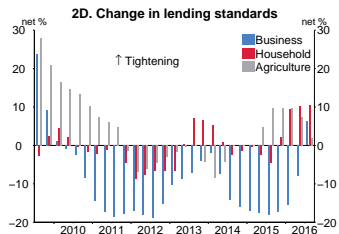
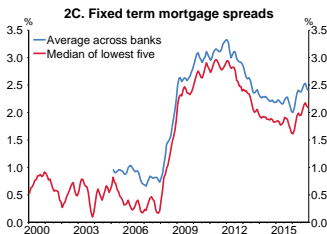
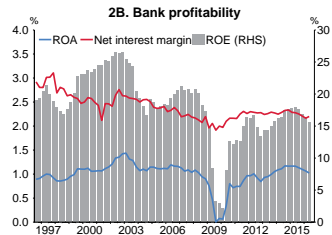
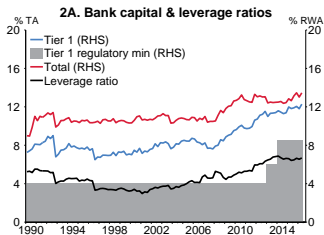
Notes and data sources in appendix

7 December 2016

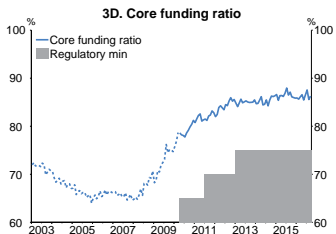
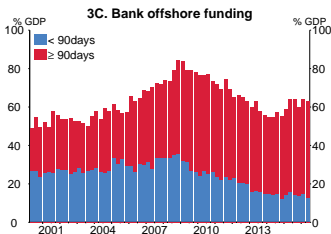
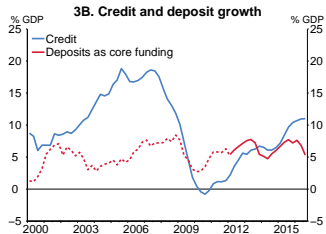
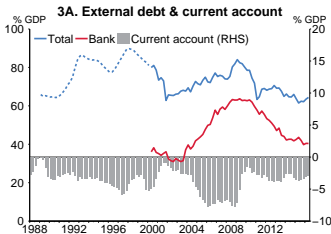
# Credit and asset prices



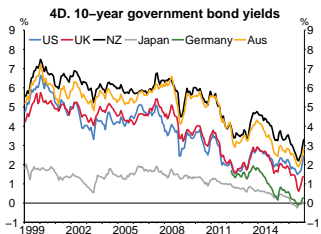
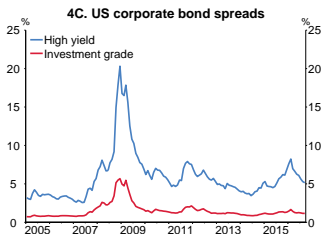
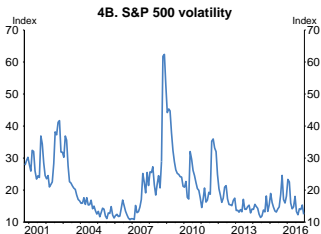
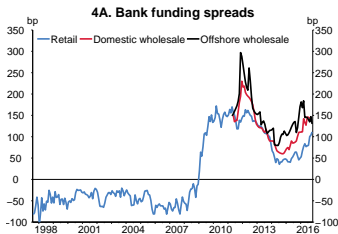
# Bank leverage and risk-taking



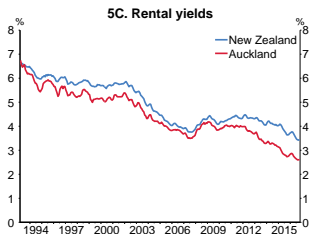
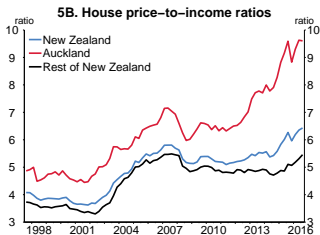
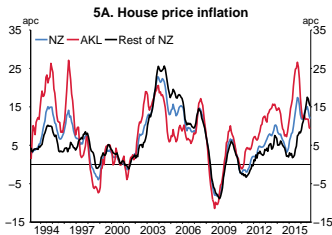
# Funding and liquidity



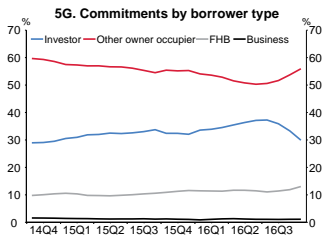
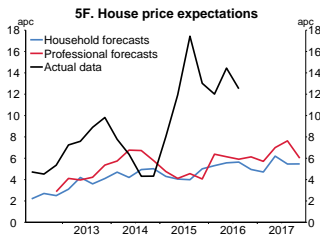
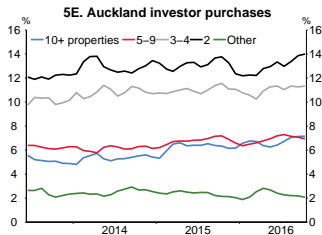
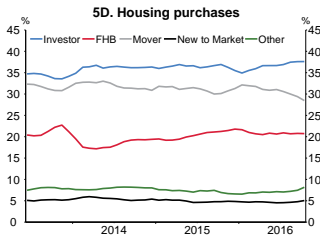
# Financial market conditions



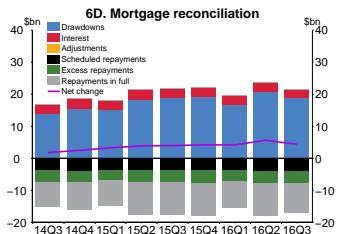
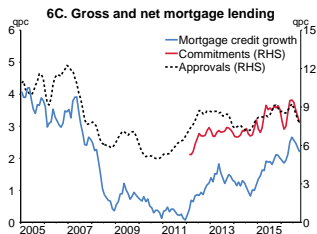
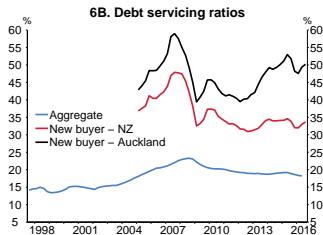
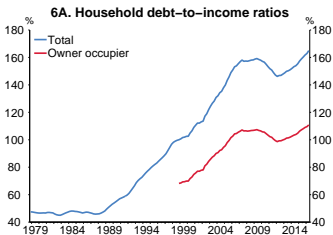
# Housing market imbalances (1)



# Housing market imbalances (2)

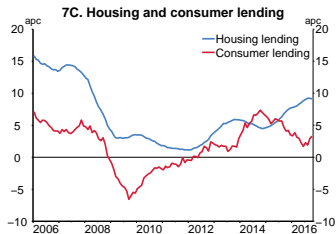
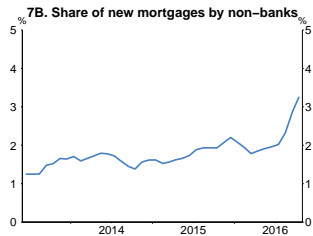
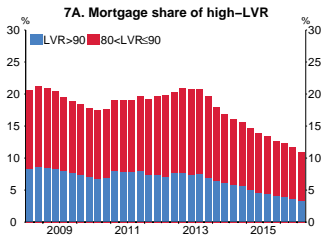


# Household balance sheet stretch

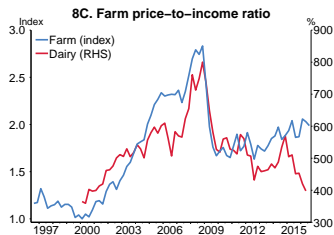
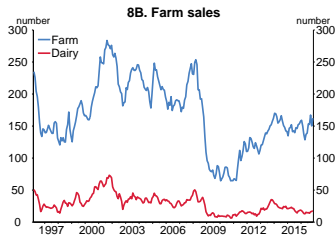
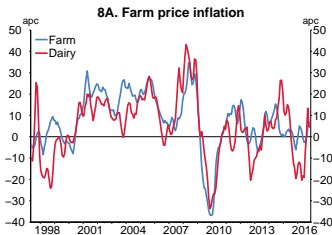




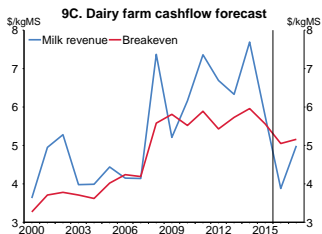
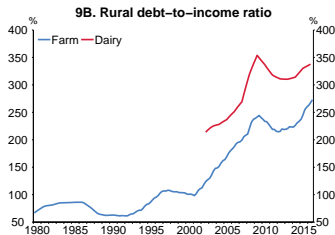
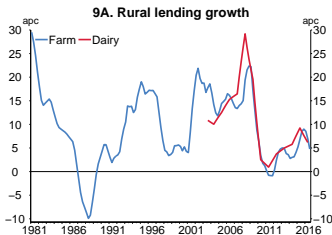
# Lending standards and regulatory leakage



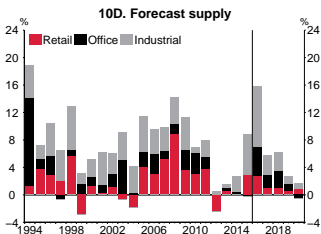
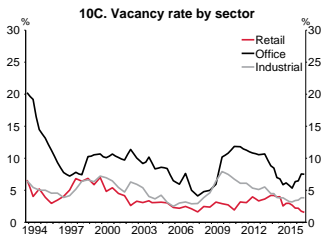
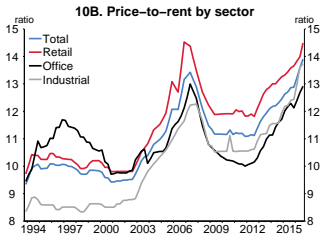
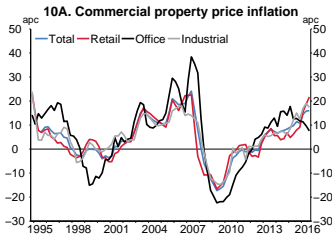
# Farm market imbalances



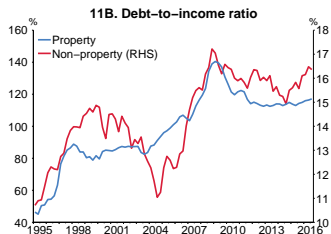
# Farm balance sheet stretch



# Commercial property imbalances



# Business balance sheet stretch



## Indicators for Aggregate Financial Risks

Indicator	Intuition	Evidence	Methodology	Source
<b>Credit cycle</b>				
1A Credit-to-GDP gap and growth	Rapid credit booms are associated with rising systemic risk. This is particularly true if credit is persistently outstripping GDP (as indicated by an elevated credit-to-GDP gap).	Credit-to-GDP gap and credit growth are two of the best predictors for financial crises in the early warning literature.	Credit growth is an annual percent change. Credit-to-GDP gap is computed in quasi real-time with a one-sided statistical filter (HP) and one-sided HP filter augmented by rolling-window ARIMA forecasts.	RBNZ <i>Standard Statistical Return (SSR)</i> , Statistics New Zealand.
1B Credit-to-GDP ratio by sector	Rapid credit growth could be more concerning if the credit-to-GDP level is already elevated. Further work is required to understand the reasons for elevated credit-to-GDP, and whether it can be attributed to trend factors such as lower neutral interest rates.		Ratio of household, business, and agricultural lending to total GDP.	RBNZ SSR, Statistics New Zealand.
1C Asset price inflation by sector	Synchronised asset prices across an economy could pose risks to the financial system, particularly if this occurs alongside rapid credit growth.	Early warning literature has found that asset prices have predictive power in addition to credit measures.	Annual percent change in house, commercial and farm prices.	REINZ, JLL.
2A Bank capital and leverage ratios	A reduction in the quality and quantity of capital over the cycle would reduce loss-absorbing capacity and indicate increased risk appetite. Falling leverage (unweighted capital) ratios during credit booms could indicate pro-cyclical approaches to risk weighting.	Global bank failures during the GFC were strongly correlated with leverage ratio.	Total capital/RWA, Tier 1 capital/RWA, Leverage ratio (Tier 1 capital/assets).	Registered bank <i>Disclosure Statements</i> .

Indicator	Intuition	Evidence	Methodology	Source
2B Bank profitability	Sustained periods of high or low profits require further investigation. Weak profitability could indicate increased competition with risks to lending standards, while high profits could be achieved by taking on riskier assets. Weak profitability during periods of stress reduces loss absorbing capacity.		Return on assets, return on equity and net interest margin.	Registered bank <i>Disclosure Statements</i> , RBNZ <i>Income Statement Survey</i> .
2C Fixed term mortgage credit spreads	Signs of reduced price or non-price lending standards could reinforce credit/asset price cycles and weaken financial system resilience. This indicator helps identify supply driven increases in credit.	Macro-financial time series models suggest that credit spreads tend to amplify housing market cycles.	Spreads on fixed mortgage rates are used as a proxy for overall credit spreads, and are defined using the relevant benchmark swap rate. They are computed for the seven largest mortgage lenders and across all fixed terms. Two methods are used to aggregate data (i) simple average of spreads (ii) median of the best five spreads. Specials for low-LVR customers are used where available.	RBNZ SSR, interest.co.nz
2D Lending standards	Easier lending standards (through reduced margins or non-price conditions) could weaken the resilience of bank portfolios.		Banks are asked whether they have eased or tightened non-price and price lending standards. A net percentage reporting tighter standards is computed (weighted by market share of each bank).	RBNZ <i>Credit Conditions Survey</i> .

Indicator	Intuition	Evidence	Methodology	Source
<b>Funding and liquidity</b>				
3A External debt and current account deficit	A high stock of external liabilities creates an exposure to offshore market volatility. This vulnerability is exacerbated if the current account deficit is also elevated, or if debt is concentrated in sectors with high leverage.	Current account deficits have some predictive power in early warning literature.	Net international investment position, bank external debt, and current account deficit. All are scaled relative to annual GDP.	StatsNZ IIP, BOP
3B Credit and deposit growth	Credit growing well in excess of deposits suggests banks are reliant on wholesale markets to fund lending. An increase in wholesale funding costs/shut-down in markets could result in a significant tightening in credit supply.	Deposit growth has outstripped lending growth in recent years, and appeared to explain banks being unaffected by market turbulence in early 2012.	Credit and deposit growth, both scaled relative to annual GDP. Uses non-market funding from the RBNZ <i>Liquidity Survey</i> after 2010 and retail funding from SSR to backdate. Haircuts are applied to non-market funding in line with the liquidity policy.	RBNZ <i>Liquidity Survey</i> , SSR.
3C Offshore funding rollover & core funding ratio 3D (CFR).	Availability of offshore funding can quickly deteriorate during periods of market stress. Vulnerabilities are increased if most of the borrowing needs to be rolled over at relatively short maturities. Compression of CFR relative to regulatory minima could indicate increased risk-taking.	Many banks reliant on short-term markets came under stress during the GFC. Some evidence in early warning literature that reliance on short-term wholesale funding has predictive power.	Bank offshore funding, and component that is due in less than 90 days. Scaled as a percentage of GDP. Core funding ratio defined as in liquidity policy.	StatsNZ IIP, RBNZ <i>Liquidity Survey</i> .
4A Bank funding spreads	Wholesale spreads proxy markets' perception of risk of NZ banks. Retail deposit spreads will give an indication of whether trends in offshore markets are passing through to average funding costs.		Long-term wholesale (domestic and offshore) and retail funding spreads. Wholesale spreads are a simple average of the landed cost of new issues by big-4 banks from the <i>Liquidity Survey</i> , at terms of between 4 and 7 years. The spread between the average 6-month deposit rate and the 180 day bank bill is the proxy for retail spreads.	RBNZ <i>Liquidity Survey</i> , SSR.



Indicator	Intuition	Evidence	Methodology	Source
4B S&P volatility and Global & corporate bond spreads 4C	Very compressed spreads or volatility in global markets could suggest risk is underpriced and an increased probability of a market correction.		Uses high-yield and investment grade bond spreads from the US, and S&P500 implied volatility.	Haver.
4D Long-term interest rates	Low global long-term interest rates can encourage a 'search for yield'. NZ long-term interest rates will typically move in line with global rates, potentially resulting in lower long-term bank lending rates.		10-year government bond yields.	Haver.

## Indicators for Housing Risks

Indicator	Intuition	Evidence	Methodology	Source
<b>Housing market imbalances</b>				
5A House price inflation by region	Rapid house price growth can increase the risk of a correction further down the road. Increases in the value of collateral also result in feedback effects with housing borrowing. Regional data can detect concentrations of risk.	Rapid house price growth is a useful leading indicator of crises, especially when combined with rapid lending.	Annual three-month moving average house price inflation for NZ, Auckland, and rest of NZ. Index for rest of NZ is constructed using share of sales for different regions.	REINZ.
5B House price-to-income ratio by region	Measures stretch in house prices relative to underlying household income. Higher house price-to-income ratios will typically imply new buyers need to take on more debt to enter the market. House price inflation is of most concern where prices are stretched.		Regions correspond to above. Average house values are estimated by rescaling REINZ indices to match QV average values in each region. Regional income data for rest of NZ is aggregated using share of households.	REINZ, New Zealand Income Survey.
5C Rental yield by region	Metric of how stretched house prices are relative to underlying rental income. Very low and falling rental yields could indicate speculative behaviour (i.e. investors are buying properties mainly due to high expected capital gain).		Ratio of regional house price to rent, for NZ and Auckland. Assumes investors purchase houses similar in value to average house value estimates discussed above.	REINZ, MBIE.
5D House purchases by buyer & type	When combined with other data, purchases by different buyer types can shed light on market risks. Investor share could be of concern if DTIs are high and rising and rental yields are falling. Buyer shares can also give insights into the distributional impact of LVR/DTI limits.	International evidence that investor lending is more risky, and often amplifies housing cycles.	Create buyer shares from CoreLogic NZ unit records using Stata. Shares are a percentage of total purchases. More detailed data is charted for Multiple-property owners in Auckland. All series are 3-month moving averages.	CoreLogic NZ.
5E				
5F House price expectations	Strong house price expectations may give rise to unstable dynamics in the housing market.		Chart shows expectations of households and professional forecasts. Data is lagged to show expected annual percent change at the relevant date.	RBNZ.

Indicator	Intuition	Evidence	Methodology	Source
5G Commitments by borrower type	Distribution of lending by buyer type can shed light on credit risks e.g. if lending is disproportionately driven by more indebted or higher risk types.		3-monthly share of commitments to first-home buyers, other owner-occupiers and investors.	RBNZ <i>New Residential Mortgage Commitments Survey</i> .
<b>Borrower balance sheets</b>				
6A Household debt-to-income ratio (DTI)	High aggregate DTI makes the household sector more susceptible to a deterioration in servicing ability or rise in interest rates. Downturns can be amplified as high DTI households attempt to restore balance sheets.	Aggregate DTIs have tended to increase prior to international crises.	Total household debt (inclusive of rental property debt) as a ratio to annual sector gross household income. Owner-occupied debt-to-income ratio is shown for comparison.	RBNZ <i>Household Asset and Liabilities (HHAL) Survey</i> .
6B Debt servicing ratios (DSRs)	Elevated DSRs could indicate increased financial pressure. For new borrowers, high DSRs required to enter the housing market could indicate new cohorts of borrowers becoming increasingly vulnerable, and/or the housing market could be hitting affordability constraints.	Early warning literature suggests DSRs have strong predictive power at short horizons (< 1 year). DSR increased prior to GFC and late 80s in NZ.	For total sector, total principal and interest payments are estimated using debt stock, assumed average time to maturity, and average gross income. New buyer DSRs are estimated for a typical buyer in NZ and Auckland, assumed to have average gross income (for their region), and purchase an average house with a 20 percent downpayment.	RBNZ SSR, New Zealand Income Survey, Interest.co.nz.
6C Gross and net mortgage lending	Rapid mortgage credit growth adds to indebtedness and is often a sign of rising systemic risks in the housing market. Rapid gross lending could still pose risks alongside weak net credit growth. Gross lending is more closely related to housing market and gives a better indication of changing indebtedness of new customers.	Mortgage lending is found to have strong predictive power for international crises, and account for most of the predictive power of the credit gap.	Net credit growth is change in mortgage debt over quarterly timeframe. Gross lending is new commitments over the quarter scaled by mortgage debt at start of period. Approvals are included for historical perspective.	RBNZ SSR, RBNZ <i>New Residential Mortgage Commitments Survey</i> , <i>Approvals Survey</i> .

<b>Indicator</b>	<b>Intuition</b>	<b>Evidence</b>	<b>Methodology</b>	<b>Source</b>
6D Mortgage reconciliation	Mortgage reconciliation shows how mortgage debt is being repaid and extended. The level of excess repayment provides an indication of the ability of borrowers to reduce their debt.		Values are dollar flows on the total stock of mortgage lending.	RBNZ LVR Lending Position Survey.
<b>Lending standards</b>				
7A Stock of high-LVR mortgage lending	See above for risks around high-LVR lending. This indicator captures the stock exposure from previous lending. Also used to assess effectiveness of LVR policy.	See evidence for 10 above.	Total high-LVR lending (includes off-balance sheet) for big-5, divided by total mortgages.	Registered bank Disclosure statements.
<b>Indicator</b>	<b>Intuition</b>	<b>Evidence</b>	<b>Methodology</b>	<b>Source</b>
7B New mortgage share by non-banks	A rising share of lending by non-banks, who do not specialise in mortgage lending, could indicate higher risks or reintermediation due to bank regulation.		Number of mortgages registered by non-banks, as a share of total.	CoreLogic NZ.
7C Consumer vs. housing lending	Significant increase in consumer lending while restrictions on mortgage lending are in place could indicate regulatory leakage.		Consumer lending growth from SSR, including minimum and maximum growth rates of big five.	RBNZ SSR.

## Indicators for Other Sectoral Risks

Indicator	Intuition	Evidence	Methodology	Source
<b>Rural sector</b>				
8A Rural land price inflation by sector	Rapid farm price growth can increase the risk of a correction further down the road. Increases in the value of collateral also result in feedback effects with borrowing. Sectoral data can detect concentrations of risk.	Booming farm prices were associated with rapid lending prior to the GFC, helping to explain the sharp fall in subsequent years.	Dairy and rural land prices, annual percent change of 3 month moving average.	REINZ.
8B Farm land sales by sector	Farm market can become very illiquid, particularly during periods of stress. Including the number of sales helps the reader to interpret the farm price index, and gives a broader indication of stress in the market.	Liquidity in the farm market dried up in the wake of the GFC.	3-month moving average of dairy and total farm land sales.	REINZ.
8C Farm price-to-income ratios by sector	High and rising farm price-to-income ratios indicate an increased risk of a correction in farm prices in the future. High ratios indicate that farm prices are detached from incomes, and purchases are likely being made on the basis of capital gain rather than income yields.	Rise in price-to-income prior to GFC resulted in a significant farm price correction in the following years.	Farm price index is used to proxy total value of farm land, while value of dairy land is estimated using REINZ index, total hectares and average land value from DairyNZ. Agricultural GDP used to proxy farm income, and dairy income is constructed using effective payout*milk production. Due to volatility in farm incomes, the trend in both income measures is estimated using an HP filter with judgement imposed to ensure the trend payout is \$6.25 in 2015-16.	REINZ, Statistics New Zealand, DairyNZ.

Indicator	Intuition	Evidence	Methodology	Source
9A Rural lending growth	Rapid credit growth could indicate deteriorating lending standards and increased probability of a crash in coming years, particularly if it occurs alongside increasingly stretched farm prices. Credit growth can also be a sign of stress during periods of weak cashflow.	Lending growth in pre-GFC years was correlated with subsequent stress.	Annual percent change in dairy and total agricultural debt.	RBNZ SSR, <i>Annual Agricultural Survey</i> .
9B Rural debt-to-income ratio	High DTI ratios makes the sector more susceptible to a deterioration in farm income or rise in interest rates. This is likely to also impair the functioning of the farm market during periods of stress.	Work with unit records shows farms with high DTIs have much larger breakeven payouts.	Total debt in each sector divided by income measures discussed above.	RBNZ SSR, <i>Annual Agricultural Survey</i> , Statistics New Zealand, DairyNZ.
9C Dairy farm cashflow forecast	Cash flow pressures in the indebted dairy sector could indicate release of SCR is appropriate, and suggests heightened risk of downward adjustment in farm prices.	See above - work with unit records shows periods of negative cash flow will have significant implications for high debt farms.	Cash flow data are averages from survey data. Breakeven cash flow is working expenses plus drawings plus interest servicing minus livestock revenue. Milk revenue is effective milk revenue.	DairyNZ <i>Economic Survey</i> .
<b>Commercial property sector</b>				
10A Commercial property price inflation by sector	Rapid price inflation increases the risk of a future correction. Commercial property prices tend to have particularly large cycles, due to high average values, large transaction costs, and long build times.	Rapid increases in commercial property prices preceded periods of stress in the late 80s and GFC.	Annual percent change in capital return index for office, retail and industrial.	JLL.
10B Commercial property price-to-rent	Rising price-to-rent ratios indicate that investors are putting an increasing weight on expected capital gain in purchasing decisions, as opposed to income yield.		Price-to-rent ratios in three sectors above, defined using the inverse of yields on market transactions.	JLL.

Indicator	Intuition	Evidence	Methodology	Source
10C Commercial property vacancy rates	Low vacancy rates suggest upward pressure on rents and prices. Vacancy rates also tend to increase sharply during periods of financial stress.		Vacancy rate by sector.	JLL.
10D Commercial property supply pipeline	Commercial property projects take a long time to execute. By the time construction finishes, rapid increases in supply often exacerbate periods of falling prices.	Both the GFC and late 80s period of stress were exacerbated by increased supply coming onstream as prices were falling.	Supply pipeline for each sector, defined as a percent of total square metres of space in each sector.	JLL.
<b>Other business sector</b>				
11A Business lending growth	Rapid credit growth could indicate deteriorating lending standards and increased probability of a crash in coming years. Rapid growth in commercial property lending is particularly concerning given the volatility in prices over history.	Rapid increases in commercial property lending preceded periods of stress in late 80s and GFC. Evidence suggests commercial property losses play a significant role in most financial crises.	Commercial property lending is proxied using lending to the property and business services ANZSIC code. Non-property lending is proxied using lending to manufacturing, utilities, construction, wholesale trade, retail trade, transport and communications.	RBNZ SSR.
11B Business debt-to-income ratios by sector	High DTI makes the sector more susceptible to a deterioration in profitability or rise in interest rates. Increase in stressed sales could amplify a commercial property market downturn.		Debt as above. Nominal GDP (total output) for the relevant ANZSIC code is used to proxy income. Real GDP and Producer Price Indices are used to bring these figures up to date.	RBNZ SSR, Statistics New Zealand.