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Financial stability risks from housing market cycles

Michael Thornley



Boom and bust cycles are prevalent features of housing markets in advanced and developing economies around the world. These cycles can present a risk to financial stability. Housing booms often precede financial crises, and the size of a boom, and its subsequent bust, can be amplified by highly leveraged mortgage lending.

The financial system can face large ‘direct’ losses on mortgage loans in the event of a housing market downturn. A number of factors influence the size of these losses, but there is evidence that losses are higher on loans to highly levered households and to property investors.

The financial system is also ‘indirectly’ exposed to the housing market via the impact of a housing downturn on household consumption and economic output more generally. This exposure increases as household debt levels rise, because heavily indebted households tend to reduce spending more aggressively after a housing bust. In addition, the financial system may face losses on lending to sectors that are closely connected to the housing market e.g. the construction and commercial property sectors.

Capital requirements bolster the resilience of individual financial firms against these risks, but in some circumstances they may not be sufficient to preserve the proper functioning of the financial system as a whole. As a result, macroprudential actions aimed at mitigating risks from housing

market cycles may be justified to help preserve financial stability and long-run economic growth.

1 Introduction

A key feature of a well-functioning banking system is the provision of mortgages to creditworthy households. Mortgages allow households to purchase homes that would otherwise require a long period of saving. This is desirable from an economic and societal perspective as it allows households to smooth their consumption over time and improves their welfare. In a financial crisis, the functioning of financial institutions and markets are disrupted and can have a material impact on the real economy and asset values. For example, problems in the banking sector can disrupt the provision of mortgages, causing housing transactions to decline and house prices to fall severely. This was demonstrated during the global financial crisis (GFC) as many countries experienced a ‘credit crunch’ and sharp declines in house prices.

The housing market can play an important role in shaping the dynamics of the financial system that lead to crises and it can increase the cost of

such crises. This is due to the amplification effect that boom-bust housing cycles can have on the financial system, sectors related to the housing market and household spending. This article examines the role of the housing market in past financial crises. It builds on previous publications by the Reserve Bank on the risks of household indebtedness and on actions to dampen financial stability risks from the New Zealand housing market.¹

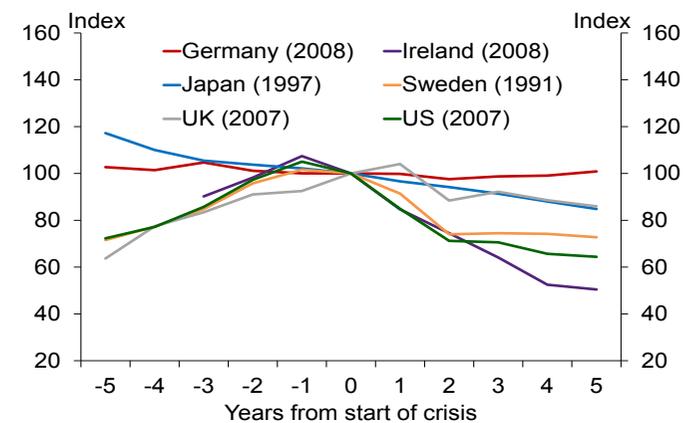
2 Housing market boom-bust cycles

The evolution of house prices reflects a wide range of supply and demand factors, such as changing demographics, incomes and interest rates. These factors often develop gradually and drive sustainable fluctuations in house prices, but there are also periods in which house prices can become separated from fundamental supply and demand factors. These periods are not particularly rare: Cerutti *et al* (2015b) finds that in a sample of 53 advanced and developing countries, there were 85 booms between 1970 and 2012 and most countries had experienced at least one housing boom.²

Periods of strong house price growth and subsequent falls have been common in the lead-up to financial crises in advanced economies in recent decades (figure 1). In the five years prior to the start of the GFC, in 2007, house prices increased about 60 percent in the UK and 40 percent in the US. In the following five years, prices fell about 15 percent in the

UK and 36 percent in the US. However, house price booms and busts are not always correlated with financial crises. For example, German house prices did not change significantly before or after the GFC and urban residential land prices in Japan began to decline in 1991, prior to the Asian financial crisis in 1997.

Figure 1
Real house prices before and after the start of selected advanced economy financial crises



Sources: BIS, Haver, Laeven and Valencia (2012), Japanese Ministry of Land, Infrastructure and Transport, and RBNZ calculations.

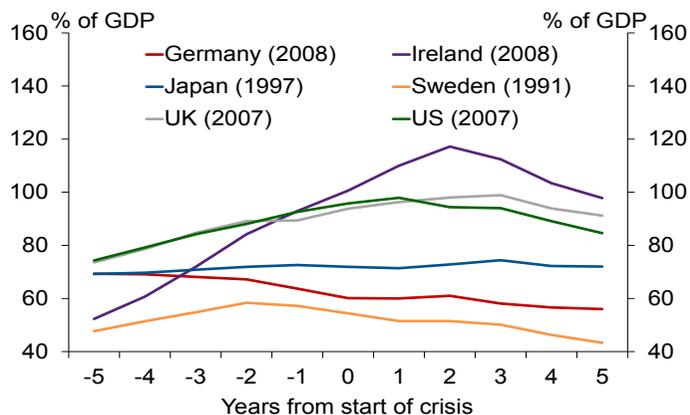
Notes: Data shows residential property index (or urban residential land prices, for Japan) deflated by consumer price index at end-March, rebased to 100 on the year the financial crisis started. Start-year of financial crisis, according to Laeven and Valencia (2012), is shown in parentheses.

Housing boom and bust dynamics can be partly explained by a corresponding cyclicity in mortgage lending. The countries which saw a large boom and bust in house prices before and after the crisis, e.g. Ireland, Sweden, UK and US, also saw an increase in household credit before the crisis and a subsequent fall in credit in the years following the start of the crisis (figure 2).

1 For example, Hunt (2015), RBNZ (2013) and RBNZ (2015).

2 A boom is defined as a period in which (i) the real growth rate of house prices is greater than 5 percent, or two standard deviations of the country specific distribution of house price real growth rates in a given quarter, and (ii) the real growth rate of house prices is above 5 percent or one standard deviation of the country specific distribution of house price real growth rates for a period of at least two years.

Figure 2
Household credit-to-GDP before and after the start of selected advanced economy financial crises



Sources: BIS, Laeven and Valencia (2012) and RBNZ calculations.

Notes: Chart shows BIS data on credit to households and non-profit institutions serving households. Start-year of financial crisis, according to Laeven and Valencia (2012), is shown in parentheses.

A wide range of factors affect house prices and the supply of mortgage credit, but it is not unexpected to find a relationship between house prices and mortgage credit. As the typical household requires a mortgage to purchase a house, developments that improve households' ability to take out mortgage loans will create upward pressure on house prices. Some developments may be positive, such as financial liberalisation and innovation which can reduce costs and barriers to financial intermediation. Others may ultimately pose a threat to financial stability, such as reduced lending standards.

There is evidence that past financial crises have often been preceded by periods of rapid household credit growth (see Jorda *et al*, 2015, and Anundsen *et al*, 2014). As a result, a number of central banks, including the Bank of England, Federal Reserve and the Reserve Bank, use some measure of household credit growth to help guide macroprudential policy setting.

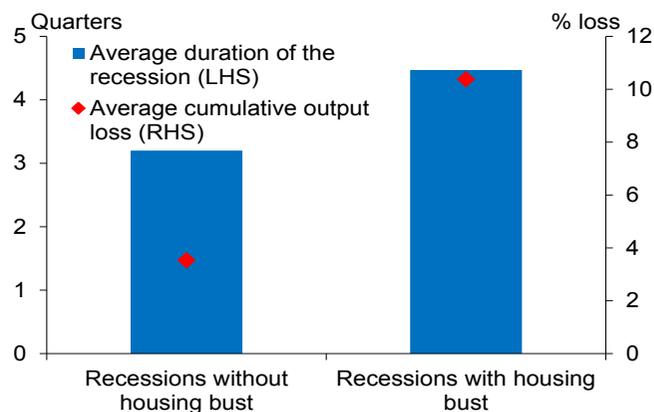
Lower lending standards and higher house prices are a particular concern if they allow weak borrowers to obtain large, unaffordable mortgages on the basis of higher house valuations against which they can borrow. This puts further upward pressure on house prices, creating a potentially unsustainable price-credit loop. For example, Mian and Sufi (2009) find that growth in the supply of mortgages was a primary cause of house price appreciation in areas of the US with high latent demand between 2001 and 2005.

In a downturn this amplification loop can operate in the opposite direction, driving down house prices. A cross-country study of 26 advanced and developing countries between 1970 and 1999 finds that house prices are more sensitive to income shocks in countries in which households can borrow at higher loan to value ratios (LVRs) (Almeida *et al*, 2006). This finding is supported a US study which finds that house prices are more sensitive to income shocks in cities that have a high proportion of borrowers with high LVR mortgages (Lamont and Stein, 1999).

Housing boom-bust cycles are undesirable from a welfare and economic efficiency perspective, but the associated financial stability risks are particularly worrying. It is estimated that more than two-thirds of systemic banking crises were preceded by a housing boom and bust, and more than two-thirds of boom-bust episodes were followed by a financial crisis (Crowe *et al*, 2011).³ Furthermore, economic downturns that are accompanied with a housing bust are estimated to last around 40 percent longer and are almost three times as severe as those without housing busts (figure 3, overleaf).

3 By contrast, only around half of financial crises follow an equity market boom-bust and only 15 percent of equity market boom-busts precede financial crises.

Figure 3
Duration and output losses of OECD recessions (1960–2007)

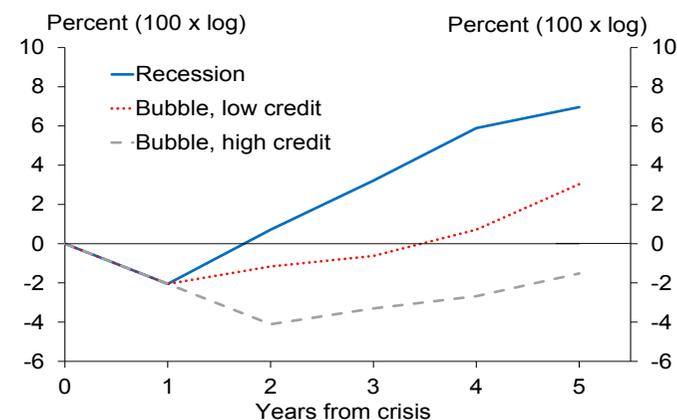


Source: Claessens *et al* (2009).

A possible explanation is that the use of credit to facilitate house purchases creates a financial stability risk from a housing bust. Jorda *et al* (2015) use data on 17 advanced economies between 1870 and 2013 to show that recessions tend to be more severe and protracted if they follow house price bubbles, especially if the housing bubble coincided with a period of above average credit growth (figure 4).⁴ The results are even more pronounced for the period after World War II, a period marked by strong growth in mortgage lending.

⁴ A house price bubble is defined as a period in which (a) house prices growth above their long-term trend, i.e. log real house prices are at least one-standard deviation above the country specific Hodrick-Prescott filter trend, and (b) there is an eventual price-correction, i.e. house prices decline by more than 15% in a three year period.

Figure 4
Recession and recovery paths after housing bubbles (1870 – 2013)



Source: Jorda *et al* (2015).

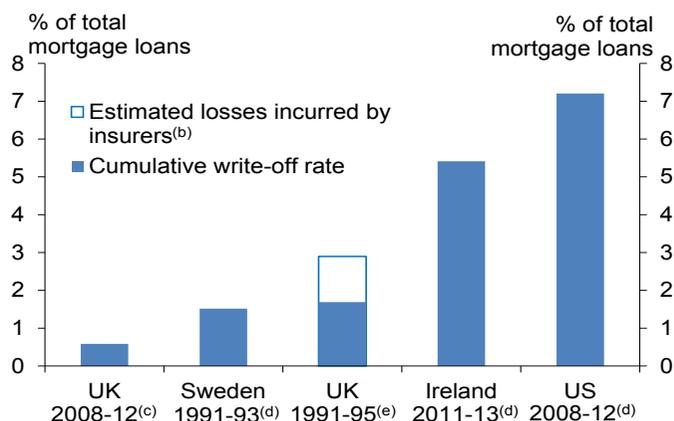
3 Direct exposure of the financial system to the housing market

The financial system is directly exposed to the housing market as mortgages are one of the largest asset classes on the banking systems' balance sheets. This means banks may face significant credit losses if borrowers default on their loans (i.e. if they are unable to service their mortgage payments) and banks make losses on houses they seize as collateral on defaulted loans (i.e. if the resale value of the house is below the value of the loan).

The scale of losses can be substantial: in its November 2013 *Financial Stability Report*, the Bank of England calculated that losses on mortgages during the GFC were more than 7 percent of the value of total

mortgage loans in the US and more than 5 percent in Ireland (figure 5). Losses on mortgages were smaller in other financial crises.

Figure 5
Cumulative loss rates on mortgage lending in past crises^(a)



Source: Bank of England.

Notes:

- (a) Cumulative losses are estimated as total write-offs incurred during the period shown on the chart divided by the starting stock of loans.
- (b) Estimated losses incurred by the UK insurance industry on loans originated by banks and building societies in 1991-95. Based on data published by MIAC-Acadametrics.
- (c) Estimated based on write-offs reported by a sample of the largest UK mortgage lenders as of end-2007. These estimates are based on calculations by Bank of England staff.
- (d) Swedish losses based on housing credit institutions. Irish losses are from 2011 to mid-2013 at Bank of Ireland, Allied Irish Bank and Permanent TSB. US losses refer to all FDIC-insured institutions.
- (e) Estimated losses incurred by UK banks and building societies based on Bank of England data, reported write-offs for a sample of UK building societies and CML possessions data. These estimates are based on calculations by Bank of England staff and are subject to change.

The variation in mortgage credit losses between countries reflects a variety of factors, including the size and nature of housing market imbalances going into the crisis, the response to the financial crises, and structural factors such as the nature of the housing market and the banking and legal systems. Mortgage lending standards in the run up to a crisis, however, are likely to be a key factor.

The probability of a borrower defaulting and the subsequent losses incurred by their bank depend on the size of the mortgage relative to the value of the house and relative to the borrower's income. In theory, borrowers with high LVRs present a greater risk as they have (i) less flexibility to renew mortgage loans or access other sources of credit to help service mortgage repayments if they face difficulty, and (ii) less 'skin in the game', so a given fall in house prices will result in a larger increase in the loss their bank would incur if they defaulted. Differences in banking and legal systems mean care must be taken when drawing inferences from other countries' experiences, but there is evidence that borrowers with high LVRs are more likely to default in a number of countries, including Ireland, Hong Kong, UK and the US.⁵

There is also evidence from the US that borrowers with a high debt to income (DTI) ratio are more likely to default than those with a low DTI ratio because their ability to meet mortgage repayments are more vulnerable to income shocks or higher interest rates (Amromin and Paulson, 2009, and Demyanyk and Van Hemert, 2011).

International evidence from the GFC also suggests that investors in residential property are more likely to default on mortgages than owner-occupiers. Investors may be more vulnerable to a decline in incomes or an increase in mortgage rates than owner-occupiers as they tend to borrow at higher debt-to-income levels. In addition, investors may be more willing to engage in 'strategic default' if they entered into negative equity. Loss rates on Irish mortgages in 2011-13 were twice as high for investors than owner-occupiers and the probability of default of investor mortgages were more sensitive to negative equity and higher debt service ratios than owner-occupier mortgages (Kelly, 2011).

⁵ See Kelly (2011), Wong et al (2004), Financial Services Authority (2009) and Demyanyk and Van Hemert (2011).

Investor mortgage default rates were also higher in the US during the GFC (Palmer, 2014) and write-offs and possession rates on investor mortgages have been around double that of owner-occupier mortgages in the UK since 2011 (HMT, 2015). One study finds that the probability of default on UK investor mortgages was 36 percent higher than for owner-occupier mortgages (McCann, 2014).

Banks can reduce their direct exposure to the housing market by selling the mortgages they originate or by bundling them into mortgage backed securities which are then sold. This can distribute risk across the global financial system to investors that are willing and able to take on the risk. But as the GFC demonstrated, it can also increase the probability and size of a financial crisis through moral hazard, by removing banks' incentive to ensure borrowers can repay their mortgages. And it may not reduce financial stability risks if the end purchasers of risky mortgages are vulnerable, systemically important institutions; for example, a number of institutions received government bailouts in the GFC, including Fannie Mae and Freddie Mac in the US, and UBS and RBS in Europe.

4 Indirect exposure of the financial system to the housing market

A study of bank losses in past advanced economy financial crises shows that losses on mortgage lending tend to make up a relatively small proportion of overall losses (Kragh-Sorensen and Solheim, 2014). The financial system, however, can also be indirectly exposed to housing market downturns as they can generate or amplify macroeconomic shocks and create losses on non-housing loans. For example, a decline

in the value of houses reduces the wealth of homeowners which may (a) cause nervous households to cut consumption and increase savings or (b) cause nervous lenders to reduce the amount of credit they extend to households. While each individual decision may be rational or prudent, taken together they may cause distress for the economy and for the financial system. Additionally, a housing market downturn can expose the financial system to losses from lending to sectors closely related to the housing market, such as the construction sector.

Impact on household consumption

There is substantial literature on how household consumption responds to changes in housing wealth. Some theories argue that consumption should be completely unresponsive to changes in house prices as (i) households can borrow against their future income to support consumption and (ii) houses are a consumption good in their own right, so house price declines would not affect a home-owner's net wealth if they coincide with a decline in rental prices.⁶

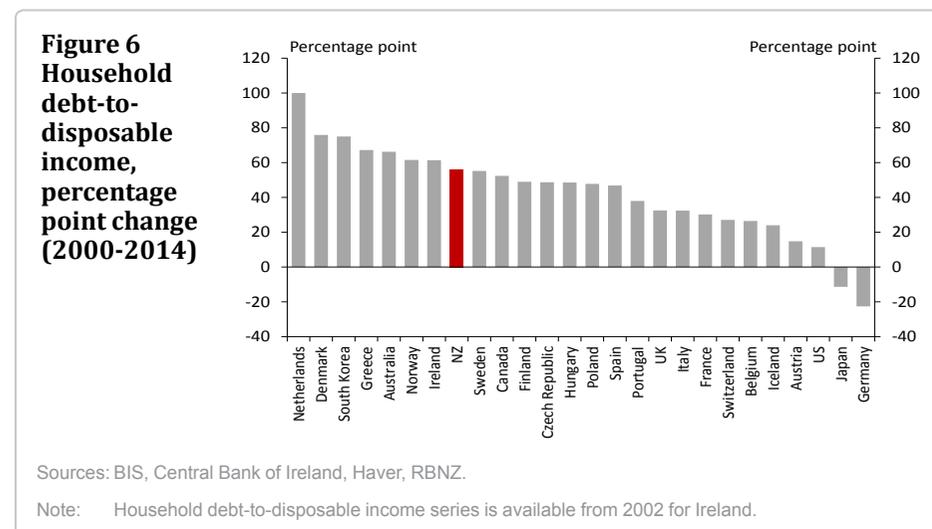
These arguments, however, depend on households having standard preferences, rational asset prices and no credit market frictions. Empirical evidence suggests that, in practice, household consumption is affected by house prices. One study finds that during the GFC, US households on average reduced their consumption by \$540 for every \$10,000 decline in the value of their home (Mian, Rao and Sufi, 2013).⁷

Recent research also suggests that the responsiveness of household consumption to house prices is affected by the size and distribution of

⁶ According to asset pricing theory, house prices and rents should co-move as the value of an asset equals the discounted value of the stream of income it generates. However, there is evidence of limited co-movement of house prices and rents in a number of countries; for example, see ECB (2014).

⁷ This marginal propensity to consume out of housing wealth is in line with previous estimates in economic literature, which give a range of around 5 to 10 cents per dollar.

household debt.⁸ This is particularly noteworthy, as household debt-to-disposable income ratios have grown substantially in many advanced economies since the turn of this century (figure 6). In New Zealand, this growth was driven mainly by mortgage debt (Hunt, 2015).



Cross-country comparisons show a relationship between debt, consumption and economic growth. Floden (2014) finds that countries with high aggregate household debt to disposable income ratios in 2007 suffered larger reductions in consumption in 2007-12, when controlling for other factors. Cecchetti *et al* (2011) assesses the relationship of debt and economic growth in 18 advanced countries since 1980 and finds that when public and corporate debt increase above certain thresholds it is bad for GDP growth. A negative relationship between household debt (above 85 percent of GDP) and future growth is found but the estimate is extremely imprecise.

⁸ This may be one explanation for why recessions tend to be bigger and more protracted if they follow housing bubbles fuelled by high credit growth, as discussed in section 2.

The relationship between household indebtedness and consumption also holds when assessed at the regional or household level within a country. One study finds that during the GFC, households in US neighbourhoods with the largest housing leverage had a marginal propensity to spend housing wealth on cars which was double that of households in neighbourhoods with the lowest leverage (Mian, Rao and Sufi, 2013).⁹ In other words, households with high-LVR mortgages reduced spending on cars more than households with low-LVR mortgages, for a given dollar fall in the valuation of their home.

Analysis of US household survey data also shows that households with high-LVR mortgages in 2007 reduced their spending in 2009 by more than less indebted households (Dyner, 2012). A similar result is found in Japan where household debt was found to depress consumption following the financial crisis in the 1990s (Ogawa and Wan, 2007). Similarly, UK and Danish households with mortgage debt to income multiples above 2 reduced spending after the GFC by more than less indebted households (Bunn and Rostom, 2014, and Andersen *et al*, 2014). It is estimated that high levels of household debt caused a cumulative fall in UK private consumption of around 2 percent between 2007 and 2012. Danish households with mortgage LVRs of 100 percent are estimated to have reduced their consumption between 2007 and 2011 by an additional 8.4 percent of their pre-crisis income than those with mortgage LVRs of 60 percent.

There are broadly two reasons why highly indebted households might reduce consumption more than other households when facing

⁹ Lamont and Stein (1999) also finds that US cities with a higher proportion of borrowers with LVRs over 80 percent are more sensitive to income shocks. In response to a 1 percent shock to income, the cumulative change in house prices over a three year period is estimated to be 1.23 percent in counties in which about 25% of mortgage borrowers have LVR mortgages over 80 percent versus a 0.68 percent change in prices in counties where only around 5 percent of borrowers have high LVR mortgages. However, the difference between the response of house prices to an income shock in high LVR counties versus low LVR counties falls away after a decade.

income or housing wealth shocks. First, income and wealth shocks may cause households to increase precautionary savings in response to lower expectations for future income, and this response may be larger for more highly indebted households (the ‘precautionary savings channel’). Second, income and wealth shocks may cause lenders to disproportionately restrict lending to highly indebted households in response to lower expectations for future income and concerns about the collateral value of their homes (the ‘credit availability channel’).

There is evidence that both channels may be in effect, although it is difficult to distinguish between them. A survey of UK households finds that highly indebted households reduced consumption after the GFC because of concerns about both future income and future credit availability (Bunn and Rostom, 2014). One study argues that the precautionary saving channel was the most prominent channel in Denmark during the GFC as households of different ages and incomes reduced their consumption by the same amount in response to a given decline in the value of their house (Andersen *et al*, 2014).¹⁰ By contrast, two studies find evidence of the credit availability channel in the US during the GFC. Mian, Rao and Sufi (2013) finds that between 2006 and 2009, households which experienced bigger falls in housing wealth faced larger reductions in credit limits and greater difficulty in refinancing their mortgages onto lower interest rates. A one percent decrease in a household’s housing wealth is estimated to lead to a 1.5 percent reduction in its credit card limit. Baker (2015) uses financial data covering 150,000 US households and their employers between 2008 and 2013 to find that the increased sensitivity of highly indebted households’ spending to income is mainly driven by reduced access to credit and liquid assets.

10 This would not be expected if the credit constraint channel explained the fall in consumption, as younger and lower income households are more likely to require credit to support spending and so would reduce consumption by more than older, higher income households less affected by tighter credit constraints.

Impact on sectors related to the housing market

A housing market downturn can affect household consumption and contribute to a general economic downturn, but its impact is likely to be particularly marked on spending and investment in sectors related to the housing market. A housing market downturn can affect the construction industry, for example, by reducing demand for new property, reducing the value of the portfolio of land they hold awaiting future construction or causing projects to be written off due to lack of funding. This was demonstrated in Ireland and Spain in the GFC, when a pre-crisis boom in construction collapsed and caused significant losses for the local banking systems.¹¹ The collapse of the domestic housing markets resulted in severe losses for the financial system, forced government bail-outs (which in Ireland amounted to around 40 percent of GDP) and, ultimately, forced the governments to seek financial support from international agencies (e.g. the IMF and the European Stability Mechanism).

A housing downturn could also depress the commercial property market by reducing the value of land and property that leveraged commercial property developers have used as collateral to borrow against, threatening their solvency or future borrowing capacity. A relatively large proportion of bank losses in past financial crises are estimated to have come from loans to the commercial property sector (Kragh-Sorensen and Solheim, 2014). For example, prior to the Nordic and Japanese financial crises in the early 1990s, there was rapid growth in commercial property prices and construction, following a property boom fuelled by financial liberalisation. Significant loan losses were incurred when rising interest rates and slowing economic activity triggered a sharp fall in commercial property prices.

11 This construction boom and bust has been well documented. Numerous newspaper and magazine articles have been written on the ‘ghost’ housing estates, and even ghost airports, built in Ireland and Spain prior to the GFC. Michael Lewis’ *Vanity Fair* article on the excesses and hubris of the Irish property boom is particularly illuminating (Lewis, 2011).

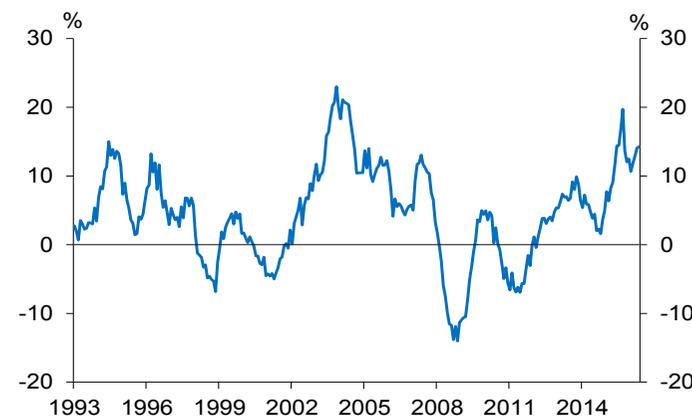
5 Summary and implications for financial stability in New Zealand

The previous sections outline that cyclicality in the housing market has been a common feature in advanced economies and the severity of a cycle can be amplified by rapid credit growth, particularly to highly leveraged borrowers. A housing market downturn can cause ‘direct losses’ for banks on mortgage lending, with losses typically being larger on mortgages to highly levered borrowers. It can also contribute to ‘indirect losses’ on lending to sectors related to the housing market, such as the construction and commercial property sectors, and more generally, by affecting household consumption and economic activity. The scale of these losses has often been larger than the direct losses incurred by the financial system in past crises, and the losses appear to be influenced by the size and distribution of private sector indebtedness.

5.1 Assessment of housing market risks in New Zealand

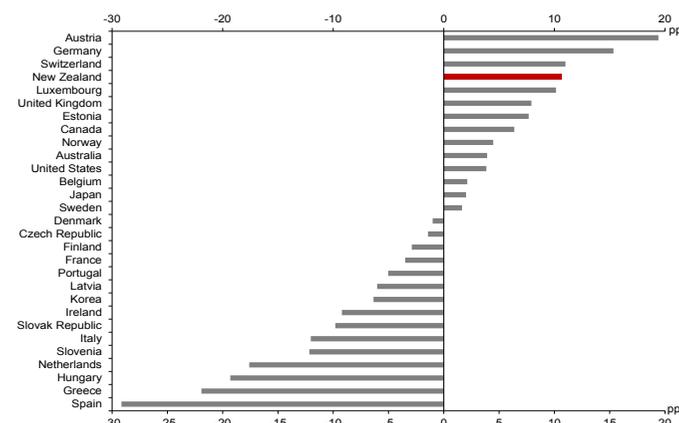
The Reserve Bank has reason to be wary of these risks in New Zealand. New Zealand house prices have displayed a degree of cyclicality in recent years (figure 7) and although we have not seen a major decline in prices since the early 1980s, many other advanced economies have experienced sharp and significant declines in house prices, particularly during the GFC. In addition, New Zealand banks’ exposure to the housing market has increased in the past two decades: in aggregate, mortgage lending comprised less than 40 percent of banks’ overall lending portfolio in 1994 and has risen to around 52 percent today.

Figure 7
New Zealand real house price inflation (annual percent change)



Source: REINZ, Statistics New Zealand.

Figure 8
House price to income ratio, percentage point change since 2010



Source: OECD.

Notes: Chart shows change in the aggregate house price to income ratio for select countries between 2010 and 2015 Q2, or latest.

House prices in New Zealand were among the fastest growing in advanced economies last year and have grown faster relative to incomes than in most advanced economies in the five years after 2010 (figure 8).

The house price to income ratio in Auckland rose to 9 in Q1 2016, high internationally and up significantly from 6 in 2012.

There are also signs that a significant proportion of new mortgage lending in New Zealand is highly levered. Currently, around 40 percent of residential mortgages are issued at more than five times the borrower's gross annual income. Anecdotally, banks were much less willing to write mortgage loans this large relative to income in the aftermath of the GFC and also required substantial deposits. This cyclical nature of mortgage supply could exacerbate cyclicalities in the housing market, as a price-credit loop can fuel dramatic escalations in house prices and amplify sharp falls in prices.

Property investors may also amplify housing market cycles as they are more likely than owner-occupiers to purchase houses during a housing boom and sell during a housing crash, as their decisions are driven by profit-seeking behaviour. This is a risk in Auckland, where nearly half of recent house sales have been to investors.

It is difficult to estimate the amount house prices could decline in a housing market downturn and the subsequent losses the financial system could face. While the New Zealand market does not currently exhibit the moral hazard and weak mortgage underwriting standards exhibited in the US and Ireland prior to the GFC, there are still risks from high LVR and high DTI mortgages.

Changes in the size and distribution of household debt may have increased the financial stability risk from a housing downturn in recent years. Since 2000 the level of household debt-to-GDP has increased significantly in New Zealand, as in other advanced economies (figure 6). And of the households that took out new mortgages in the period 2011-13, a larger proportion did so at high LVR (>80%) and DTI multiples (>4),

than in the period 2008-10 (Dunstan and Skilling, 2015). International evidence suggests that these households are likely to reduce their consumption by more than other households in a house price crash. Furthermore, stress test results suggest banks may significantly reduce their lending in an economic downturn, so highly indebted households may face tighter credit constraints and place a further drag on consumption.

5.2 Policy frameworks to mitigate housing market risks in New Zealand

One of the primary responsibilities of the Reserve Bank is to promote the maintenance of a sound and efficient financial system. The Reserve Bank has a number of policy options to help maintain financial stability. Microprudential policies, which include bank capital and liquidity regulations, promote the soundness and resilience of individual financial institutions, and therefore the integrity of the financial system as a whole. Macroprudential policies, which include countercyclical capital buffers and temporary LVR restrictions, promote greater financial stability by (a) building additional financial system resilience during periods of rapid credit growth and rising leverage or abundant liquidity, and (b) dampening excessive growth in credit and asset prices. Therefore, the Reserve Bank can use both microprudential and macroprudential policies to mitigate the risk that housing market vulnerabilities pose to New Zealand's financial system stability and the broader economy.

The financial system's first line of defence against a housing market downturn is the loss-absorbing capital it holds against expected and unexpected losses on its mortgage lending and other exposures. To enhance the resilience of this defence, the Reserve Bank monitors banks' provisioning against expected losses and requires banks to hold buffers of capital against unexpected losses, where the size of the buffer

is determined by the size and riskiness of the lending.¹² These capital requirements bolster the resilience of individual financial firms, even in a severe downturn, but in some circumstances they may not be sufficient to preserve the stability of the financial system as a whole. As the GFC demonstrated, the actions of individual banks, investors, firms and households are interconnected and can collectively result in financial system losses that are exceptional and unexpected when assessed from the perspective of an individual financial institution e.g. due to credit crunches or falls in consumption or investment.

To guard against this risk, the Reserve Bank uses stress tests to assess banks' capital positions against scenarios involving episodes of economic and financial downturns. In 2014, the Reserve Bank conducted a stress test of New Zealand's major banks using two scenarios which included mortgage losses of the scale consistent with a severe but plausible fall in house prices. On average, the banking system was able to absorb losses and retain sufficient capital to meet minimum capital requirements.

Stress test results are, however, subject to inherent uncertainty over the scenarios against which banks are tested and the approach to modelling losses on the basis of the given scenarios. Furthermore, the stress test assessed the resilience of banks to a 'static' scenario and do not take account of the on-going interaction between the macroeconomic and macro-financial elements of the scenarios and banks' response to them. These second order effects can themselves be a threat to financial stability and can fall within the scope of the Reserve Bank's macro-prudential policy instruments.¹³ In particular, a sharp tightening of bank

12 In 2013, the Reserve Bank reviewed the bank capital adequacy requirements for housing loans and introduced changes that increased the amount of regulatory capital that banks must hold against high-LVR residential mortgage lending.

13 The objective of macro-prudential policy is set out in the Memorandum of Understanding between the Minister of Finance and Governor of the Reserve Bank. It states that macroprudential instruments can "help dampen extremes in the credit cycle and capital market flows. As such, these instruments can play a useful secondary role in stabilising the macro economy."

lending to households or sectors related to the housing industry could increase the indirect effects of a housing downturn, discussed in section 4.

A second line of defence to protect the financial system from a housing market downturn is to reduce the potential scale of the downturn itself by using borrower-based macroprudential tools such as LVR and DTI limits. These measures may also temporarily reduce the probability of a housing downturn, although that is often not the primary objective.

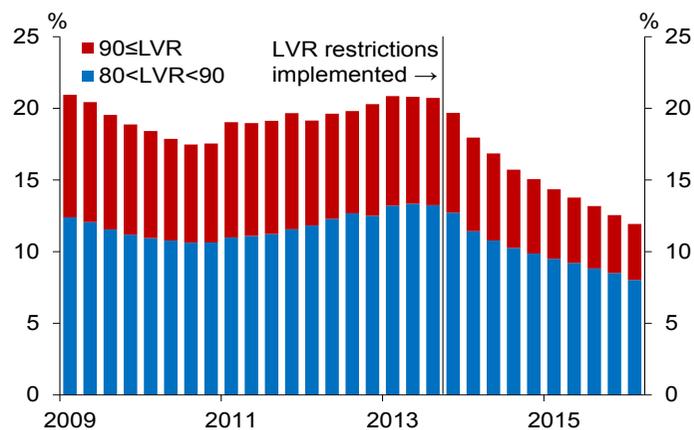
In recent years, the national authorities of many countries, including the Reserve Bank, have taken some form of proactive action to mitigate the build-up of financial stability risks from their domestic housing market. In 2013, the Reserve Bank introduced a 10 percent speed limit on mortgage lending with an LVR of greater than 80 percent, which has helped reduce the stock of high LVR mortgages from 21 percent to 12 percent (figure 9). In addition, the Reserve Bank introduced a speed limit on high LVR investor mortgages in Auckland in November 2015 which appears to have moderated the nationwide share of investor lending at LVRs greater than 70 percent.

In many cases, national authorities use more than one macroprudential tool to tackle risks from the housing market. For example, it is common for caps on LVR and DTI to be applied together (Lim *et al*, 2011). The rationale for this approach is that in theory the macroprudential tools are complementary as they can tackle the same risks from various angles.¹⁴ For example, the LVR policy in New Zealand has helped to reduce the stock of risky high-LVR lending, but risks in the housing market remain,

14 While there is a clear theoretical case to assume that LVR and DTI tools are complementary, further use of the tools will be required to test that assumption. For example, Cerutti *et al* (2015a) finds no evidence that use of the tools in combination have a statistically larger impact than use of the tools individually.

as a significant amount of New Zealand's new residential mortgage lending, particularly to investors, is at high DTI multiples (figure 10).

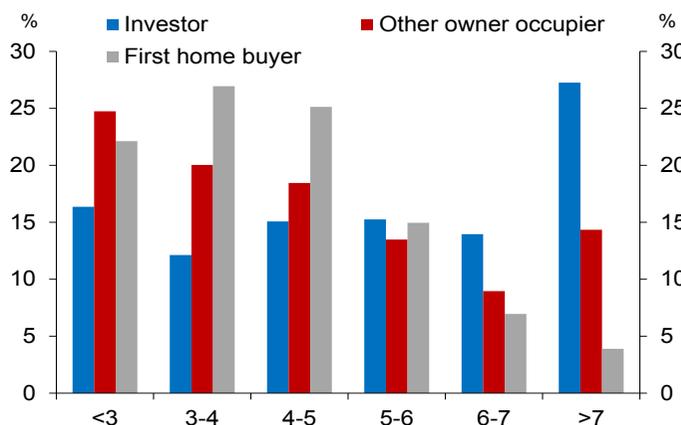
Figure 9
High LVR mortgages in New Zealand



Sources: Registered banks' *Disclosure Statements*.

Note: High-LVR loans are for the five largest banks in New Zealand only.

Figure 10
Total debt-to-income ratio by buyer type



Source: RBNZ.

Note: Chart shows the amount of lending at different total debt-to-income ratios as a percentage of total lending between May 2014 and September 2015 for different buyer types.

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