Maintaining financial system stability: the role of macro-prudential indicators

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Maintaining the stability of the financial system is a key policy goal of central banks. Recent episodes of financial instability highlight the importance of this role. This article investigates the role of macro-prudential indicators in maintaining financial stability.

1 Introduction

There are a number of ways that central banks or other government agencies can help maintain financial stability, including promoting strong market incentives, strong corporate governance, sound infrastructure, and maintaining a stable macroeconomic environment. Another tool is being able to understand the 'warning bells' that are likely to sound before a financial crisis occurs, and responding appropriately to those warnings when necessary.

The aim of this article is to investigate the role of macro-prudential indicators (ie potential warning bells) in monitoring and maintaining financial system stability.

The article:

- defines financial instability and illustrates the costs it can impose on the economy;

- touches on what factors can cause financial instability;

- summarises the main macro-prudential indicators used to monitor financial stability;

- reviews empirical evidence on leading indicators of financial instability; and

- discusses the most appropriate way for macro-prudential indicators to be used in practice.

2 What is financial instability?

A well-functioning financial system plays a number of important roles in an economy, including intermediating financial activity, making credit available to borrowers, and facilitating payments between different parties via their respective bank accounts.[2] When combined, there is little doubt that these roles, when fulfilled by a well functioning financial system, provide significant benefits to an economy. This is also evidenced by the costs that can be experienced in a period of financial instability, highlighted in the next section. It therefore follows that maintaining a sound and efficient financial system becomes an important policy objective within the wider goal of ensuring that the economy functions smoothly and at its potential.

There is no precise definition of what constitutes financial instability. However, there are a number of key factors that tend to characterise periods of financial instability. These include a significant fall in the public's confidence in financial institutions, the financial system becoming unable to fulfil its core functions, and dysfunction in the financial system causing – or having the potential to cause – significant spillover effects on the wider economy.

There are a number of ways in which financial instability might manifest itself in practice. For example, the failure of one or more systemically important banks may significantly impede financial intermediation and credit creation, and undermine confidence in the financial system. A serious and protracted failure in the payment system also has the potential to result in significant economy wide disruption, as it means that payments between different parties can no longer be made via respective bank accounts, forcing alternative, less efficient forms of payment.

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[2] As well as these factors there are a host of other roles played by a healthy banking and financial system, including pooling the risks of depositors, liquidity transformation, financial price discovery, financial risk management, and providing an avenue for monetary policy to be implemented.

It is important to emphasise, however, that financial instability does not necessarily arise as a result of isolated incidents of bank failure, short-term disruptions to the payment system, or routine volatility in financial markets. The key to whether these factors cause financial instability is whether they are of such a magnitude that they threaten an element of serious, protracted dysfunction in the financial system as a whole with significant effects on the wider economy. Whether this occurs will, of course, also depend to some degree on how well authorities are able to manage threats to financial instability.

3 What are the costs of financial instability?

Recent history provides us with a number of examples of financial crises. The most recent example of widespread financial instability was the 'Asian crisis' of 1997-98, which affected Indonesia, Thailand, Korea and Malaysia, amongst other countries. Earlier, in 1994-95, Mexico experienced a serious period of financial turmoil, and other Latin American countries also faced financial sector problems in the 1980s. In terms of developed countries, the most notable recent example is Scandinavia in the late 1980s, which experienced widespread instability in the financial systems of Sweden, Finland and Norway.

Episodes of financial instability can impose severe costs on an economy. Table 1 puts the size of some of these recent financial crises into perspective by setting out estimates of the fiscal cost to the government of restoring the financial system to an adequate level of capitalisation.

However, looking at the fiscal costs alone is likely to underestimate the costs incurred during a period of financial instability. To add to these direct costs, financial instability can also impose various indirect costs on an economy (especially if the financial crisis is not resolved swiftly), such as the costs arising from business closures, interruptions to business activity, reduced investor confidence, and reduced credit availability. Hence, it is often the case that financial crises also result in the economy moving rapidly from a period of economic growth to a severe economic contraction.

Closer to home, New Zealand and Australia experienced some degree of financial instability in the late 1980s. Fol-

Table 1
Fiscal costs of financial instability

Country	Period	Fiscal cost as a percentage of GDP
United States	1984-1991	3.2
Argentina	1980-1982	55.3
Chile	1981-1983	41.2
Norway	1987-1989	4.0
Sweden	1991	6.4
Finland	1991-1993	8.0
Mexico	1994-1995	13.5
Venezuela	1994-1995	18.0
Brazil	1994-1995	7.5
Japan	1990-1999	10.0
Korea	1997-1998	24.5
Malaysia	1997-1998	19.5
Indonesia	1997-1998	34.5
Thailand	1997-1998	34.5

Sources: Crockett (1997), MacFarlane (1999) and World Bank (1999)

lowing the financial market liberalisation of the mid-1980s, a sharp decline in asset prices in 1987-88, and a severe economic recession over the period of 1988-91, the New Zealand financial system experienced significant strain during the period of 1989-91. Over this period a number of banks experienced a substantial deterioration in the quality of their loan portfolios and financial losses that resulted in a significant erosion in their capital. One quasi-bank, DFC New Zealand Limited, was liquidated, as were some finance companies. BNZ, New Zealand's largest bank, also needed to be recapitalised twice by its owner (the government) to restore it to an adequate level of capitalisation.

4 What factors can cause financial instability?

Financial instability is most often caused by multiple factors and involves complex dynamics that vary considerably from case to case. A comprehensive discussion of the causes of financial instability is beyond the scope of this article. However, it is useful to summarise briefly the main factors that typically contribute to financial instability as a lead-in to the discussion of macro-prudential indicators.

When considering causes of financial instability it is important first to recognize that there are a number of distinct features inherent in financial systems that create an increased potential for fragility relative to the non-financial sector of the economy. The principal features are:

- **Small capital base.** Given their role as intermediaries between borrowers and lenders, banks tend to have a large amount of assets and liabilities relative to the size of their capital base, especially when compared to non-bank corporations. In the event of significant financial losses, such a thin capital base can make financial institutions more vulnerable to insolvency problems.

- **Liquidity mismatch.** Retail banks face a natural liquidity mismatch between their illiquid assets (such as long-term mortgages) and liquid liabilities (such as deposits), which makes them exposed to liquidity shortages if this risk is not sufficiently managed.

- **Information asymmetries.** There is typically an asymmetry of information between banks and depositors, meaning that depositors and other creditors do not always have enough information to distinguish 'safe' financial institutions from those that may be in difficulty. This increases the possibility of depositor panic and sudden falls in public confidence. Banks also promise to pay all depositors back on par, on a first come, first served basis, which increases the incentive for depositors to withdraw their funds quickly in the face of a generalised panic.

- **Complex risks.** Financial institutions are sophisticated organisations facing an elaborate array of risks, including credit risk, contagion risks, interest rate risk, exchange rate risk, operational risks and legal risks. Managing these adequately can be difficult, especially in an environment of increased financial complexity.

- **Disaster myopia.** Generally, financial crises do not occur frequently within a financial system. When a financial crisis has not threatened for some time, those responsible for managing the risks of financial institutions can become complacent, resulting in an over-emphasis on returns and an under-emphasis on managing risk.

- **Irrational exuberance.** It has become recognised that financial markets can at times display 'irrational exuberance', where financial market and asset prices are pushed to levels that no longer reflect the fundamentals that should determine asset prices. For example, those speculating in financial markets sometimes display 'herding' behaviour, mimicking the trading strategies of dominant investors, potentially resulting in self-fulfilling trends in asset prices. Such behaviour can cause financial markets to overshoot their fundamental levels, resulting in asset price bubbles that pose a possible threat to financial stability.

As well as these inherent sources of possible fragility, recent episodes of financial instability have highlighted a number of additional factors that have tended to contribute to financial instability. These include:

- **Moral hazard.** Moral hazard arises where the downside from risk-taking is borne by someone other than the risk-taker, creating an incentive for the risk-taker to act in a less prudent way than if they were to be faced with the full consequences of their actions. Relating this to the financial system, if depositors are insulated from risk by the government (for example, by government guarantees), depositors have little incentive to monitor their bank. Rather, the incentive for depositors is to place their deposits with the bank that is paying the highest interest rate, which is likely to be the bank that is taking the most risks. As a result, the actions of depositors will not provide incentives for banks to manage their risks in a prudent way.

- **Insufficient transparency.** Financial institutions not being required to disclose regular comprehensive, high quality information on the risks they are taking reduces the public accountability of bank directors and senior management, reducing their incentives to undertake sound risk management. Insufficient transparency also reduces the ability of depositors, creditors and shareholders to make well-informed assessments of the health of financial institutions.

- **Poor corporate governance.** Corporate governance refers to the structures put in place that determine the way in which corporations are governed. Weak corpo-

rate governance reduces the incentives, and to some extent the capacity, of banks' directors and management to identify, monitor and manage their banks' risks.

- **Rapid financial sector liberalisation.** The last 20 years have seen a marked move towards financial liberalisation in many countries.[3] Rapid liberalisation of the financial system can, in some circumstances, contribute to financial instability, especially if it has not been preceded by measures to strengthen the risk management and risk absorption capacity of the financial system.

- **Deficiencies in supervision.** Deficiencies in supervision can also contribute to financial instability, especially in a financial system with poor corporate governance, disclosure and market discipline structures. In some cases both insufficient scrutiny of the banking sector and inadequate levels of required capitalisation have contributed to financial instability.

  Conversely, if the supervisor becomes overly hands-on and prescriptive in its approach, this can have the potential to erode the incentives for the directors and management of banks to take ultimate responsibility for the management of their bank's risks, effectively passing some of the ownership of this responsibility to the banking supervisor. This can also be thought of as another example of moral hazard.

- **Poor macroeconomic policies.** Poor macroeconomic policies can, at times, also contribute to financial instability. For example, an excessively accommodating monetary policy has the potential to cause an asset price bubble through easy access to credit, encouraging speculation in asset markets. Conversely, if monetary policy is tightened too sharply, this could also contribute to financial instability by, for example, sharply increasing real interest rates, reducing domestic demand and reducing asset prices, thereby increasing the chance of banks incurring substantial loan losses.

- **An inappropriate exchange rate regime.** The choice of exchange rate regime can also have implications for financial stability. A regime where the value of the currency is pegged to the value of a foreign currency (or

basket of foreign currencies), might reduce the incentive for banks and corporations who borrow in foreign currency to manage prudently their exposures to changes in the value of the exchange rate, exposing banks to large losses on foreign borrowings if the peg is broken and the exchange rate is devalued.

5 What are the main macro-prudential indicators?

The causes of instability in the financial system, surveyed briefly so far, highlight the need for measures to be taken to reduce the potential for financial instability. There are a number of measures that can be taken by policy makers to promote financial stability, such as encouraging strong market incentives, strong corporate governance and sound infrastructure, maintaining an appropriate degree of supervision over the banking system, reducing the incidence of moral hazard, and maintaining a stable macroeconomic environment.

One other tool that might be used by a public sector agency, such as the central bank, when attempting to maintain financial stability is that of monitoring threats to financial stability and being able to intervene in financial markets when necessary. A large part of monitoring threats to financial stability involves monitoring potential leading indicators of financial instability and highlighting possible vulnerabilities in the financial system. These indicators have become known as 'macro-prudential indicators' and include banking system indicators, macroeconomic indicators and information from financial markets. Given that the focus is on the stability of the financial system as a whole, macro-prudential indicators tend to be broader indicators that might signify risks facing financial institutions in general, rather than the health of individual financial institutions.

In response to recent financial crises, international financial agencies have put significant resources towards identifying and understanding potential leading indicators of financial instability. For example, as part of the international effort to improve risk management practices and to better assess financial sector vulnerabilities, the IMF and World Bank jointly initiated a pilot Financial Sector Assessment Program (FSAP)

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[3] See Grimes (1999) for a description of financial market liberalisation in New Zealand.

in 1999. In an extension of the IMF and World Bank's wider roles of economic monitoring and assessment, the FSAP involves a specific analysis of countries' financial systems, with an emphasis on monitoring macro-prudential indicators, highlighting key vulnerabilities and monitoring compliance with international standards. Although the FSAP is currently in pilot form, it is expected to become entrenched as a part of the surveillance roles of the IMF and World Bank.

The following sections outline briefly the principal macro-prudential indicators.

Banking system indicators

Banking system indicators are concerned with the financial condition of banks. However, given the system-wide focus, for the purpose of macro-prudential monitoring, banking system indicators are typically assessed on an aggregate basis in respect to the banking industry as a whole. [4]

Although aggregate banking sector information provides a useful basis for assessing the risk profile of the banking system, there are a number of weaknesses inherent in banking system indicators that should be considered. One potential problem is that a bank's financial statements may not take into account known or suspected losses in a prudent way and hence to some extent may overestimate the bank's financial condition. Another disadvantage is that banking system indicators are typically released with a lag, often of some months, which tends to reduce their usefulness as leading indicators of financial distress. Banking system indicators also tend to be backward-looking, meaning that they describe the past health of the banking system, but generally say less about potential future threats. This is important, as threats to financial stability can appear relatively quickly.

Banking system indicators fall into a number of categories, and are summarised below.

- **Capital adequacy.** One of the key indicators of financial stability is the level of capitalisation of banks and other financial institutions. An adequate level of bank capital can help to ensure that there are shareholders in

the bank with a sufficient amount of their own funds at stake to encourage prudent management of the bank's risks.

The level of a bank's capital can also influence financial stability though its role as a buffer against potential losses that the bank may face, such as a significant decline in the quality of its loans. The higher the financial risks taken by a bank, the higher the level of capital that should be held to cover these risks. This is the general principle underlying the Basle Capital Accord, which imposes minimum capital ratios in relation to risk-adjusted exposures. [5]

- **Asset quality.** One of the main risks banks face is a deterioration in asset quality, impacting on their profitability and hence the capital of the bank. The quality of a bank's assets can be measured in a number of ways, including the proportion of a bank's loans that are not being repaid on time, or where the loans have been restructured.

A significant increase in non-performing or restructured loans may indicate that banking profitability and capital adequacy may come under pressure. In extreme cases, a severe deterioration in asset quality can threaten a bank's solvency and trigger bank failure. However, as with all financial indicators, information on asset quality is not always reliable and needs to be interpreted with caution, particularly given the potential for under-statement of non-performing loans.

- **Provisioning.** The quality of a bank's assets can also be deduced, to some extent, by the amount of provisions being set aside to cover loans that are unlikely to be

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4 In addition, of course, banking supervisors monitor individual banks on the basis of a whole array of information.

5 In 1988 the Basle Committee proposed international standards for defining capital. These standards suggested the minimum amounts of capital that should be set aside for different types of assets to act as a buffer for credit risks. From these standards, risk-based capital ratios can be calculated to compare the capital adequacy of different financial institutions and the financial sector as a whole. Currently the Basle Accord requires that banking groups should have a risk weighted capital ratio of 8 percent. At least 4 percent of this must be made up of 'tier one capital' (which represents shareholders' funds), while the rest may be made up of 'tier two capital' (which includes other forms of capital such as subordinated debt). However, one problem with the accord in its current form is that when calculating risk weighted capital ratios, assets are placed in very broad buckets according to asset quality, meaning there is a lack of sufficient differentiation between assets, resulting in a very crude measure of capital adequacy.

repaid in full. All else being equal, the higher the level of provisioning, the greater the anticipated decline in asset quality.

However, a lack of provisioning, especially in an environment where there is suspected to be an increasing proportion of non-performing loans, may also act as an indicator of vulnerabilities within a bank, as it amounts to an overstatement of the bank's capital and suggests that the bank may not be sufficiently prepared for future loan losses.

- **Exposure concentration.** If loans issued by a bank are concentrated with a small group of borrowers, in one industry, or one geographical location, it can suggest that the bank lacks the necessary diversification of its risks to cope with losses in these areas. An example of a lack of diversification might be lending predominantly to the real estate industry or placing excessive reliance on real estate as security.

- **Related party exposures.** If banks have significant loans, or other exposures, to parties with which they have corporate links or alliances, such as parent corporations, there is a risk that these loans may not have been subject to the same degree of commercial scrutiny as would be the case with an unrelated borrower. Large related party exposures can also indicate a heightened risk of contagion within a corporate group.

- **Liquidity.** The liquidity mismatch between a bank's assets and liabilities makes it vulnerable to the threat of depositor runs or general shortages in liquidity, and underscores the importance of market confidence in the bank's solvency. If this mismatch is not managed carefully, a bank can also find itself in financial difficulty, independent of the underlying quality of its assets, especially in an environment of investor nervousness.[6]

- **Sensitivity to market risks.** In recent years, given that the loans that make up banks' assets have tended to be predominantly subject to fixed interest rates, while their liabilities have been subject to variable interest rates, banks have potentially faced significant interest rate risk. This is probably more evident in countries such as the United States, where the mortgages that banks offer can commonly have interest rates fixed for 30 years. Equally, depending on the nature of a bank's operations, and the exchange rate environment within which it operates, banks may also face significant exchange rate risk. As a result, an important indicator of potential vulnerability is the extent to which financial institutions have unhedged market risks.[7]

- **Profitability.** The profitability of banks is another important indicator of the health of the financial system. On the surface, a healthy level of profitability implies that lending and other decisions by banks are being made prudently and the bank is in good health. However, as with all banking system indicators, measures of profitability need to be interpreted with caution. Profitability is only a reliable indicator if the underlying accounting measures of revenue and expenses are also reliable and take into account known or suspected losses in a prudent way. Furthermore, even if a bank is highly profitable, this may indicate that excessive risks have been taken to acquire that profit, which may cause problems in the future.

The Reserve Bank of New Zealand publishes aggregated banking system data in an annual article on the New Zealand banking system.[8] In recent years New Zealand banks have on the whole been relatively well capitalised, have had sound loan portfolios, and have held relatively low exposures to interest rate and exchange rate risks.

Macroeconomic indicators

A number of macroeconomic indicators play an important role in assessing potential threats to financial stability. Macroeconomic indicators are mainly used to assess the

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[6]   The inherent liquidity mismatch of banks' assets and liabilities and the problem of asymmetric information between banks and deposits were the main risks that threatened the financial system over the turn of Y2K. In the case of New Zealand, the banking system was well-capitalised and displayed sound risk management practices. The threat that depositors would 'panic' unnecessarily was the main risk that banks, and the Reserve Bank of New Zealand, sought to manage. (Hampton 2000).

[7]   See Hawkesby (1999) for a primer on derivative markets and how these products are used to hedge risk.

[8]   See Stinson (2000) for the latest summary of the New Zealand banking system.

potential for future threats to the banking system, and are therefore classified more as leading indicators.

However, one disadvantage of macroeconomic indicators is that they are sometimes only tangential to issues of financial stability, and hence do not always act as reliable indicators of financial instability. As an illustration, economic activity may tend to vary over the typical business cycle, but for the most part this may say little about potential threats to potential financial stability. Therefore, macroeconomic indicators need to be interpreted with caution, and in the context of a wide range of other information. Like banking system indicators, macroeconomic indicators are also typically released with a lag, which may limit their usefulness.

A few of the main macroeconomic indicators are discussed briefly below.

- **Credit growth.** Rapid growth in aggregate new lending can sometimes indicate the possibility of poor quality lending, where loans have been made without sufficient consideration to the risks involved, including the capacity of the borrower to service the debt, and the adequacy of collateral. For example, rapid new lending growth tends to occur when a financial system is being liberalised, given that when financial controls are lifted and the banking system is opened to new entrants this can result in banks competing vigorously for market share.

- **Debt levels.** Rapid credit growth in relation to the growth of the economy will eventually be reflected in an increase in the level of debt relative to the income available to service that debt. When debt levels become large relative to income, this can act as a signal that the burden of debt is growing to a level that may become difficult to repay in the future, leading to possible future loan losses for banks.

- **Capital flows.** Cross-border capital inflows are made up of foreigners lending money to domestic borrowers, foreign purchases of domestic shares and bonds, and foreign direct investment in local business ventures. Similarly to rapid credit growth, large capital inflows also have the potential to expose vulnerabilities in the financial system. Large capital inflows can create the risk of large outflows in response to sudden changes in the confidence of foreign investors, potentially causing sharp

falls in asset prices and/or in the exchange rate, and putting considerable strain on the financial system.

This risk of large capital outflows is heightened if capital inflows occurred when a country's economy was highly favoured by foreign investors on the basis of an inadequate analysis of economic benefits and risks. In this case, capital inflows may have occurred very quickly and at a pace at which they could not be absorbed properly into the economy, increasing the chance that poor investment decisions were made, where foreign loans were made to unsound domestic borrowers and foreign equity invested in unprofitable business ventures.

- **Capital flow composition.** The composition of capital flows may also have implications for financial stability. For example, it is commonly considered that foreign investors can more easily withdraw funds they have lent on a short-term basis than those lent on a long-term basis. Similarly, shares in domestic companies purchased by foreign investors for portfolio investments tend to be able to be sold more quickly and easily than foreign direct investment, where the ability to exit quickly may be more constrained.

However, the risks associated with cross-border capital flows should not be overstated. Local investors can also sell out of local investments and domestic currency, which has the same impact as foreign investors reversing capital flows.[9] Also, when clauses in contracts allow, long-term foreign lenders and foreign direct investors can also exit their positions at short notice.

- **External debt.** When large capital inflows come in the form of foreign borrowing, this will eventually be reflected in a higher level of external debt. When the level of external debt becomes large relative to the income used to service debt, this can act as a signal that the burden of external debt is growing to an unsustainable level, making the financial system more vulnerable to loan failures. Also, a high level of external debt may

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9   This was evident in New Zealand in 1984 when domestic corporations were large sellers of the New Zealand dollar when rumours surfaced that the currency would be devalued and floated. Net sales of New Zealand dollars also occurred as a result of accelerated payments for imports and the delaying of foreign currency export receipts being repatriated into New Zealand dollars.

increase the risk of foreign lenders losing confidence in the financial system. This has the potential to result in destabilising capital outflows, especially if these capital outflows cause a sharp depreciation in the currency and there are banks and corporates who have borrowed in foreign currencies without hedging their exposure to changes in the exchange rate.

- **Asset prices.** If an asset market becomes subject to excessive speculation, driving asset prices well above levels suggested by the fundamentals of the economy, there is a potentially high risk of a sharp correction to asset prices, with implications for financial stability. In an attempt to highlight possible asset bubbles, it becomes important to monitor asset prices in relation to estimates of their 'fundamental' values.[10] In recent years, equity and real estate markets have been the most common examples of asset markets becoming prone to speculative bubbles and 'irrational exuberance'. Rapid credit growth and large capital inflows can also be particularly dangerous if associated with excessive speculation in asset markets.

- **Economic growth.** A period of financial instability is likely to cause a significant slowdown in economic activity. However, in some cases, the direction of causality can work in the other direction and a contraction in economic activity can be followed by a period of financial instability.

  A sharp contraction in GDP, or decline in GDP growth, will impact on the ability of borrowers to repay loans and hence affect the quality of banks' assets, especially if the contraction is widespread and longer or deeper than borrowers had expected. A contraction in GDP can also contribute to a decline in asset prices, reducing the value of collateral, and further exacerbating bank losses.

- **Real interest rates.** The level of real interest rates can also be an indicator of potential financial instability. All

else equal, a higher level of real interest rates will put added pressure on the ability of borrowers to repay loans and tend to reduce asset prices, reducing the value of collateral, and hence reducing the quality of a bank's loan portfolio. The extent to which an increase in real interest rates has an impact on financial stability will, of course, be dependent on a number of other factors, including the initial degree to which borrowers are leveraged and the quality of the original lending decisions.

With a pegged exchange rate regime, a high level of real interest rates may also encourage banks and corporates to borrow overseas at lower foreign currency interest rates, without hedging their exposure to changes in the exchange rate. This has the potential to result in significant losses to those borrowers if the peg is broken and the value of the domestic currency is devalued, essentially increasing the domestic currency value of those borrowings and servicing costs.

- **External sector developments.** Developments in the external sector may also have impacts on financial stability, especially with a pegged exchange rate regime. For example, a fall in world demand and/or a fall in a country's export prices may mean that the country's exchange rate is no longer competitive, resulting in a slowdown in the export sector and deterioration of the current account, forcing the currency to be devalued. If banks and corporates have borrowed in foreign currencies, without hedging their exposure to changes in the exchange rate, this has the potential to threaten financial stability.

Financial market indicators

Information from financial markets can also be used to gauge possible threats to financial stability.

The main advantage of financial market indicators is that they are determined and directly observable on a real time basis in financial markets. Financial market indicators also tend to be forward looking, and hence, in theory, embody market expectations of future information, such as profits and debt servicing capabilities.

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10 **Estimating asset values according to fundamentals can be very difficult. As an example, one input when valuing the share price of a company is an estimate of the future growth rate of the company's earnings. If this company is involved in a new type of business with unusually uncertain prospects for the future it can be particularly difficult to know with any degree of certainty whether its share price is overvalued or not.**

However, one disadvantage of some financial market indicators is that they can be influenced by a relatively high degree of 'noise', which can make interpretation difficult at times. Moreover, in practice, financial market indicators tend to reflect information as events unfold and do not necessarily act as reliable leading indicators of financial instability. That is, by the time markets react, via changes in market prices, the crisis is already unfolding.

There are a number of ways in which various pieces of financial market information can be interpreted as macro-prudential indicators, the first being as leading indicators.

- **Bank share prices.** A bank's share price incorporates the market's expectation of its future profitability. A rapid fall in the share price of banks might reflect a fall in the expected future profitability of banks, or a perception of greater volatility in earnings. A fall in share prices might also reflect a higher 'risk premium' attached to the market in general, in which case what is more relevant is a fall in bank share prices relative to the market as a whole or relative to the share prices of other financial institutions.[11]

- **Credit spreads.** Given that private debt is generally a riskier investment than government debt, when banks and other corporations borrow funds they pay a higher interest rate than the government. The differences between bank and corporate borrowing rates and the government's borrowing rate are called credit spreads. If market investors sense an increased chance of banks and corporates not meeting their debt obligations, credit spreads widen. However, there are a number of other reasons why credit spreads may change, including investors becoming more or less risk averse and changes in the relative supply of government and non-government paper.

- **Credit ratings.** A worsening in the credit ratings of banks might also reflect a perception of higher risks associated with a particular bank or within the financial

system more generally. However, in practice, ratings have generally been a lagging indicator of financial instability, rather than a leading indicator, and therefore of limited usefulness in pointing to future potential financial distress.

- **Wholesale market liquidity.** Where lender banks are less willing than previously to lend funds to a specific bank this may indicate that they are losing confidence in the borrower bank's health, and fear a higher chance of insolvency. Such fears could also be reflected in lender banks demanding a premium over the interest rate that other banks pay, or more collateral to compensate for the perception of higher risk. However, these indicators are not easily observable and may largely depend on anecdotes from market participants.

When financial markets become unusually volatile there is a tendency for market activity to 'dry up' as market participants (and especially intermediaries) perceive the risks associated with any activity to have increased significantly relative to the returns anticipated from remaining in the business. Signs of a market-wide lack of liquidity relate more to very near-term threats to financial stability, as opposed to acting as leading indicators.

- **Bid-offer spreads.** A bid-offer spread is the difference between what financial intermediaries are willing to buy an asset for (the bid) and what they are willing to sell an asset for (the offer). In a market that has become, or is perceived to have a high chance of becoming, volatile, intermediaries will widen their bid-offer spreads. This reduces the chance that counterparties asking for a price from the intermediary will agree to transact, and hence reduces the chance that the intermediary will acquire a position in an asset market that is expected to become unstable and difficult to exit.

- **On-the-run/off-the-run spreads.** With a heightened sense of a threat to financial market stability, investors generally attempt to shift their portfolios into the most liquid assets possible, such that they know there will be a market available if they need to liquidate their assets quickly. On-the-run US Treasury bond issues – those bonds that are currently being issued by the US government – tend to be one of the most liquid assets in

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11 The New Zealand banking system is predominantly foreign owned, which means that no New Zealand banks are listed in the New Zealand sharemarket. As a result, it is the share price of the parent bank, most often listed on the Australian sharemarket, which needs to be monitored.

financial markets. In a time where there are financial stability concerns, the interest rate associated with these on-the-run bonds will become low relative to off-the-run bonds, as investors become willing to accept a lower interest rate as a trade-off for the greater liquidity (and hence lower liquidity risk) these assets provide. The Russian debt crisis of 1998 provides an example of a time where there was a significant reduction in on-the-run/off-the-run spreads. However, again, these spreads can be influenced by factors that are not related to financial stability, such as the relative supply of on-the-run and off-the-run bonds.

- **Market volumes.** The volume of financial market activity is also likely to change dramatically during a period of financial market instability. But it is unclear whether volumes will rise or fall. At the outset of instability there is likely to be a marked increase in volumes as investors attempt to 'run for the door'. However, heightened uncertainty and a general lack of market liquidity could also result in a fall in volumes. Those derivative products (such as futures and options contracts) that are traded on transparent financial exchanges can provide an avenue for market activity to be gauged easily.

6 How effective are macro-prudential indicators as leading indicators?

As well as the efforts made to identify and understand the theoretical links between macro-prudential indicators and financial instability, considerable resources in recent years have been put into empirically testing these links in practice. These studies typically investigate which leading indicators have been associated with financial instability in practice and also look at the question of whether macro-prudential indicators can be used successfully to predict financial instability. Unfortunately, it seems that in practice there is little evidence to suggest that macro-prudential indicators, on their own, are useful predictors of financial instability.

What are empirical models of leading indicators?

Over the past 5 years a number of empirical studies have been undertaken to investigate which macro-prudential indicators have been the most reliable leading indicators of financial instability. These studies tend to take a broadly similar approach, focusing on leading macroeconomic indicators for a wide sample of countries over a period usually spanning 1970 to 1995.

The first stage in an empirical approach is to define periods of financial instability by taking proxies for financial instability, such as bank failures, depositor runs, large-scale loan failures, collapses in collateral values, mergers between healthy and unhealthy banks, government takeovers of banks or bank closures. The next step is to deduce what macro-prudential indicators have been successful in anticipating future instability. The general approach in this step is to compare the behaviour of the prospective leading indicators before financial crises with their behaviour before periods of financial stability. A leading indicator, within this context, is one whose unusual behaviour before the crisis would have, in hindsight, significantly helped in its prediction.

What do the results of empirical research suggest?

With different sample sizes, countries studied, time periods covered, and statistical methods used, it is not surprising that the results of empirical research often come to different conclusions. Although research has, as yet, not been able to provide definitive insights, something of a stylised time line leading into a banking crisis does emerge, and is shown in figure 1.[12]

According to these studies, the main very early leading indicators have tended to be rapid credit growth, asset price inflation, strong economic growth and rising consumer price inflation. These indicators are likely to be acting as warning bells around 12 to 18 months before a banking crisis actually occurs. More near-term indicators of banking crises tend to be those factors signalling a likely deterioration in the

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[12] The results of this section are based on Kaminsky et al (1996), Demirguc-Kunt et al (1998a), Demirguc-Kunt et al (1998b), and Hardy et al (1998).

asset quality of banks, such as increases in real interest rates, falls in asset prices and economic recessions.

One notable insight of empirical research is that it has been found that in the past a current account deficit (mirroring capital inflows) has not been a reliable leading indicator of financial instability.[13] This seems to be an illustration of the fact that potential leading indicators can not be interpreted purely in isolation. Whether a large current account deficit causes financial instability will depend on a host of other factors, including other macroeconomic factors and the characteristics of the financial system at the time.[14]

Figure 1
A time line leading into a banking crisis
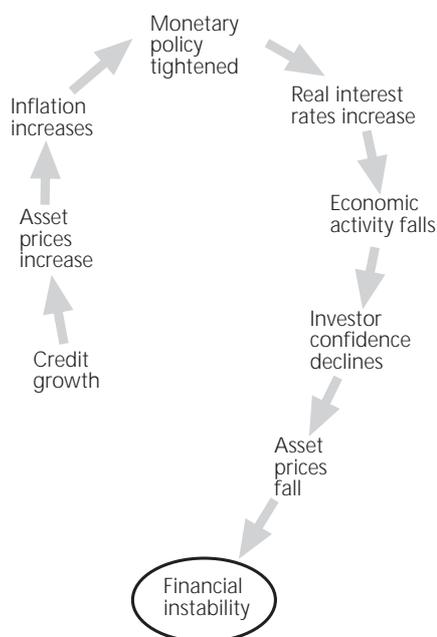
Recent studies have also found links between some structural factors and financial instability. For example, there is evidence that financial liberalisation increases the chance of banking fragility, most likely as a result of liberalisation occurring before steps have been taken to improve the risk management capacity of the financial sector and to strengthen market disciplines on financial institutions.[15]

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[13] See, for example, **Kaminsky et al (1998), Frankel et al (1996), and Sachs et al (1996).**

[14] See **Collins et al (1998)** for a discussion of the aspects relating to the sustainability of the current account deficit and the relationship between the current account and financial stability.

[15] See **Demirguc-Kunt et al (1998b).**

Evidence also exists linking deposit insurance schemes with an increased chance of banking crises.[16] This link has been explained by poorly designed deposit insurance schemes, when combined with other factors, introducing moral hazard by reducing the incentives for depositors and other creditors to monitor banks and to exercise appropriate market disciplines.

Can financial instability be predicted?

The empirical research briefly touched on in this article suggests there is evidence that several macroeconomic indicators, such as rapid credit growth and asset price inflation have acted as leading indicators of financial instability in the past. But how useful are leading indicator models for predicting financial crises outside the sample they were estimated within?

Before addressing this question it is important to recognise that there are a number of potential pitfalls with empirical approaches, which tend to weaken their ability to predict crises.

- The relationship between a leading indicator and financial instability may only exist at extreme levels of the indicator, meaning that for the majority of time no relationship can be found.

- Financial crises are relatively infrequent events, reducing the number of events from which to draw conclusions, even if data are available over a long time span.

- Given the inherent differences between countries' economies and financial systems, no two financial crises are the same.

- Some factors, such as the emphasis placed on market disciplines and corporate governance, cannot be quantified easily, leaving models of financial crises incomplete.

- Financial crises tend to be caused by multiple factors with complex dynamics, which makes prediction difficult.

- Financial crises are often triggered by a dramatic fall in the confidence in the financial system or contagion, which are difficult to anticipate and to model.

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[16] See **Demirguc-Kunt et al (1998a).**

With the majority of leading indicator models estimated before the Asian crisis of 1997-98, using data prior to 1997, the Asian crisis provided a real-life test for these established models. Unfortunately, empirical models have been disappointing in their ability to predict financial instability. As an illustration, most empirical approaches failed to anticipate consistently the banking crises of Thailand, Philippines, Indonesia, Korea and Malaysia in 1997-98.[17]

In a more in-depth analysis, a recent study investigated the ability of three prominent leading indicator models to predict the collapse of fixed exchange rate regimes. When applied to the Asian crisis it was found that these models provided more false signals than accurate ones, while they still missed most crises. Even the model deemed to have the best predictive capacity provided signals little better than guesswork.[18]

7 What is the role of macro-prudential indicators?

It has become apparent that models, on their own, using macro-prudential indicators are not particularly reliable predictors of financial stability. However, this is not too surprising, especially given the limitations of models that attempt to predict crises, highlighted in the previous section. Furthermore, the failure of these models does not imply that macro-prudential indicators are redundant as a tool in monitoring financial stability. When used in association with a comprehensive understanding of the issues of the country in question and a sound element of judgement, monitoring macro-prudential indicators should provide a useful tool to help improve the early detection of possible threats to financial stability.

One framework to analyse macro-prudential indicators is that of financial system 'stress-testing'. Rather than attempting to predict financial crises, stress-testing involves assessing how exposed the financial system is to certain shocks and in the process highlighting what, if any, are the key vulnerabilities in the financial system.

Stress-testing is typically focused on assessing the effects of relatively rare, large economic shocks on the financial system. Given that the focus is on the stability of the financial system as a whole, the attention of stress-testing tends to be on generalised shocks to the financial system, rather than idiosyncratic shocks that will only affect specific banks and have limited spillover effects.

Examples of possible shocks that can be stress-tested against include a number of macroeconomic shocks, such as a sharp, widespread contraction in economic activity, a significant reversal of foreign capital inflows, a sudden depreciation of the exchange rate, a fall in asset prices, or an unexpected increase in short-term interest rates.

Stress-testing involves assessing the direct impact of these various types of shocks on the profitability and balance sheets of individual banks and the banking system as a whole. In order to incorporate second round effects and flow-on effects back to the financial system, stress-testing also involves attempting to estimate the effects on the balance sheets and debt servicing capacities of both the non-financial corporate sector and the household sector.

As with all types of macro-prudential monitoring, there are obviously limitations in the ability to undertake stress-testing. These include limitations in obtaining sufficient data, difficulties in highlighting and quantifying the key linkages between banks, non-financial corporates and households, and difficulties in determining the nature and magnitude of the linkages between the real and financial economy. Formulating the appropriate policy response if a vulnerability is found may also be difficult.

However, stress testing can still be a useful tool, amongst others, in seeking to understand and promote financial stability. Reflecting this, although such an approach is relatively new, stress-testing is attracting greater attention internationally, including through the IMF/World Bank Financial Sector Assessment Program and the Financial Stability Forum Working Group on Capital Flows.

Another more common role for macro-prudential indicators has been in their use as indicators to be monitored and analysed on an ongoing basis. Although predictive models

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[17]   Such as Demirguc-Kunt et al (1998a), estimated with data from the period 1980-94.

[18]   Berg et al (1999) takes three models developed by Kaminsky et al (1998), Frankel et al (1996), and Sachs et al (1996) and assesses whether they would have successfully predicted the currency crises in Asia in 1997-98.

Macro-prudential indicators and the New Zealand financial system

One of the main conclusions from empirical research is that leading indicators of financial instability should not be interpreted in isolation.

The recent situation in New Zealand's financial system provides a good example of the limitations of using macro-prudential indicators to assess potential financial instability in the absence of a careful evaluation of the specific characteristics of the country in question, including the underlying factors that may work to alleviate the risks of financial instability.

At the end of the 1990s there were a number of indicators that, if interpreted on their own, would have raised concerns over the potential vulnerability of the New Zealand financial system.

- At over 7 percent of GDP New Zealand had a high current account deficit by international standards.

- A number of years of net capital inflows had left the country with a high level of net foreign liabilities, at around 100 percent of GDP.

- International credit rating agencies had downgraded the New Zealand government's foreign currency credit rating and adjusted their outlook on future revisions from stable to negative.

- Following the Asian crisis, a severe domestic drought, and a previously tight stance of monetary policy, in 1998 the economy fell into a short recession.

- Foreign currency reserves were relatively low in relation to foreign currency debt and import obligations.

However, in the specific case of the New Zealand financial system there were a number of mitigating factors that, when taken together, suggested that the degree of vulnerability was not as high as initially thought.

Financial institutions were strong, with good asset quality and a comfortable level of capitalisation to buffer against shocks. Two-thirds of the country's external debt was owed by banks, and of the country's external debt, around half was denominated in New Zealand dollars. Furthermore, most banks that had not denominated their borrowings in NZ dollars made extensive use of derivatives to hedge their exposures against movements in the exchange rate, and used derivatives to hedge their exposure to changes in interest rates. A number of corporates also had natural hedges in place, such as borrowing in foreign currencies but also receiving foreign currency receipts for their products, or had adopted formal hedging arrangements. Reflecting these hedging practices, the financial system had in effect successfully weathered a 30 percent fall in the exchange rate over a two year period, a fall in short-term interest rates from around 10 percent to 4 percent in 1998 and a period of mild recession.

Therefore, although some macro-prudential indicators, on a superficial analysis, pointed to potential vulnerabilities in the New Zealand financial system, a careful assessment of the risk management practices of financial institutions and corporates demonstrated that the potential vulnerabilities were being kept in check.

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have, as yet, been unable to forecast financial instability consistently using macro-prudential indicators, the structure of these models means they are very inflexible. By contrast, a public sector agency, such as a central bank, should be in a position to apply careful judgement to the information provided by macro-prudential indicators and be able to interpret them in the context of the particular situation in question. Under a regime of careful macro-prudential monitoring, if macro-prudential indicators begin to breach perceived limits of comfort, perhaps signalling the potential for future insta-

bility in the financial system, this can prompt a more thorough analysis into the area. Such an approach is probably a more common way in which macro-prudential indicators are currently used in practice. By contrast, at this stage, stress-testing is a less common approach.

Depending on the circumstances in question, macro-prudential monitoring and/or stress-testing might highlight key vulnerabilities in the financial system such as a large level of external debt, financial institutions having large unhedged

foreign exchange positions, a poor overall loan quality in the banking system, or asset markets being overvalued relative to levels suggested by fundamentals. If vulnerabilities are found early enough, this should allow policy makers to take pre-emptive steps to reduce vulnerabilities within the financial system.

Policy responses to possible vulnerabilities will vary from case to case, depending on the particular situation in question. One alternative is to undertake deliberate policy initiatives directed at reducing the vulnerability found, where there is such a policy available. Another alternative is for the policy maker to highlight to the public the possibility of a vulnerability developing, and hence allow time for financial institutions and investors to change their behaviour to mitigate the vulnerability before it becomes a serious problem. In recent times, this latter response has been used by policymakers in the United States to highlight the possibility of irrational exuberance driving strong asset price inflation.

8   Conclusions

As evidenced in a number of countries, financial instability has the potential to result in quite significant costs for the wider economy. It is these costs that motivate the need to maintain a stable financial system.

One tool that can be used by a public sector agency such as the central bank when attempting to maintain financial stability is that of monitoring threats to financial stability and being able to intervene in financial markets when necessary. The main focus of this paper has been to assess the role that monitoring macro-prudential indicators plays in maintaining financial stability.

As shown in the article, there are a number of potential macro-prudential indicators, including banking system indicators, macroeconomic indicators and financial market indicators. There is also empirical evidence to suggest that some macroeconomic indicators, such as rapid credit growth and asset price inflation, have regularly been associated with financial instability in the past.

However, there is little evidence to suggest that researchers or policy makers can use leading indicators to predict future financial instability with accuracy. In a sense this is to be

expected, as financial crises tend to be caused by multiple factors with complex dynamics and often involve sudden falls in investor confidence and contagion.

But this does not imply that macro-prudential indicators are redundant as a tool in monitoring financial stability. For example, macro-prudential indicators can be used, with an element of sound judgement and careful analysis, to highlight key vulnerabilities in the financial system and to assess whether the financial system could cope with adverse economic shocks if they did occur.

Finally, macro-prudential indicators are just one tool in a central bank's tool kit. The inherent limitations of macro-prudential indicators emphasise the importance of other fundamental ways that central banks and other government agencies can help promote financial stability, including promoting strong market incentives for bank management, strong corporate governance structures, sound infrastructure, and maintaining a stable macroeconomic environment.

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