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Effect of the Basel Accord capital requirements on the loan-loss provisioning practices of Australian banks

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ABSTRACT

There are two distinct regimes for bank provisioning in Australia: a forward-looking model for regulatory purposes and an incurred loss model for financial reporting. This study examines the former using a unique but confidential database. We find evidence that: (i) banks increase provisions in anticipation of future lending growth, (ii) banks allocate part of surplus capital above regulatory requirements to pre-fund future credit losses through provisions, and (iii) banks allocate part of higher earnings for the same purpose. These results suggest that bank managers use their discretion in setting provisions to dampen the impact of fluctuations in credit market conditions on their lending activities. For internal ratings-based banks, results suggest that the revised Basel framework allowing these banks to estimate expected losses using their own credit risk models may come at a cost of reduced general provisions.

1. Introduction

In its Basel III reform package, the Basel Committee on Banking Supervision (BCBS) is seeking to improve the banking sector's ability to absorb shocks arising from financial and economic stress, thus reducing the risk of spill-over from the financial sector to the real economy. A major focus of these reforms is to raise both the quality and size of the regulatory capital base, as well as to build capital buffers at individual banks that can be used in stressed economic conditions and to protect banks at times of excess credit growth.[1] The outcome of these reforms relies upon the timeliness and reliability of banks' provisioning practices for loan losses. Using a confidential dataset, this study examines the ways in which banks actively manage regulatory provisions under the Basel framework.[2] A by-product of our study is that we provide an early view of the impact on bank provisioning behaviour of switching to the internal ratings-based (IRB) approach to credit risk.

In contrast to previous studies that focus on bank provisioning practices under accounting standards for reporting to the market (for example, Moyer, 1990; Collins et al., 1995; Kim and Kross, 1998; Hasan and Wall, 2004), this study focuses on practices under prudential standards for reporting to the banking regulator. The change in focus is important for understanding the role of provisioning in supporting the Basel capital requirements, because our study covers a period when accounting standards in Australia and internationally moved to an incurred loss model of provisioning. The incurred loss model is problematic for supervisory review and the market-enforced discipline of banks' capital adequacy; because it delays the recognition of losses until financial assets are close to default (see Gaston and Song, 2014).[3]

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[1] By quality of capital, we refer to the focus of the Basel III reforms on increasing the proportion of regulatory capital that must be met by going-concern loss-absorbing capital, or common equity tier 1 (see Ingves, 2013).

[2] We thank the Australian Prudential Regulation Authority for allowing us access to the data for this study.

[3] The incurred loss provisioning model is backward-looking, in the sense that it requires that a loss event occurs before a provision can be made (see International Accounting Standards Board, IAS 39 *Financial Instruments: Recognition and Measurement*, December 2003).

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To address this shortcoming, the Australian banking regulator has maintained a forward-looking provisioning model to capture expected future credit losses in a bank's business, by decoupling its provisioning requirements from Australian accounting standards.[4] The forward-looking model is consistent with the expected loss approach to provisioning advocated by the BCBS under Basel III (see paragraphs 23–25 of the Basel III capital rules).[5] This study provides a practical test of the forward-looking provisioning model, by examining the extent to which banks use the forward-looking model to build a buffer against future credit losses and to support the stability of the bank capital base. Such a test is not available in many countries, including the United States, which continue to rely on accounting standards for both financial reporting and prudential review.

To our knowledge, this study is the first to examine bank provisioning practices for banks that use the IRB approach to credit risk under the Basel II capital framework. Previous research examines bank provisioning in the pre-Basel period before 1989 (for example, Beatty et al., 1995) and under the Basel I capital framework (Ahmed et al., 1999; Shrieves and Dahl, 2003; Anandarajan et al., 2007; Fonseca and González, 2008). The Basel II framework was developed to improve the risk-sensitivity of the capital requirements and provide greater incentives for banks to develop their risk management capabilities (see paragraphs 5 and 6 of the Basel II capital framework). Under Basel II, banks that receive approval from the regulator are permitted to use their own risk assessments in the capital calculations. The IRB approach also establishes a direct linkage between regulatory provisioning and expected losses derived from the bank's credit risk modelling. In managing this process, an IRB-accredited bank may raise additional provisions to deal with the uncertainty associated with estimating future credit losses using its internal model. This study tests whether the adoption of the IRB approach has increased the propensity for these banks to maintain provisions against future credit losses.

Based on quarterly data for twenty-three banks operating in Australia from September 2003 to December 2012 (representing about two-thirds of the number of banks and 99% of the total assets of locally-incorporated banks), we find evidence that banks use regulatory loan-loss provisions as a counter-cyclical buffer. The provisioning behaviour of banks suggests that they incorporate forward-looking indicators of lending growth as part of their assessment of default risk. We also find that banks allocate higher provisions when their risk-based capital ratios and earnings are higher than average and adjust provisions downwards in periods when these indicators are weaker. For banks that receive approval from the regulator to use the IRB approach to credit risk, results suggest that the revised Basel framework allowing these banks to estimate expected losses using their internal models may come at a cost of reduced general provisions (rather than giving rise to additional provisions against model risk).

2. The impact of bank discretionary behaviour on loan-loss provisions

This section discusses characteristics which may influence a bank's decision-making for provisioning. In principle, loan-loss provisions are a buffer to preserve a bank's solvency by absorbing existing and estimated future credit losses in its business. To the extent that provisions reflect the quality of the loan portfolio, they are likely to be susceptible to short-term fluctuations resulting from changes in macroeconomic conditions and developments in the solvency of individual counterparties. Provisioning may also be affected by country-specific circumstances with regard to accounting, regulatory and tax rules and by bank behaviour with regard to its performance and risk management practices.

The conceptual framework underlying the Basel Accord is that expected future losses will be covered by provisions, while unexpected future losses will be covered by capital. Despite this rationale, provisioning practices may be backward-looking if banks mainly set provisions in response to revealed problem loans. During periods of economic expansion, fewer problem loans are identified and the level of provisions is usually low. Conversely, during economic downturns provisions increase because defaults are more widespread across the bank's lending business. Using bank-level data from 29 OECD countries, Bikker and Metzemakers (2005) show that provisioning levels vary significantly with the business cycle. This pattern implies that banks' buffers need to be restored during downturns, meaning that fewer profits are available to supplement existing capital, possibly forcing banks to reduce lending.[6] However, credit risk arises when loans are made; not only during a downturn when more defaults are experienced. In this case, banks may under-provision during periods of economic expansion (Laeven and Majnoni, 2003). This study tests the extent to which regulatory provisions are influenced by credit risk, measured in relation to problem loans, asset quality and the current state of the business cycle; but also in relation to forward-looking indicators of economic activity.

In addition, the research literature identifies three discretionary actions bank managers may take when setting provisions. The first action is concerned with capital management. Both specific provisions and general provisions reduce equity capital via their effect on retained earnings. Thus, a poorly capitalised bank may be less willing to make loan-loss provisions (Kim and Kross, 1998). However, to the extent that general provisions count towards non-equity regulatory capital, a bank may raise more general provisions to preserve its total regulatory capital base (Ahmed et al., 1999). Reasons for managing the capital ratio through provisions include the high cost of raising new capital, implicit and explicit guarantees that make debt funding cheaper and shareholder preferences for dividend payments. The second action is income smoothing. Bank managers may seek to reduce earnings variability; to signal lower business risk, reduce funding costs, reduce tax expense or improve management rewards. Consistent with this prediction, several studies document a positive relationship between non-discretionary bank earnings and provisions (Greenawalt and Sinkey, 1988; Ma, 1988; Collins et al., 1995 for United States banks; Shrieves and Dahl, 2003 for Japanese banks; Pérez et al., 2008 for Spanish banks; Hess et al., 2009 for Australian banks).[7] The third action occurs when bank managers use provisions to signal their financial strength to investors (Wahlen, 1994; Beaver et al., 1997; Liu et al., 1997).

Recent studies investigate a counter-cyclical explanation for a bank's discretionary behaviour in setting loan-loss provisions

[4] A similar approach was proposed by the Turner Review in the United Kingdom. The Review recommended that existing accounting rules for provisioning be augmented by the creation of a non-distributable economic cycle reserve (ECR), which would set aside profit in good years to anticipate losses likely to arise in the future. See the UK Financial Services Authority's publication, *The Turner Review: A Regulatory Response to the Global Banking Crisis*, released in March 2009.

[5] We note that the International Accounting Standards Board is moving to an expected loss model for provisioning in its new standard, IFRS 9 *Financial Instruments*, July 2014. The new standard comes into effect from 1 January 2018.

[6] Beatty and Liao (2011) find that during the period after implementation of Basel risk-based capital regulations, banks with greater delays in expected loss recognition reduce their lending during recessions more than banks with smaller delays.

[7] In the United States, Beatty et al. (2002) find that publicly listed banks use discretion in their loan-loss provisions to avoid reporting small declines in earnings. Fonseca and González (2008) find that the extent of income smoothing by banks varies from country-to-country depending on investor protection and accounting disclosure, restrictions on bank activities and the extent of official and private supervision.

(Bikker and Metzemakers, 2005; Bouvatier and Lepetit, 2008). The counter-cyclical view is that credit risk is built up in a boom and materialises in a downturn. Favourable conditions associated with an economic expansion could lead to excessive increases in lending and a relaxation of lending standards. These practices may result in higher risks, which increase the likelihood of an economic recession. If banks set aside greater provisions in response to strong earnings, they are likely to increase provisions at a time when risks are building up in credit markets. In effect, this form of discretionary behaviour may reduce the pro-cyclicality of bank lending. A similar role may be performed by the allocation of surplus regulatory capital. For poorly-capitalised Japanese and European banks respectively, Shrieves and Dahl (2003) and Bouvatier and Lepetit (2008) find a positive relationship between surplus capital under the Basel I regulatory framework and loan-loss provisions. The findings of these studies suggest that banks increase provisions when their regulatory capital ratios improve. In this study, we test whether banks with surplus regulatory capital and above-average earnings set aside part of these surpluses to cover future credit losses.

3. Capital adequacy regulation in Australia

In Australia, banks are regulated by the Australian Prudential Regulation Authority (APRA), which was established in 1998. APRA has the power under federal legislation to set prudential standards, which underpin its approach to supervising depository institutions. The prudential standards set out minimum capital, governance and risk management requirements, which are legally binding.

3.1. Implementation of the Basel Accord capital requirements

Capital adequacy refers to the amount of capital maintained by depository institutions to absorb unanticipated losses. Prior to 1 January 2008, APRA's approach to assessing a bank's capital adequacy is based on the Basel I capital framework (the Basel Accord of 1988).[8] Under the rules of the Basel Accord, capital for supervisory purposes is considered in two tiers: tier 1 and tier 2.[9] Tier 1 (core capital) comprises the highest quality capital elements. A bank's capital base is the sum of its tier 1 and tier 2 capital less any deductions. At least 50% of a bank's capital base must be tier 1 capital. Under Basel I, all banks use standardised risk weights to calculate the capital requirement. The Basel Accord requires that the ratio of a bank's capital to risk-weighted assets (referred to as the risk-based capital ratio) be at least 8%.[10] Where it believes there are prudential reasons for doing so, APRA may require a bank to maintain a minimum capital ratio above 8% (in which case at least half of the ratio must take the form of tier 1 capital).

From 1 January 2008 to 31 December 2012, APRA's approach to assessing a bank's capital adequacy is based on the Basel II capital framework.[11] An innovation of the revised framework is the greater use of risk assessments provided by banks' internal systems as inputs to capital calculations. In particular, a bank that has received approval from APRA to use the IRB approach to credit risk is permitted to use its own internal models to quantify the capital required for credit risk. Aside from this feature, the revised framework retains key elements of the 1988 capital adequacy framework, including the requirement for banks to hold total capital equivalent to at least 8% of risk-weighted assets and the definition of eligible capital. APRA continues to have the discretion to increase the capital requirements for individual banks above Basel minimum requirements.[12]

After the period examined in this study (from 1 January 2013), APRA implemented the Basel III capital framework.[13] This reform package seeks to address lessons from the financial crisis of 2008 to 2009, by raising both the quality and quantity of the regulatory capital base. The new framework establishes a minimum requirement for common equity tier 1 capital (comprising common shares and retained earnings) of 4.5% of risk-weighted assets and increases the minimum requirement for tier 1 capital to 6% of risk-weighted assets. Furthermore, the new framework introduces a conservation buffer for common equity tier 1 capital of 2.5% of risk-weighted assets that can be drawn down in periods of stress and a countercyclical buffer of between 0% and 2.5% of risk-weighted assets to protect the banking sector from periods of excess credit growth.

APRA is empowered to impose a range of sanctions should a bank breach minimum capital requirements and intervenes at an early stage to prevent capital from falling below minimum levels. If a bank's capital ratio declines below the required capital ratio set by the regulator and towards the Basel minimum, APRA would significantly increase its supervisory intensity and require the bank to develop and implement a plan to restore its capital ratio. In situations where the bank is unable or unwilling to respond, APRA may resort to the exercise of formal powers under the *Banking Act 1959*. These include the power to restrict bank operations and to suspend payments to shareholders. In more serious cases, it has the power to order a compulsory transfer of the business of a bank or to revoke a banking licence. Consequently, a bank with capital that APRA considers to be inadequate is likely to incur greater regulatory costs than a bank with adequate capital.[14]

[8] For details of the Basel I capital framework, refer to Basel Committee on Banking Supervision's publication, *International Convergence of Capital Measurement and Capital Standards*, released in July 1988.

[9] Tier 1 capital is defined as the sum of the book value of equity (paid-up common stock and retained earnings), qualifying non-cumulative perpetual preferred stock and minority interests in the equity of subsidiaries less goodwill and other tangible assets. Tier 2 capital consists of other capital elements that contribute to the overall strength of a bank as a going concern but do not satisfy all of the characteristics of tier 1 capital. Tier 2 capital is the sum of the general reserve for credit losses (up to a maximum of 1.25% of risk-weighted assets), perpetual preferred stock, hybrid capital instruments, perpetual debt, mandatory convertible debt securities, subordinated term debt and intermediate preferred stock.

[10] A bank's risk-weighted assets for credit risk is calculated as the sum of risk-weighted on-balance sheet assets and risk-weighted off-balance sheet credit equivalent amounts. Under Basel I, assets and credit equivalent amounts of off-balance sheet items are assigned to one of several broad risk categories, according to the nature of the obligors, guarantors and collateral. The dollar amount in each risk category is then multiplied by the risk weight associated with that category. The sum of the resulting weighted values from each of the risk categories is the bank's credit risk-weighted assets.

[11] For details of the Basel II capital framework, refer to the Basel Committee on Banking Supervision's publication, *International Convergence of Capital Measurement and Capital Standards: A Revised Framework*, revised in June 2006.

[12] APRA generally exercises its power to set minimum requirements for tier 1 and total capital above minimum levels established by the Basel Committee (see International Monetary Fund, 2012: 54). Depository institutions are not permitted to disclose their required capital ratios, although their public documents indicate that the regulator sets such requirements.

[13] For details of the Basel III capital framework, refer to the Basel Committee on Banking Supervision's publication, *Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems*, released in December 2010 and revised in June 2011.

[14] This presumption assumes that regulators bestow no favours on commercial banks. If some favours are bestowed on commercial banks, the incentives to respond to regulatory costs are reduced but not eliminated (as noted by Moyer, 1990: 129).

3.2. APRA's forward-looking provisioning model

Australian banks use a forward-looking model of loan-loss provisioning specified by APRA for regulatory reporting purposes.[15,16] The regulatory model distinguishes between two types of provisions: specific provisions and a general reserve for credit losses (see *Prudential Standard APS 220 Credit Quality*, May 2006).[17] Specific provisions are provisions raised against credit losses that are expected to be realised in the short term (within the next 12–18 months). They include all provisions for impairment assessed by a bank on an individual basis in accordance with Australian accounting standards and a portion of provisions assessed on a collective basis which are not eligible to be included in the general reserve for credit losses.[18] The general reserve for credit losses is a reserve to cover credit losses that are expected but not certain to arise over the full life of the all the loans making up the business of the bank.

The evidence required to substantiate the general reserve for credit losses is less clearly defined than for specific provisions. In determining whether to raise specific provisions against a loan portfolio, the bank may consider factors such as the extent of non-compliance of loans with their contractual terms, the likelihood of loans which are not well secured being subject to administration or bankruptcy proceedings and internal or external credit ratings suggestive of a substantial increased risk of potential default. In contrast, the general reserve is to cope with latent losses for loans that are not currently in breach of contractual terms or exhibiting signs of distress. Factors relevant to determining the general reserve may include historical loss experience and recent trends in losses, but must also consider any factors that are likely to cause losses to differ from historical experience. These factors include amendments to lending policies, changes in the bank's risk profile and the impact of changes in economic and credit cycles. Assessing these factors necessitates the exercise of a range of subjective judgements. Consequently, the general reserve is potentially influenced by the discretionary behaviours of bank managers to a greater extent than specific provisions.

3.3. Treatment of loan-loss provisions under Basel I and Basel II

The level of provisioning and reserves established by a depository institution against potential credit losses has significant implications for the assessment of its capital adequacy. In Australia, the treatment of provisions in the capital ratio calculations is similar to that in most other countries adopting the Basel I and Basel II rules, except that general loan-loss reserves only qualify for inclusion in tier 2 capital on an *after-tax basis*.

Table 1 shows the impact of increasing specific provisions and the general reserve for credit losses on the risk-based capital ratios for all banks in the Basel I period and standardised banks in the Basel II period (panel A) and IRB banks in the Basel II period (panel B).[19] For Basel I banks and Basel II standardised banks (panel A), an increase in either specific provisions or the general reserve always reduces retained earnings by the after-tax amount of the provision or reserve. Although specific provisions reduce the amount of risk-weighted assets (RWA), the impact of an increase in specific provisions on the numerators of the capital ratios (through retained earnings) outweighs the impact on the denominator and lowers both the tier 1 capital ratio and the total capital ratio. The general reserve (on an after-tax basis) is eligible to be included in tier 2 capital up to 1.25% of RWA. Consequently, an increase in general reserves decreases the tier 1 capital ratio but leaves the total capital ratio unchanged (provided the bank has not exceeded the reserving threshold for general reserves for credit losses).

For Basel II IRB banks (Table 1 panel B), provisioning is a two-step process that is closely aligned with the bank's credit risk assessment methodology. In the first step, the IRB bank must separately estimate the expected losses (EL) for defaulted and non-defaulted exposures before any tax effects.[20] The sum of these two amounts immediately creates a shortfall that is charged 50% against tier 1 capital and 50% against tier 2 capital. Therefore, the estimation of the EL effectively decreases both the tier 1 capital ratio and the total capital ratio of the bank. In the second step, the bank allocates eligible provisions (EP) on an after-tax basis against the two categories of EL.[21] This allocation process further reduces the tier 1 capital ratio, because it reduces retained earnings at the same time that it reduces the shortfall in provisions being charged in equal amounts against tier 1 and tier 2 capital. Any surplus EP above EL on non-defaulted exposures up to 0.6% of RWA for credit risk is eligible to be included in tier 2 capital. Therefore, an increase in EP against EL on non-defaulted exposures decreases the tier 1 ratio, but leaves the total capital ratio unchanged until the reserving threshold is reached.

In summary, increasing provisions or reserves for anticipated credit losses always reduces the tier 1 capital ratio under the rules of the Basel Accord. It also reduces the total capital ratio, except when a standardised bank increases the general reserve for credit losses or an IRB bank allocates eligible provisions against expected losses on non-defaulted exposures within the reserving thresholds in each of these cases.

4. Data and sample

This study focuses on 23 banks operating in Australia with at least twelve quarters of relevant data in the period from September 2003 to December 2012. These banks represent about two-thirds of the number of banks and 99% of the total assets of Australian-incorporated banks. Table 2 presents the sample banks, comprising eighteen banks that use the standardised approach to credit risk across the entire sample period (in panel A) and five banks that

[15] APRA implemented its forward-looking model from 1 July 2006, when Australian accounting standards moved to an incurred loss model of provisioning consistent with International Financial Reporting Standards (IFRS). The adoption of IFRS meant that provisions for impairment must be based on loss experience and only recognised after an event on which the loss is based has occurred. This was a departure from previous practice under which general provisions were recognised where impairment was considered probable.

[16] As opposed to maintaining a parallel provisioning model for regulatory purposes, the approach in many other BCBS member countries has been to provide guidance to banks for determining accounting provisions in a way that is consistent with regulatory objectives. For example, banking regulators in the United States issue policy statements on determining the allowance for loan and lease losses in accordance with U.S. Generally Accepted Accounting Principles (see Federal Financial Institutions Examination Council, 2001, 2006).

[17] In this study, we focus on the levels of specific provisions and general reserves for credit losses rather than the quarterly changes in these measures, because the levels are more important for the financial soundness of the bank.

[18] Appendix 1 illustrates the movements in Australian accounting standards provisions used by the banks examined in this study. Appendix 2 illustrates the relationship between the two provisioning models used by Australian banks: the forward-looking model for regulatory purposes and the incurred loss model for reporting to the market.

[19] A standardised bank is a bank that is required to apply risk weights to its on-balance sheet assets and off-balance sheet exposures according to the risk classes delineated in the capital standards. An IRB bank is a bank that has approval from the regulator to use its own credit risk models for determining the risk weights.

[20] An IRB-approved bank uses its own credit rating system for estimating expected losses.

[21] Eligible provisions are defined as the sum of all provisions (specific provisions and general reserves for credit losses, partial write-offs and discounts on defaulted assets) that are attributed to exposures treated under the IRB approach.

Table 1
Treatment of loan-loss provisions under Basel I and Basel II.

Panel A: Basel I banks and Basel II standardised banks

Impact on:	Impact of a one dollar increase in: Specific provisions	Impact of a one dollar increase in: General reserves
Tier 1 capital ratio		
Numerator	↓ Retained earnings	↓ Retained earnings
Denominator	↓ RWA	No impact on RWA
Net impact	↓ Tier 1 capital ratio	↓ Tier 1 capital ratio
Total capital ratio		
Numerator	↓ Retained earnings	↓ Retained earnings ↑ General reserve (to a max. of 1.25% of total RWA)
Denominator	↓ RWA	No impact on RWA
Net impact	↓ Total capital ratio	None

Panel B: Basel II IRB banks

Impact on:	Impact of a one dollar increase in: Step 1: EL defaulted	Step 2: EP defaulted	Impact of a one dollar increase in: Step 1: EL non-defaulted	Step 2: EP non-defaulted
Tier 1 capital ratio				
Numerator	↑ Shortfall in provisions (50%)	↓ Retained earnings	↑ Shortfall in provisions (50%)	↓ Retained earnings
		↓ Shortfall in provisions (50%)		↓ Shortfall in provisions (50%)
Denominator	No impact on RWA	No impact on RWA	No impact on RWA	No impact on RWA
Net impact	↓ Tier 1 capital ratio	↓ Tier 1 capital ratio	↓ Tier 1 capital ratio	↓ Tier 1 capital ratio
Total capital ratio				
Numerator	↑ Shortfall in provisions	↓ Retained earnings ↓ Shortfall in provisions	↑ Shortfall in provisions	↓ Retained earnings ↓ Shortfall in provisions ↑ Surplus provisions (to a max. of 0.6% of credit RWA)
Denominator	No impact on RWA	No impact on RWA	No impact on RWA	No impact on RWA
Net impact	↓ Total capital ratio	None (when in shortfall)	↓ Total capital ratio	None

receive approval to use the IRB approach to credit risk in the Basel II period (in panel B).[22] Quarterly data are obtained from APRA's statistical data collections on the capital base, regulatory capital requirements, risk-weighted assets, non-performing loans, total loans, specific provisions and general reserves for credit losses, total assets, wholesale funding, shareholders' equity and earnings for the sample banks. Quarterly macroeconomic and financial market data are obtained from the Reserve Bank of Australia and Bloomberg respectively.

The analysis is restricted to licensed banks which are required to maintain capital in Australia.[23] These include domestic banks and foreign subsidiary banks. Branches of foreign banks are not required to maintain capital in Australia and these banks are excluded from the sample.[24] Building societies and credit unions apply a provisioning methodology prescribed by the regulator and these depository institutions are also excluded from the sample.[25]

[22] Macquarie Bank is accredited to use the foundation internal ratings-based (FIRB) approach to credit risk, where the bank must provide its own estimates of probability of default (PD) and maturity (M) and rely on supervisory estimates for loss given default (LGD) and exposure at default (EAD) in determining the capital requirement for a given credit exposure. ANZ Bank, Commonwealth Bank, National Australia Bank and Westpac are accredited to use the advanced internal ratings-based (AIRB) approach to credit risk, where the banks must provide their own estimates of all the credit risk components.

[23] Fifty-five observations for banks with tier 1 capital ratios before provisions greater than 30 per cent are excluded from the sample. These banks have little incentive to adjust provisions based on considerations of capital adequacy.

[24] Foreign bank branches are not permitted to accept retail deposits from Australian residents.

[25] Fifteen observations for one bank using the prescribed provisioning methodology are discarded.

Table 2
Sample banks.

Panel A: Standardised banks

Bank name	Bank type
Adelaide Bank Limited	Domestic
AMP Bank Limited	Domestic
Arab Bank Australia Limited	Foreign subsidiary
Bank of Cyprus Australia Limited	Foreign subsidiary
Bank of Queensland Limited	Domestic
Bank of Western Australia Ltd	Domestic
Beirut Hellenic Bank Ltd	Foreign subsidiary
Bendigo and Adelaide Bank Limited	Domestic
Citigroup Pty Limited	Foreign subsidiary
HSBC Bank Australia Limited	Foreign subsidiary
ING Bank (Australia) Limited	Foreign subsidiary
Investec Bank (Australia) Limited	Foreign subsidiary
Members Equity Bank Pty Limited	Domestic
NM Rothschild & Sons (Australia) Limited	Foreign subsidiary
Rabobank Australia Limited	Foreign subsidiary
Rural Bank Limited	Domestic
St. George Bank Limited	Domestic
Suncorp-Metway Limited	Domestic

Panel B: Internal ratings-based banks

Bank name	Bank type	IRB adoption date
Australia and New Zealand Banking Group Limited	Domestic	1 January 2008
Commonwealth Bank of Australia	Domestic	1 January 2008
Macquarie Bank Limited	Domestic	1 January 2008
National Australia Bank Limited	Domestic	1 July 2008
Westpac Banking Corporation	Domestic	1 January 2008

5. Results

5.1. Descriptive statistics

Table 3 presents descriptive statistics for the banks in our sample. Figures in this table are presented in annual terms.

Table 3
Descriptive statistics for sample bank-observations, $N = 796$.

Data item	Mean	Standard deviation	Lower quartile	Median	Upper quartile
Total loans $mil	63,034	104,908	2,840	12,965	49,815
Loans to households %	54.3	29.3	38.5	60.7	73.4
Loans to businesses %	45.6	29.3	26.4	39.2	61.5
Loans to government %	0.2	0.5	0.0	0.0	0.1
Non-performing loans %	1.87	2.48	0.57	0.99	2.00
RWA for credit risk %	90.5	34.6	68.9	81.3	103.0
GDP growth % pa	3.03	0.98	2.00	2.98	4.32
Leading index % pa	−0.18	0.80	−0.85	0.00	0.75
Uncertainty index % pa	18.8	9.1	11.6	16.4	23.1
Wholesale funding %	11.0	12.2	1.1	7.4	16.0
Specific provisions %	0.38	0.60	0.05	0.16	0.43
General reserves %	0.56	0.39	0.32	0.50	0.72
Tier 1 capital ratio	11.1	4.1	8.3	9.9	12.4
Total capital ratio	13.5	3.7	11.1	12.3	14.7
EBPT % pa	1.32	0.68	0.72	1.20	1.70

This table presents summary statistics for the banks in our sample. The sample period is September 2003 to December 2012. *Loans to households* is loans to households divided by total loans. *Loans to businesses* is loans to businesses divided by total loans. *Loans to government* is loans to government divided by total loans. *Non-performing loans* in non-performing loans divided by total loans. *RWA for credit risk* is the ratio of risk-weighted assets for credit risk to total loans. *GDP growth* is the real GDP growth rate. *Leading index* is the growth rate of the Westpac-Melbourne Institute Leading Index of Economic Activity. *Uncertainty index* is the level of the S&P/ASX 200 VIX. *Wholesale funding* is wholesale funding divided by total loans. Wholesale funding comprises settlement account balances due to financial institutions, acceptances, securities sold under agreement to repurchase, promissory notes/commercial paper and other debt securities and loans. *Specific provisions* is the ratio of specific provisions to total loans. *General reserves* is the ratio of general reserves for credit losses to total loans. *Tier 1 capital ratio* is the tier 1 risk-based capital ratio before provisions. The Basel II capital framework is implemented in Australia from 1 January 2008. The tier 1 capital ratio before provisions for standardised banks is calculated as tier 1 capital plus total provisions multiplied by one minus the corporate tax rate, divided by total risk-weighted assets plus specific provisions. The tier 1 capital ratio before provisions for IRB banks (after Basel II implementation) is calculated as tier 1 capital plus total provisions multiplied by one minus the corporate tax rate plus the shortfall in provisions for credit losses (50%), divided by total risk-weighted assets. *Total capital ratio* is the total risk-based capital ratio before provisions. The total capital ratio before provisions for standardised banks is calculated as total capital plus total provisions multiplied by one minus the corporate tax rate minus the general reserve for credit losses (to a maximum of 1.25% of total RWA), divided by total risk-weighted assets plus specific provisions. The total capital ratio before provisions for IRB banks (after Basel II implementation) is calculated as total capital plus total provisions multiplied by one minus the corporate tax rate plus the shortfall in provisions for credit losses minus surplus provisions on non-defaulted exposures (to a maximum of 0.6% of credit RWA), divided by total risk-weighted assets. *EBPT* is earnings before provisions and taxes, divided by average assets. All flow variables in this table are presented in annual terms.

Fig. 1 illustrates provisions as a percentage of total loans by type from September 2003 through December 2012. The average size of the loan portfolio for all sample banks is $63.0 billion (Table 3).

In this study, we use three backward-looking measures of the credit risk associated with a bank's loan portfolio: (i) the ratio of non-performing loans to total loans[26]; (ii) the ratio of risk-weighted assets for credit risk before provisions to total loans[27]; and (iii) the average real GDP growth rate over the past four quarters. Further, we use two forward-looking indicators of credit market conditions: (i) the growth rate of the Westpac-Melbourne Institute Leading Index of Economic Activity[28]; and (ii) aggregate uncertainty as measured by the S&P/ASX 200 VIX index.[29] For sample banks, the median ratio of non-performing loans to total loans is 0.99% and the median ratio of credit risk-weighted assets before provisions to total loans is 81.3%. The median annualised GDP growth rate is nearly 3%.

For sample banks, the mean ratio of total provisions to total loans is 94 basis points, comprising specific provisions of 38 basis points and general reserves for credit losses of 56 basis points. After decreasing over a period of four and a half years, both specific provisions and general reserves increase abruptly in response to the financial crisis of 2008–2009, then decline towards pre-crisis levels (see Fig. 1).

A bank's capital position is measured by the tier 1 capital ratio and the total capital ratio. Similar to Kim and Kross (1998), we adjust the risk-based capital ratios to eliminate the influence of loan-loss provisions.[30] The mean tier 1 and total capital ratios before provisions for all sample banks are 11.1% and 13.5% respectively, suggesting that on average banks have a comfortable buffer above the Basel minimum requirements.[31]

Table 4 presents the correlations between the variables in our sample. Specific provisions are positively correlated with general reserves for credit losses. Banks with smaller loan books, greater exposure to business lending, more non-performing loans, higher credit risk-weighted assets, stronger capital ratios relative to regulatory requirements and that fund a greater proportion of their loan books with wholesale borrowings have higher provisions (both specific provisions and general reserves). Banks have higher specific provisions when economic growth has been weak in recent quarters and when there is greater uncertainty about future economic conditions.

[26] A loan is non-performing when payments of interest and principal are 90 days or more past due or payments are less than 90 days past due, but there are other good reasons to doubt that payments will be made in full.

[27] For standardised banks, RWA for credit risk are calculated net of specific provisions but gross of general reserves for credit losses. Therefore, specific provisions are added back to RWA to reflect the amount before provisions. For IRB banks, RWA for credit risk are measured gross of both specific provisions and general reserves for credit losses. Therefore, no adjustment is required to reflect the amount of credit RWA before provisions for these banks.

[28] The Westpac-Melbourne Institute Leading Index of Economic Activity combines a selection of economic variables that typically lead fluctuations in economic activity into a single measure that provides a cyclical indicator for the Australian economy. The component variables are the S&P/ASX 200 index, dwelling approvals, United States industrial production, Reserve Bank of Australia Commodity Prices Index, aggregate monthly hours worked, Westpac-Melbourne Institute Consumer Sentiment Index, Westpac-Melbourne Institute Unemployment Expectations Index and the term spread (10 year bonds minus 90-day bank bills).

[29] Computed since January 2008, the S&P/ASX 200 VIX measures the 30-day implied volatility of the Australian stock market using mid prices for S&P/ASX 200 put and call options. Before this period, we use the average of the implied volatilities on closest maturity S&P/ASX 200 put and call options.

[30] In this way, the risk-based capital ratios used in this study represent the capital ratios faced by the bank before it raises provisions to cover any potential credit losses.

[31] Furthermore, Australian banks generally maintain a comfortable buffer over APRA-imposed minimum capital levels in the period examined in this study.

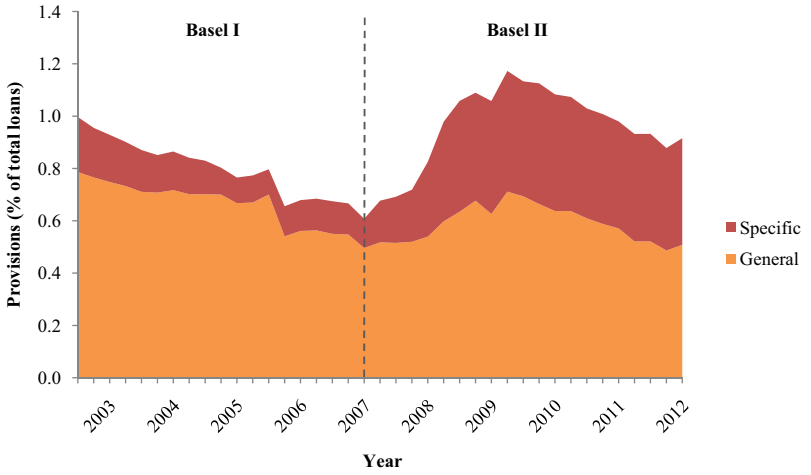

Fig. 1. Regulatory loan-loss provisions by type. This figure plots provisions as a percentage of total loans by type from June 2003 through December 2012. The Basel II capital framework is implemented in Australia from 1 January 2008. Numbers in this figure are presented on an asset-weighted basis.

Table 4
Pearson correlation coefficients for key variables of the sample bank-observations.

	LOGSIZE	LBUS	NPL	RWAC	GDPG	LEAD	AVIX	WFUND	SPROV	GRCL	RT1CAP	RCAPB
LBUS	−0.40***											
NPL	−0.22***	0.40***										
RWAC	−0.23***	0.50***	0.35***									
GDPG	−0.06*	0.00	−0.15***	0.14***								
LEAD	−0.04	0.02	−0.06	0.08**	0.11***							
AVIX	0.07*	−0.03	0.13***	−0.14***	−0.40***	−0.62***						
WFUND	0.27***	−0.13***	0.04	0.42***	−0.06	−0.01	0.04					
SPROV	−0.15***	0.31***	0.77***	0.45***	−0.09***	−0.03	0.08**	0.11***				
GRCL	−0.08**	0.39***	0.44***	0.59***	−0.07*	0.06*	−0.04	0.12***	0.59***			
RT1CAP	−0.41***	0.31***	0.05	0.11***	0.04	0.04	−0.09***	−0.15***	0.15***	0.19***		
RCAPB	−0.30***	0.31***	0.03	0.19***	0.05	0.06*	−0.13***	0.05	0.13***	0.25***	0.89***	
EBPT	0.16***	−0.03	−0.03	0.08**	0.01	0.05	−0.04	0.02	0.06	0.04	0.06*	0.04

LOGSIZE is the logarithm of total loans and advances in billions of Australian dollars. *LBUS* is loans to businesses divided by total loans. *NPL* is non-performing loans divided by total loans. *RWAC* is the ratio of risk-weighted assets for credit risk to total loans. *GDPG* is the average real GDP growth rate over the past four quarters. *LEAD* is the change in the Westpac-Melbourne Institute Leading Index of Economic Activity relative to the previous quarter. *AVIX* is the level of the S&P/ASX 200 VIX index. *WFUND* is wholesale funding divided by total loans. *SPROV* is the ratio of specific provisions to total loans. *GRCL* is the ratio of general reserves for credit losses to total loans. *RT1CAP* is the difference between the actual tier 1 risk-based capital ratio before provisions and the required tier 1 risk-based capital ratio set for the bank by the regulator. *RCAPB* is the difference between the actual total risk-based capital ratio before provisions and the required total risk-based capital ratio set for the bank by the regulator. *EBPT* is earnings before provisions and taxes divided by average assets. *, ** and *** indicate significance at the 10%, 5% and 1% levels.

5.2. The effects of credit risk, capital adequacy and earnings on bank provisioning

5.2.1. Analysis for all banks

In this subsection, a panel regression approach is used to examine the effects of credit risk, capital adequacy and earnings on loan-loss provisioning practices for all sample banks. Specifically, the levels of provisions are regressed on various bank characteristics including measures of credit risk, risk-based capital ratios before provisions in excess of regulatory requirements and earnings before provisions and taxes.

The specification of the panel regression is as follows:

$$PROV_{i,t} = \alpha_i + \beta_1 \times NPL_{i,t} + \beta_2 \times RWAC_{i,t} + \beta_3 \times GDPG_t + \beta_4 \times LEAD_t + \beta_5 \times AVIX_t + \beta_6 \times IRB_{i,t} + \gamma_1 \times RCAP_{i,t} + \gamma_2 \times EBPT_{i,t} + \gamma_3 \times WFUND_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $PROV_{i,t}$ is the ratio of provisions (specific provisions or general reserves for credit losses) to total loans, $NPL_{i,t}$ is non-performing loans divided by total loans, $RWAC_{i,t}$ is the ratio of risk-weighted assets for credit risk before provisions to total loans, $GDPG_t$ is the average real GDP growth rate over the past four quarters, $LEAD_t$ is the change in the Westpac-Melbourne Institute Leading Index of Economic Activity relative to the previous quarter, $AVIX_t$ is the level of the S&P/ASX 200 VIX index, $IRB_{i,t}$ is a zero-one dummy variable which equals one if the bank has received approval to use the internal ratings-based approach to credit risk, $RCAP_{i,t}$ is the difference between the actual risk-based capital ratio (the tier 1 capital ratio or the total capital ratio) before provisions and the required risk-based capital ratio set for the bank by the regulator, $EBPT_{i,t}$ is earnings before provisions and taxes divided by average assets and $WFUND_{i,t}$ is wholesale funding divided by total loans. Bank-specific intercepts capture any unobserved bank effects not included in the model (for example, degrees of sectoral or geographic concentration or different business models in general). All *t*-statistics are adjusted for cross-sectional and time-series dependence in the regression residuals by clustering the standard errors at both the bank and quarter levels (as suggested by Thompson, 2011).[32]

The regression results are presented in Table 5. Concerning the backward-looking measures of credit risk, the coefficients on NPL

[32] For our baseline results, the clustered standard errors are substantially larger than when we run the same regressions with robust White-corrected standard errors. This check suggests that there are sufficient clusters in the bank dimension for the two-way clustering procedure to effectively correct the standard errors for heteroskedasticity.

Table 5
The effects of credit risk, regulatory capital adequacy and earnings on bank provisioning practices.

	Specific provisions		General reserves	
Independent variables	(1)	(2)	(3)	(4)
NPL	0.1699***	0.1710***	0.0282***	0.0286**
	(12.63)	(12.97)	(2.58)	(2.47)
RWA for credit risk	0.0020	0.0021	0.0021*	0.0021*
	(0.60)	(0.65)	(1.74)	(1.86)
GDP growth	0.0507	0.0528	−0.1594***	−0.1555**
	(0.67)	(0.69)	(−2.61)	(−2.52)
Leading index	0.0165	0.0199	0.0349*	0.0370*
	(0.37)	(0.45)	(1.80)	(1.73)
Uncertainty index	0.0045	0.0053	0.0019	0.0022
	(0.70)	(0.84)	(0.76)	(0.83)
IRB approach	0.0011	0.0011	−0.0015**	−0.0014**
	(0.66)	(0.74)	(−2.28)	(−2.08)
Excess tier 1 capital	0.0160		0.0154*	
	(1.53)		(1.67)	
Excess total capital		0.0228**		0.0177*
		(1.97)		(1.67)
EBPT	−0.0142	−0.0174	0.0409*	0.0396
	(−0.62)	(−0.75)	(1.66)	(1.55)
Wholesale funding	0.0144**	0.0134**	0.0009	0.0001
	(2.05)	(2.01)	(0.36)	(0.04)
Bank intercepts	Yes	Yes	Yes	Yes
Quarter intercepts	No	No	No	No
R^2	0.79	0.79	0.75	0.75
Banks	23	23	23	23
Observations	796	796	796	796
Effect of LQ to UQ change (%)				
Excess tier 1 capital	0.04		0.04	
Excess total capital		0.06		0.05

This table examines the effects of credit risk, regulatory capital adequacy and earnings on bank loan-loss provisions. The sample period is September 2003 to December 2012. *Specific provisions* is the ratio of specific provisions to total loans. *General reserves* is the ratio of general reserves for credit losses to total loans. *NPL* is non-performing loans divided by total loans. *RWA for credit risk* is the ratio of risk-weighted assets for credit risk to total loans. *GDP growth* is the average real GDP growth rate over the past four quarters. *Leading index* is the change in the Westpac-Melbourne Institute Leading Index of Economic Activity relative to the previous quarter. *Uncertainty index* is the level of the S&P/ASX 200 VIX. *IRB approach* is a zero-one dummy variable which equals one if the bank has received approval to use the IRB approach to credit risk. *Excess tier 1 capital* is the difference between the actual tier 1 risk-based capital ratio before provisions and the required tier 1 risk-based capital ratio set for the bank by the regulator. *Excess total capital* is the difference between the actual total risk-based capital ratio before provisions and the required total risk-based capital ratio set for the bank by the regulator. *EBPT* is earnings before provisions and taxes divided by average assets. *Wholesale funding* is wholesale funding divided by total loans. Robust *t*-statistics in parentheses are based on standard errors clustered at both the bank and quarter levels. *, ** and *** indicate significance at the 10%, 5% and 1% levels. *Effect of LQ to UQ change* is the estimated coefficient for the excess capital ratio multiplied by the interquartile range of the excess capital ratio for all bank-observations.

and RWA for credit risk are both expected to be positive since an increase in non-performing loans or risk-weighted assets for credit risk implies an increase in expected credit losses. The GDP growth variable captures the effect of recent macroeconomic conditions on loan-loss provisions, beyond the risk profile of an individual bank.[33] The coefficient on GDP growth is expected to be negative since credit losses are likely to be higher in a deteriorating macroeconomic environment. In the regressions for specific provisions (columns 1 and 2), the coefficient on NPL is positive and significant but those on RWA for credit risk and GDP growth are statistically insignificant. In the regressions for general reserves for credit losses (columns 3 and 4), the coefficients on both NPL and RWA for credit risk are positive and significant and the coefficient on GDP growth is negative and significant. These results are consistent with the idea that banks raise specific provisions in response to existing impairments, whereas they raise the general reserve in response to existing impairments together with the inherent quality of the loan portfolio and prevailing economic conditions.[34]

Turning to the forward-looking indicators of credit market conditions, the coefficient on the leading index can be expected to be positive if banks build up additional provisions when the outlook for lending activity is improving (for example, when dwelling approvals and business confidence are rising). Further, the coefficient on the uncertainty index can be expected to be positive if banks allocate provisions to protect against uncertainty about future credit market conditions. The estimated coefficient on the leading index is positive and significant at the 10% level in the regressions for general reserves. This result is consistent with forward-looking behaviour by bank managers, who allow higher provisions when economic activity is gathering momentum and the demand for loanable funds is increasing.[35] Despite the positive coefficient against the uncertainty index in all regressions, there is no statistically significant evidence that bank managers buttress provisions to allow for uncertainty about market conditions. In the context of the Basel framework, this latter function may reside more naturally with capital than with provisions.

The coefficient on the IRB dummy variable is expected to be positive, if internal ratings-based banks allocate higher provisions to mitigate against the model risk associated with estimating expected losses using their internal models. There is no evidence

[33] As an alternative, we try using the seasonally-adjusted unemployment rate to measure the state of the business cycle. The results are similar to those reported in Table 5.

[34] APRA reviews the provisioning practices being applied by banks and, in some cases, exercises its power to increase levels of provisioning. Thus, in addition to a bank's assessment, the provisions will sometimes reflect the regulator's assessment of default risk.

[35] We obtain similar results when we use medium-term GDP growth forecasts released by the International Monetary Fund to measure the outlook for lending activity.

for this conjecture in the regression results. To the contrary, the results suggest that IRB banks have significantly lower general reserves for credit losses after they adopt the IRB approach to credit risk.[36] The general reserves for IRB banks are based on their own internal estimates of expected losses on non-defaulted credit exposures. This reliance on the internal modelling methodologies of IRB banks for estimating expected losses may come at a cost of lower general reserves.

Under the Basel rules, if banks with surplus regulatory capital use part of that surplus to boost provisions, we would expect to see positive coefficients on the variables which account for excess tier 1 capital and excess total capital. The estimated coefficients for these variables are positive in all four regressions and are statistically significant in the regressions for the impact of excess total capital on specific provisions and for the impact of excess tier 1 and total capital on general reserves. These results are consistent with surplus capital being used to increase provisions, with the surplus being directed towards funding both short-term credit losses through specific provisions and medium to longer-term credit losses through the general reserve.[37] The effect of the excess capital ratios on bank provisioning practices is economically significant. For example, changing from a bank at the lower quartile for its excess tier 1 capital before provisions to a bank at the upper quartile is associated with an additional 4 basis points in specific provisions and an additional 4 basis points in general reserves.

The positive relationship between excess regulatory capital and provisions contrasts with the results of studies by Ahmed et al. (1999) and Pérez et al. (2008). Ahmed, Takeda and Thomas document a significantly negative relationship between regulatory capital and provisions for United States banks under the Basel I framework. Their finding can be explained by the different treatment of provisions under United States capital standards; where the *before-tax amount* of general loan-loss reserves counts as tier 2 capital up to the threshold of 1.25% of RWA and reduces RWA in excess of the threshold. Consequently, banks concerned about falling below the Basel minimum requirement for total capital may have an incentive to increase general provisions. No such incentive exists under Australian prudential standards in the period for this study (see Table 1). Pérez, Salas-Fumás and Saurina find no evidence of a relationship between regulatory capital and provisions for Spanish banks in a period spanning pre-Basel and Basel I. In Spain, loan-loss reserves are counted as neither tier 1 nor tier 2 capital. The lack of a positive relationship between regulatory capital and provisions in their study can be explained by the prescriptive rules for provisioning established by the Spanish central bank, that more strictly limit the discretion of bank managers to alter provisions than in other countries including Australia.

If banks provision more in times when earnings are higher, then we would expect a positive relation between earnings before provisions and taxes (EBPT) and loan-loss provisions. The coefficient in front of EBPT is positive in both regressions for general reserves (columns 3 and 4 of Table 5) and is significant at the 10% level in column 3. However, the coefficient on this variable is statistically insignificant in the regressions for specific provisions (columns 1 and 2). These results suggest that banks accumulate more provisions when earnings are higher and are disposed towards funding medium to longer-term credit losses in this way. The significant relationship with general reserves is consistent with Hess et al. (2009), who find evidence of a positive relationship between earnings before provisions and taxes and bad-debt expense for Australian banks.

In addition, banks that fund a greater proportion of their loan books with wholesale borrowings have significantly higher specific provisions, suggesting that these banks may receive slightly more scrutiny of their provisions from the market.[38,39]

5.2.2. Further analysis for internal ratings-based banks

To better understand the incentives facing IRB banks under the revised Basel Accord, we investigate whether either the expected losses (EL) or eligible provisions (EP) reported by an IRB bank may be influenced by the strength of the bank's capital base.

Table 6 reports descriptive statistics for EP and EL reported by IRB banks (panel A), together with the results of panel regressions to examine the impact of capital before provisions on the ratio of EL to total loans (panel B), the ratio of EP to EL (panel C) and the ratio of EP to total loans (panel D). The table presents results separately for defaulted and non-defaulted exposures. Fig. 2 illustrates the progression of EL as a percentage of total loans by exposure type (panel A) and total EP as a percentage of total EL and the risk-based capital ratios (panel B) for the five sample IRB banks through the Basel II period. Numbers in the figure are presented on an asset-weighted basis.

For the IRB banks, the mean ratios of EL to total loans in the Basel II period are 80 basis points for defaulted exposures and 70 basis points for non-defaulted exposures (Table 6, panel A). In comparison, the mean ratios of EP to total loans are 61 basis points for defaulted exposures and 44 basis points for non-defaulted exposures.[40] Expected losses (especially those on defaulted exposures) increase in response to the financial crisis of 2008–2009 (Fig. 2, panel A). As a percentage of total EL, the total EP allocated by IRB banks shows a slight upward trend over the Basel II period (Fig. 2, panel B). In the same period, IRB banks increased their tier 1 capital ratios (with a main emphasis on common equity tier 1 capital), in preparation for the more stringent capital adequacy requirements forthcoming under the Basel III framework.

In the regressions to explain the ratio of expected losses to total loans (Table 6, panel B), credit risk is captured by the ratio of non-performing loans to total loans (NPL) together with bank-specific fixed effects. Because IRB banks use their internal models for estimating both RWA and EL for credit risk, we deflate capital before

[36] A potential identification concern is that the switch to the IRB regime is contemporaneous with the 2008–2009 financial crisis. To help disentangle these effects, we try including a crisis dummy variable alongside an interaction term to capture crisis effects specific to IRB banks. Both of these additional terms are insignificant in the regressions for general reserves and the results with respect to the IRB dummy variable are unchanged.

[37] In unreported analysis, we test whether standardised banks with high levels of general reserves are more capital-sensitive when setting general reserves. To test this proposition, we examine whether the coefficients on the excess capital ratios are larger for standardised banks that have general reserves greater than 1.25% of RWA. Note that there are only fourteen observations in our sample meeting this condition. The analysis reveals no statistically significant differences. We cannot test whether IRB banks exceeding the reserving threshold are more capital-sensitive when setting general reserves, because there are no observations in our sample for which an IRB bank has surplus provisions on non-defaulted exposures greater than 0.6% of credit RWA.

[38] An alternative explanation for the positive relationship between wholesale funding and specific provisions is that banks that use higher levels of wholesale funding have less diversified portfolios. However, an analysis of industry sectors does not provide support for this alternative explanation: the four major Australian banks use higher levels of wholesale funding than other Australian banks and foreign subsidiary banks, despite the major banks having *more* diversified loan portfolios relative to banks in the other industry sectors.

[39] In unreported analysis, we test for a structural break in provisioning practices when APRA implemented its new provisioning model from 1 July 2006. Results suggest that specific provisions are significantly higher under the new regime. However, there is no evidence that general provisions are affected. When we control for the structural break in the regression analysis, the results reported in this section continue to hold.

[40] Aggregating across both categories of exposures, total EP represents 70.2% of total EL. This percentage is close to 100 minus the Australian company tax rate of 30%, suggesting that on average IRB banks allocate provisions on a before-tax basis close to total EL. Whereas EL are reported on a before-tax basis, EP are required to be reported on an after-tax basis in the Basel II period.

provisions by total assets instead of risk-weighted assets (to avoid using the endogenously determined risk-based capital ratio in the regressions). The results show that the coefficients on the total asset-based capital ratios (Tier 1 capital/TA and Total capital/TA) are positive and significant in the first regression for defaulted exposures (column 1) and in both regressions for non-defaulted exposures (columns 3 and 4). In interpreting these results, we note that all of the Australian IRB banks raised significant amounts of

Table 6
The effect of bank capital ratios on eligible provisions under the IRB approach.

Panel A: Descriptive statistics, N = 98

Data item	Defaulted exposures	Non-defaulted exposures
Eligible provisions		
Mean %	0.61	0.44
Median %	0.43	0.40
Standard deviation %	0.43	0.13
Expected losses		
Mean %	0.80	0.70
Median %	0.49	0.66
Standard deviation %	0.68	0.17

Panel B: Regression of expected losses relative to total loans on bank capital ratios

	EL^{def}/TL		$EL^{non\text{-}def}/TL$	
Independent variables	(1)	(2)	(3)	(4)
NPL	0.4233***	0.4353***	0.0196	0.0310*
	(14.79)	(15.92)	(1.38)	(1.78)
Tier 1 capital/TA	0.0915**		0.0705***	
	(2.71)		(6.83)	
Total capital/TA		0.0444		0.0986***
		(1.22)		(7.66)
EBPT	0.0634	0.0495	−0.0565	−0.0687
	(0.64)	(0.51)	(−1.02)	(−1.09)
Bank intercepts	Yes	Yes	Yes	Yes
R^2	0.94	0.93	0.58	0.64
Banks	5	5	5	5
Observations	98	98	98	98
Effect of LQ to UQ change (%)				
Tier 1 capital/TA	0.16		0.12	
Total capital/TA		0.10		0.22

Panel C: Regression of eligible provisions relative to expected losses on bank capital ratios

	EP^{def}/EL^{def}		$EP^{non\text{-}def}/EL^{non\text{-}def}$	
Independent variables	(1)	(2)	(3)	(4)
Excess tier 1 capital	0.9954		5.2371***	
	(0.54)		(4.10)	
Excess total capital		0.3937		1.4125
		(0.22)		(1.06)
EBPT	−2.4124	−2.4021	−0.2208	0.4195
	(−0.29)	(−0.27)	(−0.05)	(0.08)
Bank intercepts	Yes	Yes	Yes	Yes
R^2	0.46	0.46	0.57	0.48
Banks	5	5	5	5
Observations	98	98	98	98
Effect of LQ to UQ change (%)				
Excess tier 1 capital	1.12		5.90	
Excess total capital		0.42		1.52

Panel D: Regression of eligible provisions relative to total loans on bank capital ratios

	EP^{def}/TL		$EP^{non\text{-}def}/TL$	
Independent variables	(1)	(2)	(3)	(4)
NPL	0.1394***	0.1584***	−0.0162	−0.0025
	(4.52)	(3.80)	(−1.46)	(−0.20)
Tier 1 capital/TA	0.1441***		0.0895***	
	(4.61)		(5.62)	
Total capital/TA		0.0737**		0.1006***
		(2.36)		(5.26)
EBPT	−0.0682	−0.0903	−0.0011	−0.0160
	(−0.82)	(−0.83)	(−0.02)	(−0.27)
Bank intercepts	Yes	Yes	Yes	Yes

Table 6 (*continued*)

Panel D: Regression of eligible provisions relative to total loans on bank capital ratios	EP^{def}/TL		$EP^{non\text{-}def}/TL$	
Independent variables	(1)	(2)	(3)	(4)
R^2	0.88	0.84	0.52	0.55
Banks	5	5	5	5
Observations	98	98	98	98
Effect of LQ to UQ change (%)				
Tier 1 capital/TA	0.25		0.16	
Total capital/TA		0.17		0.23

This table examines the relation between bank capital adequacy and eligible provisions under the internal ratings-based approach to credit risk. The sample period is March 2008 to December 2012. Eligible provisions are reported on an after-tax basis and net of any associated deferred tax assets. Panel A reports summary statistics of the ratio of eligible provisions to total loans and the ratio of expected losses to total loans. Panel B reports the results of regressing the ratio of expected losses to total loans on bank capital ratios before provisions. Panel C reports the results of regressing the ratio of eligible provisions to expected losses on bank capital ratios before provisions. Panel D reports the results of regressing the ratio of eligible provisions to total loans on bank capital ratios before provisions. EP^{def} is eligible provisions on defaulted exposures. $EP^{non\text{-}def}$ is eligible provisions on non-defaulted exposures. EL^{def} is expected losses on defaulted exposures. $EL^{non\text{-}def}$ is expected losses on non-defaulted exposures. *TL* is total loans. *NPL* is non-performing loans divided by total loans. *Tier 1 capital/TA* is tier 1 capital divided by total assets before provisions. *Total capital/TA* is total capital divided by total assets before provisions. *Excess tier 1 capital* is the difference between the actual tier 1 risk-based capital ratio before provisions and the required tier 1 risk-based capital ratio set for the bank by the regulator. *Excess total capital* is the difference between the actual total risk-based capital ratio before provisions and the required total risk-based capital ratio set for the bank by the regulator. *EBPT* is earnings before provisions and taxes divided by average assets. Robust *t*-statistics in parentheses are based on standard errors clustered at the quarter level. *, ** and *** indicate significance at the 10%, 5% and 1% levels. *Effect of LQ to UQ change* is the estimated coefficient for the capital ratio multiplied by the interquartile range of the capital ratio for IRB bank-observations.

new capital as a response to severe funding pressures in offshore wholesale markets over 2008 and 2009.[41] Over this period, the banks in our sample mostly relied on private placements, dividend reinvestment plans and, to a lesser extent, share purchase plans. However, the expected losses of IRB banks did not peak until June 2010 (see Fig. 2, panel A). In these circumstances, the regression results suggest that IRB banks did not consider the likelihood of more adverse conditions until they had rebuilt their capital base.[42] That is, banks may not have fully revised their estimates for the probability of default (PD) and loss given default (LGD) associated with credit exposures until they had a sufficient capital buffer to cope with the stressed conditions and meet the requirements of the Basel III framework.[43]

In the regressions to explain the ratio of eligible provisions to expected losses (Table 6, panel C), the excess risk-based capital ratios before provisions are used as explanatory variables on the basis that the banks allocate EP against EL independently of the process for estimating total RWA.[44] Noticeably, the estimated coefficient in front of excess tier 1 capital is positive and statistically significant in the regression for the ratio of EP to EL on non-defaulted exposures (column 3), implying that banks allocate higher EP against EL on these exposures when their tier 1 capital ratios are further above levels required for each bank by the regulator. In economic terms, changing from an IRB bank at the lower quartile for its excess tier 1 capital ratio before provisions to an IRB bank at the upper quartile is associated with an increase in the ratio of EP to EL on non-defaulted exposures of 5.9%. In contrast, the coefficient in front of excess total capital is statistically insignificant in the regression for non-defaulted exposures (column 4). These findings are consistent with the allocation of EP against EL reducing the tier 1 capital ratio, but having no impact on the total capital ratio (see Table 1, panel B).

Table 6, panel D examines the combined effect of capital before provisions on the ratio of eligible provisions to total loans. Following the approach used in panel B, credit risk is measured by the NPL variable and bank-specific fixed effects and the impact of capital before provisions is measured by the variables Tier 1 capital/TA and Total capital/TA, to avoid relying on endogenous risk estimates. The coefficients in front of Tier 1 capital/TA and Total capital/TA are positive and significant in all four regressions, suggesting that IRB banks use surplus regulatory capital to increase EP on both defaulted and non-defaulted exposures under the Basel II framework.

6. Conclusion

Based on confidential regulatory data collected by APRA, this study examines the loan-loss provisioning practices of 23 banks operating in Australia in the period from September 2003 to December 2012. In a departure from accounting standards, APRA administers a forward-looking provisioning model for the prudential supervision of banks. The model distinguishes between specific provisions to cover credit losses expected to be realised in the next 12–18 months and a general reserve to cover losses that are expected but not certain to arise over the full life of all the loans in a bank's portfolio. The forward-looking model is consistent with the expected loss approach to provisioning advocated by the Basel Committee on Banking Supervision in its Basel III reforms.

Analysing provisioning behaviour across the whole sample, we find evidence that: (i) banks incorporate forward-looking indicators of lending growth as part of their assessment of default risk, (ii) banks allocate part of surplus capital above bank-specific regulatory requirements to pre-fund future credit losses through provisions, and (iii) banks accumulate additional provisions when their earnings are higher. These findings imply that bank provisioning behaviour has both pro-cyclical and counter-cyclical characteristics: Provisions are sensitive to cyclical fluctuations in default risk; however, banks adjust provisions in anticipation of future economic conditions and to cushion the impact of cyclical fluctuations in capital adequacy and earnings. In addition, banks that fund a greater proportion of their loan books with wholesale borrowings maintain significantly higher provisions, suggesting that these banks may be more closely monitored by wholesale funding markets.

[41] For example, market statistics show that the four major banks, ANZ Bank, Commonwealth Bank, National Australia Bank and Westpac were among the top five Australian companies for secondary capital raisings over 2008 and 2009, raising a total of $37.8 billion (see the Australian Securities Exchange report, *Capital Raising in Australia: Experiences and Lessons from the Global Financial Crisis*, ASX Information Paper, 29 January 2010).

[42] The credit risk parameters used by the IRB banks for provisioning purposes are likely to be influenced by the recommendations of auditors and the banking regulator.

[43] An alternative explanation is that banks were monitoring developments in the United States subprime lending market, but did not have sufficient evidence to revise loss expectations until the spill-over effects on economic activity were felt in their key lending markets in Australia and abroad. This explanation seems less plausible, given that business confidence as measured by the National Australia Bank decreased at a rapid pace in 2008 and bottomed in early 2009.

[44] This assumption is consistent with the two distinct steps by which IRB banks determine their provisioning levels, depicted in Table 1, panel B.

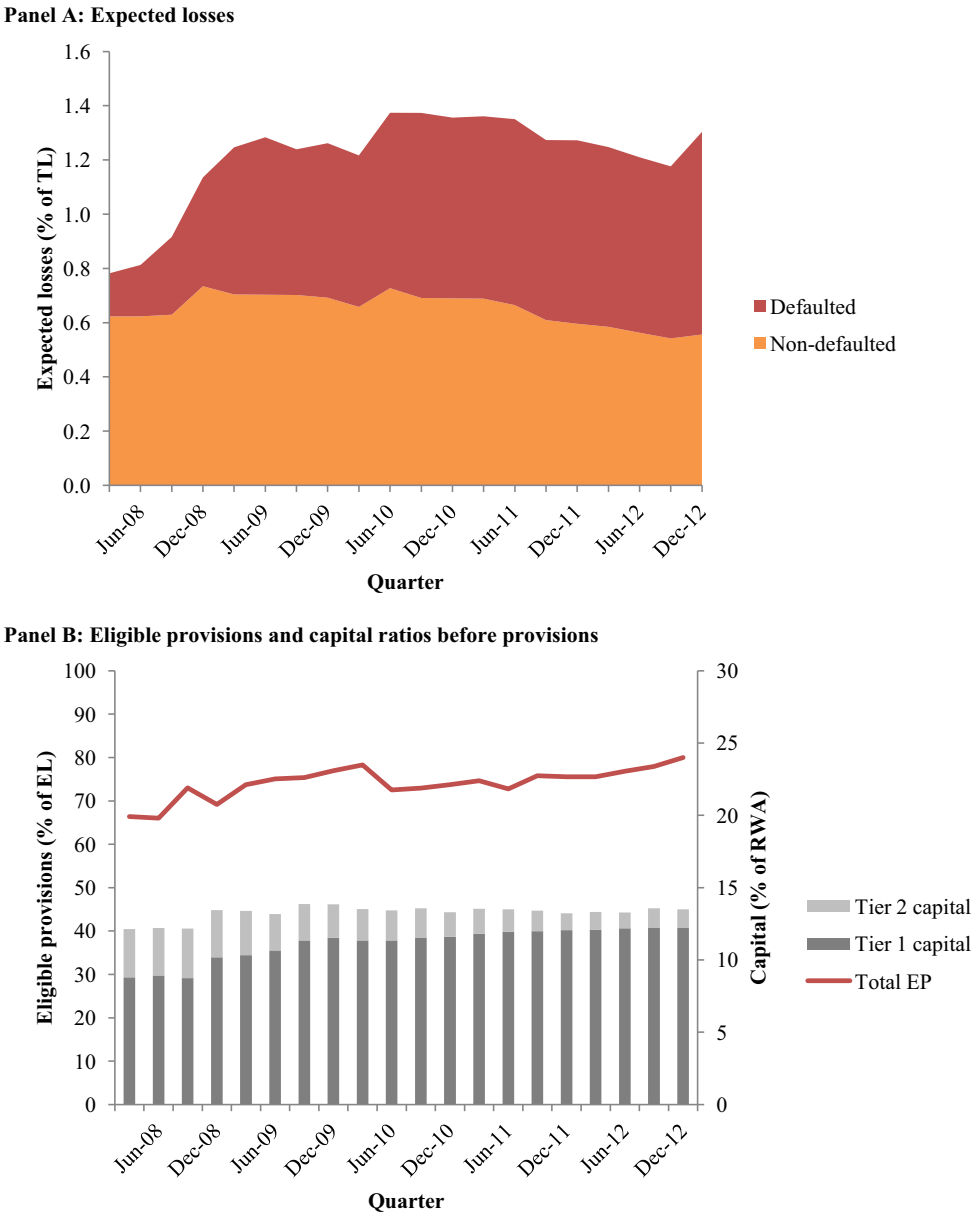

Fig. 2. Provisioning inputs and capital ratios of Basel II IRB-approved banks. This figure illustrates the progression of provisioning inputs and capital adequacy for the IRB banks, under the Basel II capital framework from March 2008 through December 2012. Panel A plots IRB-expected losses as a percentage of total loans by type. Panel B plots IRB-eligible provisions as a percentage of total expected losses and tier 1 and tier 2 risk-based capital ratios before provisions. Numbers in this figure are presented on an asset-weighted basis.

A feature of the Basel II capital framework is the greater use of IRB banks' internal credit risk assessments as inputs to capital calculations. Our results suggest that IRB banks have significantly lower general reserves for credit losses after they adopt the IRB approach to credit risk. The reliance on the internal modelling choices of IRB banks for determining expected losses may come at a cost of lower general reserves. Interestingly, an analysis of IRB banks' expected losses suggests that these banks did not factor in the likelihood of more adverse conditions during the financial crisis of 2008–2009 until they had reinforced their capital base. Furthermore, the IRB banks allocated more provisions against expected losses on non-defaulted exposures when their tier 1 capital ratios before provisions were stronger. These findings suggest that improving the quality of their capital base in preparation for the more stringent requirements under Basel III was a greater priority for banks in this period than bolstering loan-loss provisions.

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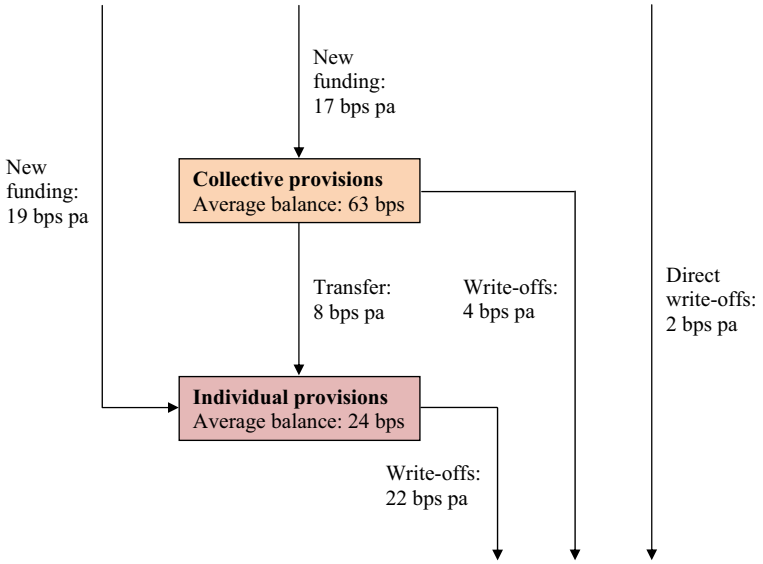

Fig. A1.1. Movements in provisions for impairment. This figure illustrates movements in Australian accounting standards provisions for all sample banks. The sample period is September 2003 to December 2012. Australian accounting standards have been harmonised with International Financial Reporting Standards (IFRS) from January 2005.

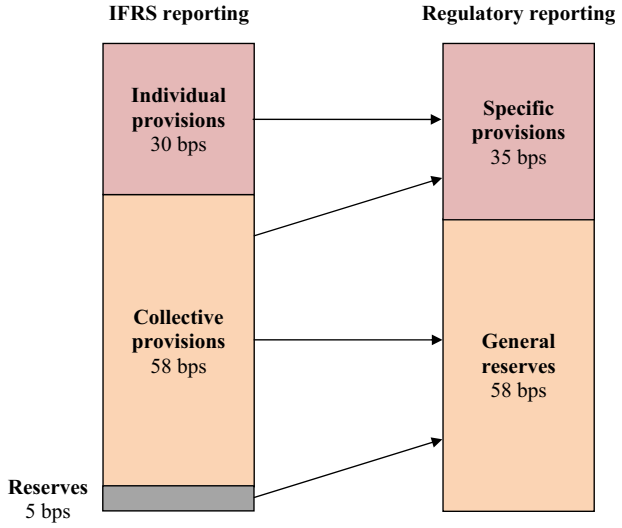

Fig. A2.1. Relationship between accounting provisions and regulatory provisions. This figure illustrates the allocation of Australian accounting standards provisions to specific provisions and general reserves for credit losses for regulatory purposes for all sample banks. The sample period is September 2006 to December 2012.

Finance and Regulation 2014 Symposium on Market and Regulatory Performance, Asian Finance Association 2014 Annual Conference, European Conference on Banking and the Economy 2014, Financial Management Association International 2014 Annual Meeting, Australasian Finance and Banking Conference 2014 and Macquarie University. We thank David Connolly and Meghann Garry at the Australian Prudential Regulation Authority for helping us extract the data used in this study.

Appendix A1. Provisioning waterfall for Australian banks

Fig. A1.1 illustrates movements in provisions under Australian accounting standards. Australian accounting standards have been harmonised with International Financial Reporting Standards (IFRS) from January 2005. The figure shows movements for provisions assessed on an individual loan basis and for those assessed on a portfolio (collective) basis. For each data item (for example, new funding for collective provisions), first the asset-weighted average across all banks for each quarter from September 2003 to December 2012 is calculated; and then a simple time-series average of the cross-sectional averages is reported. Numbers in this figure are presented in annual terms.

Appendix A2. Comparison of the provisioning models used by Australian banks

Fig. A2.1 illustrates the relationship between the two provisioning models used by Australian banks: the forward-looking model specified by APRA and the incurred loss model for reporting to the market. For each data item, first the asset-weighted average across all banks for each quarter from September 2006 to December 2012 is calculated; and then a simple time-series average of the cross-sectional averages is reported.

Requirements for reclassifying accounting provisions as two types of regulatory provisions are specified in APRA's Prudential Standard APS 220 *Credit Quality*, May 2006. All provisions assessed by a bank on an individual basis under Australian accounting standards (30 basis points) and a portion of provisions assessed on a collective basis for which losses are expected to materialise in the short term (5 basis points) are treated as specific provisions for regulatory purposes. Collective provisions for losses that are expected but not certain to arise are included in general reserves for credit losses (53 basis points). Where the bank does not maintain sufficient general reserves made up of collective provisions, it is required to establish a reserve against retained earnings for the additional amount (5 basis points).

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