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Credit Losses in Australasian Banking

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We analyse the determinants of bank credit losses in Australasia. Despite sizeable credit losses over the past two decades, ours is the first systematic study to do so. Analysis is based on a comprehensive dataset retrieved from original financial reports of 32 Australasian banks (1980–2005). Credit losses rise when the macro economy is weak. Asset markets, particularly the equity market, are also important. Larger banks provide more for credit losses while banks with high cost-income-ratios show greater loan loss provisions. Strong loan growth translates into significantly higher credit losses with a lag of 2–4 years. Finally, the results show strong evidence of income smoothing activities by banks.

I Introduction

The stability of the banking sector is of major importance for economic outcomes. Banks form the backbone of modern economies and instability in the banking sector can pose problems to the economic system as a whole. Credit losses, or more generally, asset quality problems, have repeatedly been identified as a key trigger of bank failures, for example, Graham and Horner (1988), Caprio and Klingebiel (1996). Agencies in charge of prudential supervision of the financial system as well as macroeconomic policy-makers thus take a keen interest in the determinants of such losses.

Research with data on the credit loss experience (CLE) of banks, in particular loan loss provisions, has traditionally focused on the discretionary use of loan losses by bank managers. Seminal papers by Schreiner (1981) and Greenawalt and Sinkey (1988) have explored income smoothing activities of US banks by means of their loan-loss provisions. The hypothesis is that banks engage in earnings management by reserving more in good times as a precaution for use in potentially leaner times. Besides income smoothing, Lobo and Yang (2001) review evidence in the literature for additional behavioural factors which influence the setting of loan loss reserves. Such motivations include signalling when a bank increases the loan loss provision to signal it is strong enough to absorb future potential losses, capital management in the context of meeting minimum capital requirements[1] and, finally, taxation aspects when loan loss provisions become a tax deductible expense.

Most of the research above has focused on US banks but the development of the new Basel capital regime (Basel II), which strives to increase the risk sensitivity of bank minimum capital requirements, has motivated studies for other

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[1] Basel I capital adequacy rules allowed loan loss provisions, subject to certain upper limits, to be counted as a component of regulatory capital (BCBS, 1988b, items 18–21, pp. 5–6). Moyer (1990, 3.1, pp. 129–131) explicitly posits capital management through loan loss provisions.

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markets as well.[2] These take a more macroprudential perspective, attempting to improve the understanding of fundamental drivers of credit losses.

This paper analyses drivers of credit losses in Australasia over the past two decades. Little is known about the systematic determinants of these losses. We analyse the nature of these determinants, providing the first comprehensive study of the drivers of credit losses in Australasian banking.

Our analysis is based on a comprehensive sample of bank specific credit loss data of 32 Australasian banks for 1980–2005. Unlike most other studies, these data have been retrieved from original bank financial reports and not from external data providers (e.g. Bankscope). This has the advantage of more credit loss specific data items[3] and, more importantly, it allows for extended time series covering the major crises which occurred in the Australian and New Zealand banking systems during the early 1990s. Parameter estimates gained with such long time series may be more robust than estimates based on risk characteristics of the loan portfolio in the 'normal' course of business. In the words of Danielsson (2002, p. 1273), 'statistical analysis made in times of stability does not provide much guidance in times of crisis'.

The paper proceeds as follows. Section II provides background information on the development of the Australasian banking system during the observation period and defines the sample. Section III introduces the methodology including the modelling approach and a discussion of the aggregate macroeconomic and bank specific factors considered. Section IV presents empirical results for the overall sample as well as country specific samples. Section V concludes.

II The Data Sample

This article utilises a database of financial and credit loss information for a sample of Australasian banks for the period 1980–2005. This section describes the general development of the Australasian banking system followed by a review of the data sample including a discussion of the set of variables considered for this empirical analysis.

Both the Australian and New Zealand banking systems have undergone major structural changes over the past decades. The 1980s saw the initiation of major sector reforms (Campbell Inquiry 1981 in Australia; Financial Policy Reform starting 1984 in New Zealand). The various types of financial institutions such as trading banks, savings banks, state banks, trust banks and building societies were initially subject to carefully delineated sets of legislation, but a substantial blurring between their activities had occurred. In particular non-bank financial institutions, subject to less stringent controls than commercial banks, had started to make substantial inroads into the traditional banking business as they were, for example, allowed to offer higher interest rates to depositors compared with banks. To address this, major liberalisation started in the 1980s which saw the creation of clear and uniform rules for bank registration. The regulatory regimes in the latter half of the period are relatively 'hands-off' compared with considerably more interventionist systems early in the period.[4]

The observation period covers the major banking system crises in both New Zealand and Australia which occurred in 1990/1991. In New Zealand, it culminated with the 1990 near collapse and subsequent government bail-out for Bank of New Zealand, the leading bank at the time. In Australia, the state banking system was affected by the 1991 demise of both the State Bank of South Australia (later absorbed into a predecessor of St. George Bank) and the State Bank of Victoria (amalgamated into Commonwealth Bank of Australia). Other banking firms also suffered during these years, most notably market leader Westpac which paid the price for its involvement in some high profile commercial real estate projects.[5]

The fallout of the crises, coupled with the broader move to privatise government-owned assets, led to a substantial re-shaping of the banking scene. Central and state government owned institutions

[2] Cavallo and Majnoni (2001) and Bikker and Metzemakers (2003) use global samples and Valckx (2004) looks at loan loss provisioning in the EU. Country specific research includes Arpa, Giulini, Ittner and Pauer (2001) for Austria, Salas and Saurina (2002) for Spain, Pain (2003) for UK commercial and mortgage banks, Kearns (2004) for the leading Irish banks and Quagliariello (2004) for a comprehensive sample of Italian banks.

[3] The database relies on approximately 55 raw data elements per institution, of which 12 are specifically related to the CLE of the bank.

[4] Descriptions of this transformation process include Wallis Inquiry (1997, pp. 567–597) and Davis (2004, pp. 9–15) for Australia; Grimes (1998) for New Zealand.

[5] Westpac's cumulative write-offs from 1990 to 1993 represented about 8 per cent of loans outstanding. See Carew (1997) and Davidson and Salisbury (2005) for an account of Westpac's crisis.

were all privatized and in most cases later absorbed into other banks. Australia's banking market concentration saw the emergence of four leading banking groups (ANZ, Commonwealth Bank, NAB and Westpac). Similarly, four banking groups ANZ-National, ASB, BNZ and Westpac now hold the bulk of system assets in New Zealand, each of them controlled by one of the major Australian banks.

The sample considered for this study essentially contains all banking firms with activities in retail and/or rural banking but excludes institutions that are predominantly wholesale and/or merchant banks. In total, it includes 23 Australian and 10 New Zealand banks (listed in Tables 1 and 2). The number of banks in the sample varies through time ranging from 13 for 1980 to 28 banks for 1989 and 1990. The increased concentration in the banking system is reflected in a decline to just 16 institutions for the years 2004 and 2005.

The data collected for these banks are annual observations of credit loss and financial information retrieved from the banks' published accounts.[6] In the case of mergers and acquisitions, the time series of the surviving entity is used to extend the series of the dominant pre-merger entity.[7] These data are complemented by macroeconomic times series considered as potentially relevant drivers of credit losses. The data are analysed in a panel of 832 potential observations (32 banks across 26 years); however, many of the banks do not exist for the whole sample period so we are left with 361 actual observations. A discussion of the set of variables considered follows below. It first evaluates proxies for a bank's CLE and then outlines potential aggregate macroeconomic and bank specific drivers of credit losses. An overview of the series is provided in Table 3; summary statistics can be found in Table 4 (macroeconomic series) and Table 5 (bank specific series).

There are a number of potential proxies which provide information about a bank's CLE. In line with comparable macro-prudential literature (e.g. Fernández de Lis *et al*., 2000; Arpa *et al*., 2001; Bikker & Hu, 2001; Cavallo & Majnoni, 2001; Pain, 2003; Kearns, 2004),[8] we choose impaired asset expense as a percentage of loans (IAE_LN) as our dependent variable. Impaired asset expense appears as a flow measure in the financial statement and represents a bank management's judgement of credit losses occurred during the reporting period. It may not precisely reflect actual credit losses in an ex-post analysis, that is, in view of subsequent loan write-offs (de-recognitions) which later remove impaired assets off the balance sheet based on more definite information. IAE_LN gives, however, a timely indication of credit events. Some authors (Gizycki, 2001; Esho & Liaw, 2002; Salas & Saurina, 2002) have alternatively chosen the stock of credit loss provisions or impaired assets as a dependent variable but the erratic nature of write-offs might distort these measures (Pain, 2003, p. 25).[9] In particular, write-offs of assets which may potentially have become impaired some years back may mean that the stock of provisions and impaired assets decline even though significant new bad debts have arisen (Hess *et al*., 2008). Similarly, the introduction of statistical provisioning regimes at many banks in the mid to late 1990s, which led to increased levels of general provisions, has just a one-time effect on IAE_LN and is not 'stored' into subsequent observations. We therefore prefer the flow measure of impaired asset expense to the stock measure.

We hypothesise that credit losses will reflect developments in current and lagged macroeconomic factors. Two indicators are used for the cyclical state of the economy, GDP growth (GDPGRW) and the change in the rate of unemployment (ΔUNEMP); movements in these macroeconomic variables are likely to affect asset quality and the ability of borrowers to service loans. Asset market developments may also affect asset quality and borrowers' cash flows, consequently impacting on the value of collateral held by banks. We concentrate on two asset market variables, the return on the national share index (RET_SHINDX), and percentage changes in the housing price index (HPGRW). Earlier work also considered nominal

[6] Balance sheet dates from June 30 to May 31 of the subsequent year are attributed to a particular year, for example, an observation for a bank reporting per 30 September 2000 and 31 March 2001 are both attributed to year 2000.

[7] A special case is the takeover of State Bank of New South Wales (SBNSW) by Colonial Mutual Life per 31 December 1994. The series of Colonial State Bank extends the series of SBNSW. Accordingly only 22 time series of Australian banks are analysed in this research.

[8] The terms 'loan loss provisions expense', 'charge for bad and doubtful debts' or 'ongoing provisions' are often used in this literature.

[9] This can be seen from the following accounting relationship: Stock of provisions$_t$ = Stock of provisions$_{t-1}$ + New impaired asset expense$_t$ – (Write-offs$_t$ – Recoveries$_t$) + Currency and other adjustments$_t$.

TABLE 1
Overview of Banks in Database (Australia)

Bank identifier	Bank full name	Institution's earlier name	Successor	Registered	Data range
AU AdelaideBk	Adelaide Bank	Co-operative Building Society of South Australia		1994 to present	1988–2005
AU AdvanceBk	Advance Bank	NSW Building Society	AU StGeorge	1985–1998	1986–1996
AU ANZ	ANZ Banking Group			Whole period	1979–2005
AU BendigoBk	Bendigo Bank			1995 to present	1991–2005
AU BkMelbourne	Bank of Melbourne	RESI Statewide Building Society	AU Westpac	1989–1998	1998–1996
AU BkWest	Bank West/HBOS Australia	Rural & Industries Bank of Western Australia	HBOS Australia	Whole period	1983–2005
AU BoQ	Bank of Queensland			Whole period	1980–2005
AU CBC Sydney	Commercial Banking Company of Sydney Limited		AU NAB	to 1982	1979–1981
AU ChallengeBk	Challenge Bank	Hotham Permanent Building Society (Vic)/Perth Building	AU Westpac	1987–1996	1987–1995
AU Colonial*	Colonial/Colonial State Bank	Colonial Mutual Life Assurance Society	AU CoWthBk	1995–2001	1996 –1999
AU CommBk	Commercial Bank of Australia		AU Westpac	To 1982	1979–1981
AU CoWthBk	Commonwealth Bank			Whole period	1979–2005
AU EldersRural	Elders Rural Bank Limited			2000 to present	1999–2005
AU NAB	National Australia Bank	National Bank of Australasia		Whole period	1979–2005
AU PIBA	Primary Industry Bank of Australia		Rabobank Australia	1987–2003	1979–1993
AU SBNSW*	State Bank of New South Wales	Rural Bank of New South Wales	AU Colonial	To 1994	1980–1995
AU SBSA	State Bank of South Australia	The State Bank of South Australia	AU Advance Bk	To 1994	1980–1994
AU SBVictoria	State Bank of Victoria		AU CoWthBk	To 1991	1979–1990
AU StGeorge	St. George Bank	St. George Building Society		1993 to present	1989–2005
AU SuncorpMet	Suncorp-Metway, Suncorp after 2002	Metway Bank	renamed Suncorp in 2002	1988 to present	1991–2005
AU TasmaniaBk	Tasmania Bank	Statewide Bank (Launceston Bank for Savings), The Tasmanian Permanent Building Society	AU TrustBk TAS	To 1991	1984–1990
AU TrustBk TAS	Trust Bank Tasmania	SBT Bank (The Savings Bank of Tasmania), Hobart Savings Bank	AU CoWthBk	To 1999	1983–1999
AU Westpac	Westpac (AUS)	Bank of New South Wales		Whole period	1979–2005

* AU SBNSW and successor AU Colonial are treated as one time series in this empirical research. Accordingly, a total of 32 bank series are considered in this empirical research.

TABLE 2
Overview of Banks in Database (New Zealand)

Bank identifier	Bank full name	Institution earlier name	Successor	Registered	Data range
NZ ANZ	ANZ National Bank	ANZ Banking Group (New Zealand) until 2004		Whole period	1980–2005
NZ ASB	ASB Ltd.	Auckland Savings Bank		1989 to present	1983–2005
NZ BNZ	Bank of New Zealand			Whole period	1979–2005
NZ Countrywide	Countrywide Bank	Countrywide Building Society	NZ NBNZ	1987–1998	1983–1998
NZ NBNZ	National Bank of New Zealand		NZ ANZ	To 2004	1979–2003
NZ Rural Bank	Rural Bank	Rural Banking and Finance Corporation of New Zealand	NZ NBNZ	1990–1994	1984–1992
NZ Trust Bank	Trust Bank NZ	Trustee Bank Group	NZ Westpac	1989–1996	1988–1996
NZ TSB Bank	TSB Bank	Taranaki Savings Bank		1989 to present	1987–2005
NZ UnitedBK	United Bank	United Building Society	NZ Countrywide	1990–1994	1983–1992
NZ Westpac	Westpac Banking Corp. (NZ)	Bank of New South Wales		Whole period	1987–2005

TABLE 3
Description of Variables and Expected Impact on Credit Losses

	Variable name	Acronym	Expected sign
Dependent variable			
Credit loss experience	Impaired asset expense as % of loans	IAE_LN	n.a.
Determinants of credit losses			
Aggregate macroeconomic			
Economic cycle	Real GDP growth	GDPGRW	Negative
	Unemployment rate (p.p. change)	ΔUNEMP	Positive
Asset price shocks	Share index (% change)	RET_SHINDX	Negative
	Housing price index (% change)	HPGRW	Negative
Bank specific			
Bank characteristics	Size: share of system loans	SH_SYSLNS	Positive/Negative
	Net interest margin	NIM	Positive/Negative
	Cost-income ratio	CIR	Positive/Negative
Past credit expansion	Growth rate bank assets	ASGRW	Positive
	Point difference of bank loan growth relative to system loan growth	DVLNGRW	Positive
Income smoothing	Earnings before taxes and provisions (as % of assets)	EBTP_AS	Positive

interest rates (and their constituent parts, real interest rates and inflation). The effects of these variables on asset markets are already reflected in the share and housing return variables, and the additional terms did not yield robust results when included in addition to the asset return variables. For brevity, results including interest rate terms are therefore omitted here.

A number of bank specific drivers of credit loss provisioning are considered. A first group (SH_SYSLNS, NIM, CIR) is included as controls for current institution specific characteristics. These controls for bank characteristics are required since we are dealing with a heterogeneous sample of banks that ranges from small regional mortgage lenders to multi-line internationally

TABLE 4
Descriptive Statistics Aggregate Macroeconomic Factors (1980–2005)

Acronym	Mean (%)	Median (%)	Maximum (%)	Minimum (%)	Standard deviation (%)	Skewness	Kurtosis	Observations	ADF*
GDPGRW_AU	3.3	3.8	6.6	−0.7	1.8	−0.667	3.074	26	0.0064
GDPGRW_NZ	2.8	2.8	8.5	−1.9	2.2	0.277	3.287	26	0.0055
HPGRW_AU	8.7	8.4	38.8	−4.2	8.6	1.508	6.757	26	0.0040
HPGRW_NZ	10.1	8.7	31.6	−2.5	8.5	0.703	3.100	26	0.0846
RET_SHINDX_AU	9.0	8.8	41.5	−26.6	14.8	−0.019	3.354	26	0.0003
RET_SHINDX_NZ	7.5	6.3	57.1	−49.5	20.9	−0.239	4.291	26	0.0075
ΔUNEMP_AU	−0.05	−0.49	3.31	−1.61	1.14	1.553	4.921	26	0.0052
ΔUNEMP_NZ	0.08	−0.05	2.50	−1.80	1.01	0.496	2.906	26	0.0526

Notes: Series suffixes: AU – Australia; NZ – New Zealand.
* *p*-value for Augmented Dickey-Fuller statistic testing null of unit root; lag length is chosen according to Schwarz Information Criterion.

TABLE 5
Descriptive Statistics of Bank Specific Series

	Mean (%)	Median (%)	Maximum (%)	Minimum (%)	Standard deviation (%)	Skewness	Kurtosis	Observations	Cross sections
IAE_LN	0.57	0.27	16.51	–7.41	1.38	6.48	67.17	491	32
ASGRW	17.0	14.1	180.6	–40.1	19.1	3.06	21.91	517	32
DVLNGRW	7.1	3.3	147.8	–39.5	20.7	2.86	17.2	513	32
CIR	65.0	65.6	131.7	18.0	12.3	0.12	5.61	519	31
EBTP_AS	1.7	1.6	17.0	–1.5	1.1	7.14	88.87	477	32
NIM	3.34	3.06	11.07	0.51	1.43	1.97	9.18	510	31
SH_SYSLNS	8.0	3.4	34.4	0.0	8.3	0.90	2.79	536	32

diversified institutions. SH_SYSLNS, defined as the bank's share of total private sector credit, is the primary size proxy, indicative of both risk diversification and market power of banks. Its expected effect is uncertain since better diversified banks may face lower credit losses but at the same time be tempted into higher risk lines of business. Likewise the effect of wider net interest margins (NIM) is uncertain. Wider margins could be the result of riskier loans which lead to greater credit losses; alternatively, wider margins are typically associated with a lower risk retail focus and a reliance on traditional home lending business. The cost-income ratio (CIR) is chosen as the cost efficiency proxy, also having an uncertain relationship with CLE.[10]

[10] CIR is defined as non-interest expense (operational expense) over total operating income (net interest income plus other operating income). It is widely used by practitioners and in comparable CLE studies such as Pain (2003) and Salas and Saurina (2002). Note, however, that CIR is contentious for efficiency studies in banking; see, for example, the discussion in Hess and Francis (2004).

High CIR banks may be prone to greater credit losses because they either do not maintain adequate risk controls or they offer sophisticated but at the same time risky financial products (e.g. merger and acquisition financing, syndicated loans); alternatively, such banks may maintain extensive (but costly) credit evaluation procedures and thus exhibit lower credit losses.

Ideally, our model should include proxies directly measuring the risk characteristics of a bank's loan portfolio, for example, the exposure to certain lending categories. Unfortunately such information is not consistently disclosed by all banks throughout the observation period and some standardization of risk classes was only brought about by the Basel I Capital Accord (BCBS, 1988a). Proxies (for instance the share of residential mortgage loans in the bank's loan portfolio) can thus only be employed for empirical modelling with data after 1990.[11]

[11] Hess (2008, table 6.7, p. 277) estimates equations incorporating such measures over a shorter sample period.

Bank specific factors include two proxies for a bank's growth (ASGRW, DVLNGRW). Banks that expand (too) rapidly may be faced with elevated credit losses in subsequent years (e.g. Clair, 1992). Such institutions may loosen lending criteria but may not be able to accurately appraise required provision at the time. ASGRW is defined as the actual bank asset percentage growth rate. Relative growth differentials may be more relevant because strong growth in times of economic expansion might be in line with growth in the general economy and asset quality may not necessarily be compromised where there has been no substantive increase in a bank's market share. To control for this influence, we define another bank specific growth variable, DVLNGRW, as the percentage point difference of a bank's loan growth rate from the growth rate of credit in the overall system (growth in total private sector credit).

To account for potential behavioural influences on provisioning levels, we include earnings before taxes and loan loss provisions over average total assets (EBTP_AS) as an explanatory variable.[12] Smoothing reported income by means of discretionary provisions was explored by (Greenawalt & Sinkey Jr., 1988). Based on analytical results by Fudenberg and Tirole (1995), we hypothesise that management in banks with good (poor) current performance relative to future performance will 'save' income for ('borrow' income from) the future by reducing (increasing) current income through loan loss provisions (Kanagaretnam *et al*., 2003). This hypothesis calls for a positive coefficient on a contemporaneous earnings proxy and negative coefficients on lagged earnings proxies.

III The Model

In line with comparable macro-prudential literature, we adopt a reduced form distributed lag model with cross-sectional fixed effects as our primary approach to explaining banks' credit losses. Alternative model formulations are also considered in robustness tests discussed later in this section.

We begin with a model incorporating all variables discussed in section II. Controls for bank characteristics are included as current variables; all other variables are entered also with lags. These lags extend to 2 years for each variable other than the credit growth variables (ASGRW, DVLNGRW) which extend to 4 years. The longer lags on the credit growth variables reflect a hypothesis that the impacts of rapid past credit growth on asset quality may not become apparent for a material passage of time. Such long lags result in the loss of some cross-sections and time periods. Accordingly, the 361 usable observations analysed are from 28 banks for 1984–2005. Our initial equation is shown as Equation (1).

$$\begin{aligned} \mathrm{IAE\_LN}_{i,t} &= \sum_{j=0}^{2} \beta_{1,j}\mathrm{GDPGRW}_{i,t-j} \\ &+ \sum_{j=0}^{2} \beta_{2,j}\Delta\mathrm{UNEMP}_{i,t-j} + \sum_{j=0}^{2} \beta_{3,j}\mathrm{RET\_SHINDX}_{i,t-j} \\ &+ \sum_{j=0}^{2} \beta_{4,j}\mathrm{HPGRW}_{i,t-j} + \beta_5\mathrm{SH\_SYSLNS}_{i,t} \\ &+ \beta_6\mathrm{NIM}_{i,t} + \beta_7\mathrm{CIR}_{i,t} + \sum_{j=0}^{2} \beta_{8,j}\mathrm{EBTP\_AS}_{i,t-j} \\ &+ \sum_{j=0}^{4} \beta_{9,j}\mathrm{ASGRW}_{i,t-j} + \sum_{j=0}^{4} \beta_{10,j}\mathrm{DVLNGRW}_{i,t-j} \\ &+ \eta_i + u_{i,t} \end{aligned} \tag{1}$$

where $\mathrm{IAE\_LN}_{i,t}$ is the CLE variable, impaired asset expense as a percentage of loans for bank i in year t; the explanatory variables on the right hand side of the equation are explained in Table 3, η_i is a bank specific intercept term, $u_{i,t} \sim$ iid $(0, \sigma_u)$ is the error process.

The macroeconomic and asset market variables in Equation (1) are included with an i (bank specific) subscript since we are dealing with an Australasian sample and relevant variables therefore differ across countries. The final column of Table 4 tests each of these variables for stationarity. The null hypothesis of a unit root is rejected (at the 10 per cent level or below) for each of the macroeconomic and asset market variables for each country. It is therefore statistically appropriate to include each of these variables in the equation.

In estimating Equation (1), we find it preferable to include either GDPGRW or ΔUNEMP separately as the macroeconomic indicator, rather than both together, given the correlation between the two variables. Similarly, the two credit growth indicators are highly correlated with each other. DVLNGRW provides more significant results in keeping with the hypothesis that raising market share can be a costly strategy in terms of asset quality, so we retain this variable in preference to ASGRW. Of

[12] This approach to earnings proxy modelling (using average assets) is widely used in the relevant literature, for example, in Ahmed *et al.* (1999) and, more recently, Kearns (2004).

the two asset market variables, the share market return (RET_SHINDX) dominates housing price growth (HPGRW) in terms of significance; thus we concentrate on results incorporating only the former variable. Results for the ensuing parsimonious equation (alternatively using GDPGRW and ΔUNEMP as the macroeconomic indicators) are presented in Table 6 (columns 1 and 2).[13]

IV Empirical results

Columns 1 and 2 of Table 6 contain the full sample results using GDPGRW and ΔUNEMP, respectively, as the economic cycle variable. Columns 3 and 4, respectively columns 5 and 6, report corresponding results for the Australian and the New Zealand bank sub-samples.

GDP growth (GDPGRW) and the change in the unemployment rate (ΔUNEMP) have the expected effects on a bank's annual loan loss provisions. For the full sample, the effects are felt most strongly contemporaneously and with a lag of 1 year. Based on the Schwarz and Akaike information criteria, the unemployment rate based model shows greater explanatory power, consistent with results found by Kearns (2004, p. 118) for a smaller and shorter sample of Irish banks. A one percentage point (p.p.) decrease in GDP growth that is sustained for at least 3 years results in a peak annualised increase in IAE_LN of 0.17 p.p.; alternatively, a sustained one p.p. increase in ΔUNEMP results in a rise in IAE_LN of 0.37 p.p.[14] These estimated responses in impaired assets compare with a mean level for IAE_LN of 0.57 per cent and so are of a material economic magnitude.[15] Each of the macroeconomic variables is significant for each country, albeit with the New Zealand impacts occurring with a longer lag than for Australia.

In addition to these macroeconomic cycle effects, the contemporaneous and 1 year lagged share index return (RET_SHINDX) is significantly negative for the overall sample and for Australian banks, but not for the (smaller) New Zealand sub-sample. The return on the share index has a more significant effect on credit losses than residential property prices. This result reflects the 1990 surge in credit losses which was primarily driven by asset shocks emanating from the corporate and commercial sector rather than from the housing market.

The size proxy (SH_SYSLNS), defined as the bank's share of system loans, is consistently positive, with significance at 10 per cent for the full sample estimates. This result, indicating higher levels of provisioning for larger banks, may reflect structural heterogeneity of the sample as smaller banks are predominantly housing lenders with comparably lower levels of provisioning requirements. Another contributing factor might be the effects of the market power hypothesis which postulates that monopolistic market structure promotes lending by larger banks to young firms which, in turn, leads to higher credit losses (Petersen & Rajan, 1995). We cannot differentiate between these two explanations with the data at hand.

The coefficients for the net interest margin (NIM) are consistently negative and are significant at 1 per cent for the combined and Australian samples.[16] These results reject the hypothesis that wide interest margins reflect higher risk lending (with associated greater credit losses). Instead, we attribute the negative NIM coefficient to the different characteristics of low versus high NIM banks. The former appear to have a greater presence in the business lending market and are typically larger institutions. The other group comprises predominantly smaller, retail-focused mortgage lenders requiring wider interest margins, but which nevertheless have lower credit losses due to their residential mortgage-focused book. Our observation is backed by the result that larger banks tend to exhibit lower net interest margins (as indicated by a negative and significant correlation of –0.22 between SH_SYSLNS and NIM).

Highly significant coefficients on the CIR for all samples indicate that high CIRs are associated with higher levels of impaired assets. One could

[13] Regression results of the full model as shown in Equation (1) are not reported but are available on request.

[14] The thought experiment considered here involves 3 years of rising unemployment, for example, from an unemployment rate initially at 5 per cent rising to one of 8 per cent 3 years later.

[15] It is difficult to compare these sensitivities to results of other studies due to differences in model design (e.g. alternative dependent CLE variables and different variable transformations). The sensitivities in Australasia nonetheless seem lower with regard to GDP growth compared with the international studies of Bikker and Hu (2001, table 3, p. 12) for banks from 29 countries from 1979 to 1999 and Valckx (2004, table 1, p. 7) using bank profitability statistics for all 15 EU countries from 1979 to 2001.

[16] Coefficients for New Zealand are very similar to those of Australia; the smaller New Zealand sample size is reflected in a higher standard error for this sub-sample.

TABLE 6
Regression Results for Drivers of Bank Impaired Asset Expense

	ALL	Signi-ficance	*T*-statistics	ALL	Signi-ficance	*T*-statistics	AU	Signi-ficance	*T*-statistics	AU	Signi-ficance	*T*-statistics	NZ	Signi-ficance	*T*-statistics	NZ	Signi-ficance	*T*-statistics
Independent	IAE_LN			IAE_LN			IAE_LN			IAE_LN			IAE_LN			IAE_LN		
Constant	–0.0351	***	–4.32	–0.038	***	–4.74	–0.032	***	–3.55	–0.036	***	–4.18	–0.036	***	–3.32	–0.039	***	–3.98
GDPGRW	–0.0674	*	–1.68				–0.136	**	–2.33				–0.004		–0.06			
GDPGRW(–1)	–0.1108	**	–2.43				–0.135	***	–3.22				–0.103		–1.46			
GDPGRW(–2)	–0.0170		–0.67				0.006		0.19				–0.085	*	–1.83			
ΔUNEMP				0.174	**	2.44				0.194	***	2.74				0.055		0.58
ΔUNEMP(–1)				0.194	***	2.99				0.157	*	1.97				0.298	**	2.46
ΔUNEMP(–2)					0.075	1.26				0.070		1.22				0.139		1.27
RET_SHINDX	–0.015	*	–1.90	–0.014	**	–1.99	–0.017	***	–3.72	–0.015	***	–3.13	–0.018		–1.19	–0.017		–1.27
RET_SHINDX(–1)	–0.008	**	–2.11	–0.006		–1.32	–0.014	**	–2.08	–0.014	**	–2.03	–0.005		–0.96	–0.001		–0.15
RET_SHINDX(–2)	0.008		1.20	0.010		1.43	0.010		1.64	0.008		1.47	0.011		1.00	0.015		1.23
SH_SYSLNS	0.045	*	1.78	0.047	*	1.92	0.011		0.57	0.011		0.57	0.062		1.45	0.060		1.45
NIM	–0.303	***	–2.81	–0.320	***	–2.81	–0.292	***	–2.82	–0.336	***	–3.05	–0.298		–1.19	–0.379		–1.60
CIR	0.057	***	5.86	0.054	***	5.52	0.067	***	6.16	0.062	***	5.43	0.046	***	5.00	0.047	***	6.00
EBTP_AS	1.160	***	12.80	1.137	***	12.20	1.063	***	7.47	1.079	***	7.40	1.155	***	7.37	1.148	***	7.53
EBTP_AS(–1)	–0.122		–1.45	–0.131	*	–1.66	–0.361	***	–2.82	–0.326	**	–2.44	–0.028		–0.36	–0.030		–0.46
EBTP_AS(–2)	–0.093		–1.40	–0.102		–1.57	0.067		0.83	0.040		0.49	–0.113		–1.02	–0.113		–1.07
DVLNGRW	0.0004		0.13	–0.0003		–0.10	0.004		1.31	0.003		1.16	–0.005		–0.76	–0.005		–0.75
DVLNGRW(–1)	–0.0011		–0.46	–0.0018		–0.71	0.001		0.17	–0.001		–0.25	–0.001		–0.48	–0.001		–0.41
DVLNGRW(–2)	0.0036		1.42	0.0038		1.56	0.007	**	2.30	0.007	**	2.17	–0.002		–0.51	–0.002		–0.55
DVLNGRW(–3)	0.0032	*	1.80	0.0042	**	2.12	0.003	1.31	0.003	1.44		0.005	1.07			0.006		1.26
DVLNGRW(–4)	0.0071	**	2.18	0.0073	**	2.25	0.006	*	1.91	0.006	*	1.80	0.010		1.51	0.012		1.54
Cross-sections incl.	28			28			19			19			9			9		
Observations	361			361			238			238			123			123		
Adjusted R^2	0.726			0.735			0.700			0.692			0.785			0.788		
F-Statistics	22.640	***		23.708	***		16.772	***		16.180	***		18.766	***		19.150	***	
Schwarz	–6.131			–6.166			–6.273			–6.246			–5.794			–5.811		
Akaike	–6.616			–6.651			–6.798			–6.771			–6.388			–6.405		
Durbin–Watson	1.943			2.007			1.929			1.932			2.176			2.218		

Notes: ***, ** and * denote significance at the 1, 5 and 10 per cent levels, respectively. Estimation for full observation period 1984–2005 for common sample of Australian and New Zealand banks (ALL), Australian banks (AU) and New Zealand Banks (NZ). Dependent variable is impaired asset expense as % of loans (IAE_LN). Explanatory variables as defined in Table 3. Panel sample are annual data 1980–2005 (1980–1983 data are used for lagged variables). All equations estimated with cross-section fixed effects. All *t*-statistics use White diagonal standard errors and covariance (d.f. corrected).

conjecture that operational problems at banks (high CIR) go hand in hand with poor credit risk management and thus higher loan losses. Alternatively, the product mix of high CIR banks might require high levels of operational costs (e.g. cost intensive off-balance sheet business) without these institutions necessarily being inefficient. Our results in relation to CIR are consistent with those of Berger and De Young (1997) who found relative cost efficiencies to precede reductions in problem loans. The results are also in line with Salas and Saurina (2002, Table 2, p. 218) who find positive, but not always significant, coefficients for the CIR proxy.

Estimates in Table 6 show consistently positive relationships between the level of provisioning and the banks' contemporaneous pre-provision earnings (EBTP_AS), consistent with previous results for other markets supportive of an income smoothing pattern (e.g. Greenawalt & Sinkey Jr., 1988 for USA; Arpa *et al.*, 2001, p. 107 for Austria; Bikker & Hu, 2001 for 26 OECD countries; Cavallo & Majnoni, 2001 for G10 countries; Bikker & Metzemakers, 2003 for USA, EU; Kearns, 2004 for Ireland). The significant contemporaneous terms are consistent across the Australian and New Zealand sub-samples. Lagged terms of EBTP_AS show negative coefficients (albeit not significant for the New Zealand sub-sample) consistent with the theory that necessary provisions are postponed into following years if earnings are low in that particular time period. These results indicate that banks in both countries appear to be motivated to manage earnings. One may conjecture that Australian banks, which are mostly exchange listed, have less discretion in smoothing income compared to their (mostly) non-listed (or subsidiary) New Zealand counterparts. Despite possibly stronger incentives to stabilize their earnings over time than for non-listed banks, market scrutiny forces them to correct the over (under) statement of provisions in the following year.[17] However, this conjecture is not tested explicitly here and we do not have independent information on whether the timing of impaired asset recognition is treated equally by Australian parent banks and their New Zealand subsidiaries.

Significance of the coefficients on relative asset growth (DVLNGRW) is affected by the lags considered. Contemporaneous and 1-year lagged growth has no significant impact on credit losses; terms lagged 2 years and beyond have the expected unfavourable effect (significant positive coefficients). This is especially so for the full and Australian samples; for New Zealand, the strongest impact occurs at the fourth lag. The results are consistent with the hypothesis that at the time of a bank's credit expansion (relative to its peers), bank management has an overly optimistic judgment of the risks associated with their strategy, an assessment which has to be corrected in subsequent years as the true nature of loan quality emerges. Relative growth, that is, growth of market share, thus appears to be a contributor to future credit losses, although our results do not allow us to conclude whether absolute growth or relative growth has a stronger impact.

These findings appear to explain some of the controversy in the literature regarding the effect of past credit growth with prior studies typically including just one or two lags of the asset growth parameter. Pain (2003, p. 29), for instance, estimated negative (albeit small) coefficients for his one-period lagged growth proxy. Likewise Cavallo and Majnoni (2001, p. 20) find the contemporaneous loan growth rate has a negative sign implying that provisions tend to decrease as a share of total assets when the rate of new lending increases. Our results indicate that both studies have apparently measured associations of current lending growth with provisioning as opposed to measuring the longer term impact of banks 'buying market share' at the expense of subsequent asset quality.

Our results are in some respects similar to Salas and Saurina (2002, Table 2, p. 218) who study lags for asset and branch network growth of up to 4 years and generally find negative coefficients for shorter lags but positive coefficients for longer lags. Their results are less clear-cut than ours since they use a stock CLE proxy, 'problem loan ratio', corresponding to the level of impaired assets in Australasian accounting terminology. This stock variable is likely to provide a blurred picture of credit events in a particular period since the level of impaired assets will be the consequence of loan defaults and debt workouts possibly many years back. Our use of impaired asset expense (i.e. the flow of new provisioning) as the dependent

[17] This cross-country pattern also occurs in relation to impaired asset responses to the macroeconomic variables (GDPGRW and ΔUNEMP), with the impacts in Australia occurring with less of a lag, on average, than in New Zealand. The consistency of these patterns supports the conjecture that Australian banks have less room to manoeuvre in reporting asset impairments than do their New Zealand counterparts.

variable yields more clear-cut results than the use by Salas and Saurina of the stock of provisions.

V Robustness Tests

To test the robustness of our empirical results, the model of Equation (1) has been estimated with a number of alternative formulations. Firstly, an autoregressive term in the form of a lagged dependent variable was added but did not exhibit any significance. This is as expected given that the Durbin-Watson statistic in columns 1 and 2 is each close to 2. Researchers who have used lagged dependent variables in comparable studies (e.g. Gizycki, 2001; Salas & Saurina, 2002) have employed level proxies, such as stock of impaired assets or provisions, as their dependent variables. For these stock variables one would expect a memory effect, but this reasoning does not extend to IAE_LN which is a flow variable.

Specifying the dependent variable as impaired asset expense as a share of loans, while intuitive, has the potential to raise problems associated with limited dependent variables as values observed for IAE_LN will typically be positive and near zero. A logistic transformation of the dependent variable [i.e. $\ln(x/(x+1)]$ can be employed for positive values but there are some observations of negative IAE_LN in cases when a bank recovers provisions of earlier years (e.g. BNZ for the years 1993–1997). Despite the loss of observations, the model has been estimated with logit transformed IAE_LN, yielding qualitatively similar results (results available on request). However, a Durbin–Watson statistic of just above 1 indicates the presence of autocorrelation for this model and it is therefore rejected in favour of the levels specification.

Equation (1) is estimated with bank specific intercept terms (fixed effects); a Wald-test of these terms rejects the null hypothesis that they are redundant at < 0.1 per cent. One could alternatively consider a random effects model where the latter are modelled as realisations of independent random variables with mean zero and finite variance. We prefer the fixed-effect formulation, however, since random effects models are typically a good choice in panel estimates only where the number of cross-sections is large, providing enough information to estimate the bank specific error process (Davidson & MacKinnon, 2004). This is not the case in our application. Moreover, a random effects model cannot be estimated for the full model since the number of coefficients exceeds the number of banks. Besides, the likely correlation between the unobserved factors and other independent variables used in this study would strengthen the case for a fixed-effect estimation. For robustness, we have nonetheless estimated the smaller parsimonious model as a random effects model. While the Hausman test statistic of just under 20 (distributed as chi-sqare (17) on the null) indicates that the random effects estimator is consistent and efficient, the results are virtually the same as for the fixed-effects model. They are not reported but are available on request.

Equation (1) includes three contemporaneous variables for bank specific characteristics (SH_SYSLNS, NIM, CIR) which are potentially endogenous variables driven by macroeconomic conditions. To test the robustness of our parsimonious formulation we have instrumented these three variables with their lagged terms in a two stage least squares model. Regression results are virtually unchanged and so are not reported here.

Finally, we test our cross-sectional regression residuals for heteroskedasticity using the Brown–Forsythe test, finding no conclusive evidence for differing variances. Nevertheless, to correct for the presence of heteroskedasticity of unknown form, all reported t-statistics use robust White diagonal standard errors (White, 1980).

VI Summary and Conclusions

This study identifies major drivers of credit losses in the Australasian banking system. Despite the importance of the topic, little such research has been conducted previously for this region. The analysis has been made possible through the compilation of a dataset of financial and credit loss data for 33 Australasian banks annually from 1980 to 2005 from bank source documents. We choose impaired asset expense as a percentage of loans as the dependent variable in a fixed-effects panel regression model. This dependent variable has been widely used in comparable studies and is available consistently throughout the observation period.

Explanatory variables include aggregate variables proxying the state of the economic cycle as well as asset price proxies. The impacts of the macroeconomic variables are as expected, with the change in the unemployment rate having greater explanatory power than GDP growth. With respect to asset prices, the return on the share index has a more significant effect on credit losses than residential property prices. This result reflects the major banking crisis in Australasia circa-1990 which was primarily associated with asset shocks emanating from the corporate and commercial sector rather than from the housing market.

Bank specific variables are included to control for institution specific characteristics. We find that smaller banks and banks with wider net interest margins have, on average, lower levels of credit losses. Banks with higher CIRs generally have greater credit losses. This latter result implies that high CIR institutions either have to spend extra resources to monitor high-risk lending activities, or that their high CIRs reflect poor management and control practices.

Important results are found with respect to the effect of past bank credit expansion. We find significantly greater asset quality problems for fast expanding banks (relative to their peers) with a lag of 2–4 years following their asset expansion. Our findings provide strong evidence that managers opting for quick growth do not accurately gauge the provisioning requirements associated with their strategy.

Finally, the coefficients for the contemporaneous pre-tax and provision earnings proxy are consistently positive and significant for all samples considered; negative coefficients are estimated for lagged earnings terms. Managers of Australasian banks thus apparently have employed discretionary elements of impaired asset expense for the purpose of achieving certain target earnings. In particular, they seem to have increased provisions in good years to 'store' earnings for potentially lean years in future.

Our results are similar for both the Australian and New Zealand sub-samples, albeit with generally greater significance for the Australian banks relative to the smaller New Zealand sub-sample. In detail, however, there are differences; for example, with regard to the timing of effects. This means that, while the general impacts might be similar, the actual transmission mechanisms are subject to specific local influences. Continued research into drivers of bank credit losses in Australasia may usefully consider structural modelling approaches that help further to understand the channels of influence and timing of the particular factors considered here within each market.

Furthermore, financial market events following the end of our sample period (2005) will result in material additions to the information on banks' CLEs. A study incorporating observations for post-2005 years will no doubt be of interest in future years.

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