An exploration of measures to assess a bank's credit loss experience

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Abstract

Data related to the credit loss experience (CLE) of financial institutions are widely used for a wide variety of research yet literature typically omits a discussion on the construction and selection of suitable CLE proxies. Based on a comprehensive dataset of potential CLE proxies retrieved from original financial reports of 32 Australasian banks (1980 – 2005), this article analyses properties and interactions of potential proxies through time. It is found that some commonly used proxies correlate rather poorly and bad debt provisioning is only partially matched by subsequent write-offs. Moreover, even derecognitions in the form of write-offs do not seem to be definite as up to 25% of loans written-off are ultimately recovered. The results highlight the need for caution in the use of (and possible adjustments to) historical credit loss data proxies commonly used by researchers.

Keywords: Banking, Credit Risk, Loan Loss Provisions, Australia, New Zealand, Disclosure

JEL Codes: G20, G21

1 Introduction

Data on the credit loss experience (CLE) of banks, in particular loan loss provisions, is used by a wide variety of research. Traditionally, this research has focused on the discretionary aspects when a bank's management uses its discretion to set loan loss reserves. Accordingly, seminal papers by Schreiner (1981) and Greenawalt & Sinkey Jr (1988) 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 potential lean times ahead. Besides income smoothing, Lobo & Yang (2001) reviews evidence in the literature for three additional behavioural factors which influence the setting of loan loss reserves. These 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.

The strongest current contributions in this literature comes, however, from authors associated with authorities in charge of prudential banking supervision which need to understand drivers of CLE for the purpose of maintaining stability and integrity of their systems. In fact, credit losses, or more generally, asset quality problems have repeatedly been identified as the ultimate trigger of bank failures, e.g. by Graham & Horner (1988) and Caprio & Klingebiel (1996). Specifically the development of the new Basel Capital (Basel II) has motivated many studies in this area, including Cavallo & Majnoni (2001) and Bikker & Metzemakers (2003) for global samples, and even more articles with country-specific analysis (Kearns, 2004; Pain, 2003; Quagliariello, 2004; Salas & Saurina, 2002).

[1] Basel I capital adequacy rules allow loan loss provisions, subject to certain upper limits, to be counted as component of regulatory capital (BCBS, 1988, items 18-21, p. 5-6). Seminal work on this subject is by Moyer (1990, 3.1, p. 129-131) who explicitly posits capital management trough loan loss provisions.

All these article employ models which include both macro and bank specific factors as determinants of CLE. While behavioural proxies discussed above are used to control for management discretion, the authors are rather concerned with drivers of actual changes in credit losses than with distortions due to behavioural issues. The CLE proxy ratios they typically employ are either annual provision expense or the stock of loan reserves as a percentage of loans but some authors use the amount of impaired assets[2] as the numerator in this ratio (e.g. Keeton, 1999; Quagliariello, 2004). When they do so, they implicitly rely on the assumption that their CLE proxies in fact reflect the true ex post credit losses experienced by the financial institutions. Surprisingly, there is virtually no analysis in the literature which would test this presumption and no attempt is made to consider the properties of proxies to gauge CLE.

This article sets out to close this gap by evaluating a wider selection of potential CLE proxies for a comprehensive sample of bank specific credit loss data of 32 Australasian banks for the 1980 to 2005 time period. 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 crisis which occurred in the Australian and New Zealand banks systems during the early 90s.

The paper will proceed as follows. Section 2 provides a primer on the bank's accounting for loan losses, which is particularly important to understand the lead/lag characteristic of provisions, write-offs and, finally recoveries. In theory, there are numerous data items which could serve as a potential proxy for a bank's CLE and section 3 first constructs and section 4 then explores a number of CLE ratio series and the relationship between them. This includes a study of issues related to the choice of CLE ratio denominators (section 4.2), an analysis of both

[2] Impaired assets are termed 'delinquent loans' by Keeton (Keeton, 1999)

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

contemporaneous and lead/lagged correlations among the proxies (section 4.3), and , finally, a review of recovery patterns once debts have been written off (section 4.4). Section 5 draws the conclusions.

2 A primer on accounting for loan losses

This section provides an introduction to accounting for loan losses which at first glance often looks confusing. The following general definition, sourced from the Australian Accounting Standards Board's disclosure requirements for financial institutions AASB (1996, 7.2.1)[4], provides a useful starting point for this topic:

> "In the ordinary course of business, financial institutions suffer losses on loans, advances and other credit facilities as a result of their becoming wholly or partially uncollectable. The amount of probable losses that have been specifically identified is recognized as an expense and deducted from the appropriate category of assets as a *specific provision* for impairment. The amount of probable losses not specifically identified but which experience indicates is present in the portfolio of loans and similar facilities as at the reporting date is also recognised as an expense and deducted from the appropriate grouping of assets as a *general provision* for impairment."

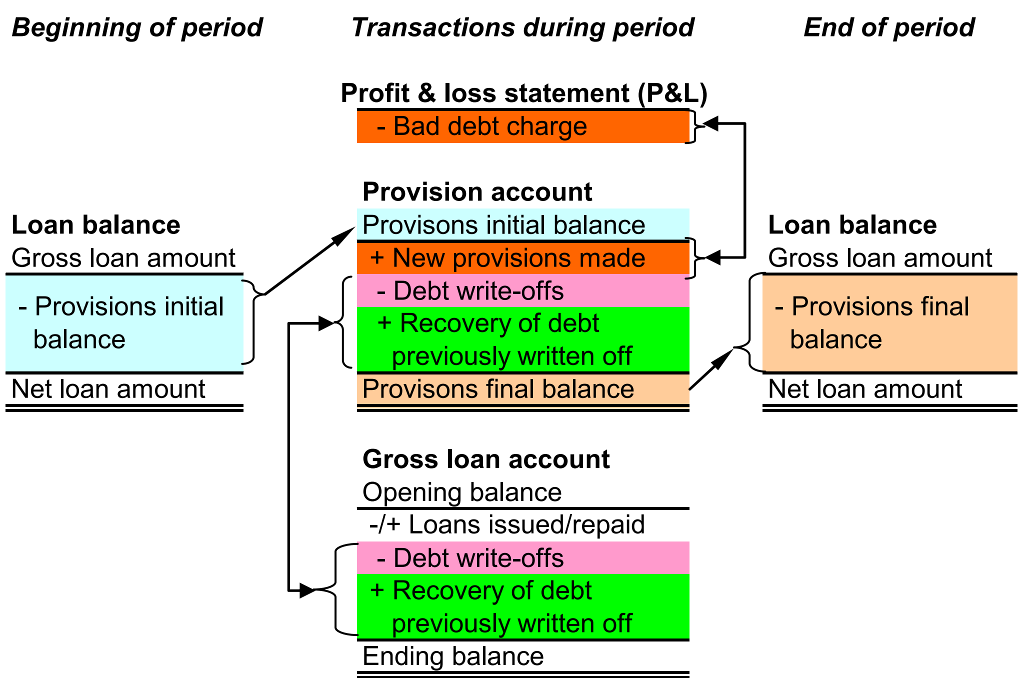
2.1 Basic accounting transactions

Figure 1 visualizes these accounting transactions using the loan account as an example and without distinguishing between specific and general provisions in the first instance. The banks maintain a counter-asset provision account whose opening balance is the difference between the gross loan amount and the net loan amount, i.e. the portion of the loan portfolio it does not expect to collect. If it identifies potential loan losses during the accounting period, it will charge them to the profit and loss (P&L) statement while at the same time increasing (crediting) the loan loss provisions. This means potential losses are not immediately written off from the gross loan

[4] This definition is about to change with the adoption of IFRS based AASB 139. In particular, the use of general provisions is more restricted and limited to assets with objective impairments. The term 'collective' provisions will be used instead. This generalized description of provisions nevertheless remains valid in principle.

balance. Write-offs, also called derecognitions, will typically occur later when the bank actually loses control of its contractual rights, for example if the loan is sold or legal rights are otherwise extinguished[5]. At that point, the corresponding provision is removed (debited) in an offsetting transaction. In some instances such derecognized bad debt might still be recovered, at which time some the gross loan account is increased (debited) and the corresponding provision reinstated, respectively, as some banks will do it, be directly applied to reduce the bad debt charge of the accounting period.

Figure 1: Provisioning for bad loans – generic description of method



[5] Neither New Zealand nor Australia accounting standards prescribe specific rules on the derecognition of financial assets such as loans equivalent to IAS 39.35 which states that "an entity should derecognise a financial asset or a portion of it when, and only when, the entity loses control of the contractual rights that comprise the financial asset (or a portion of it)". This practice is also recommended by the Basel Committee on Banking Supervision (BCBS, 1999, p.15).

2.2 Life cycle perspective

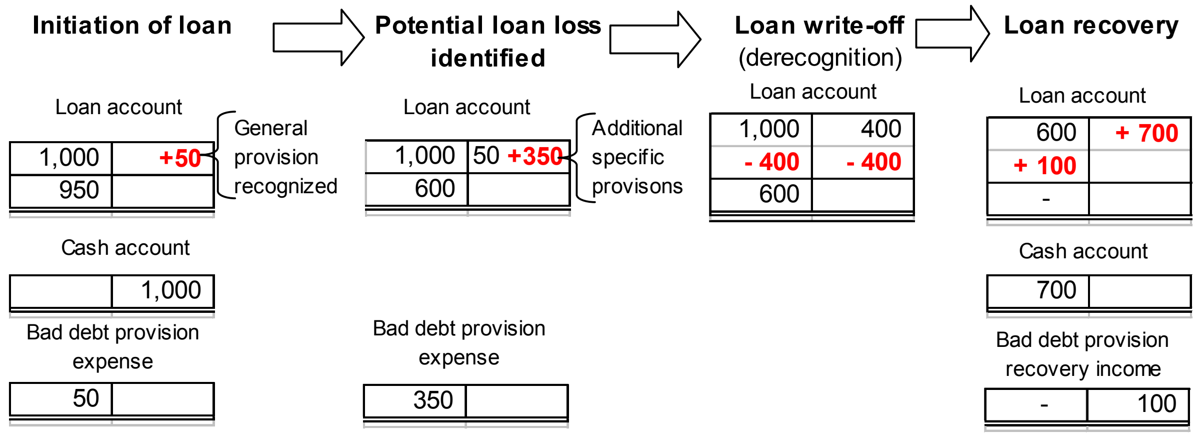
Another approach to understanding accounting for bad debt is to follow the life cycle of a loan that suffers a loss. This is illustrated by means of a simplified numerical example in Figure 2 which does not consider the complexities of accounting for interest earned on defaulted loans.

When a loan is initiated, the bank will typically recognize a *general provision* against it which is maintained as a global provision for a whole portfolio of loans, i.e. not for specific loans. As discussed for example in Wall and Koch (2000), there are at least three schools of thought as to how these should be set and there is even an argument whether they are justified for properly priced loans[6]. General provisions nonetheless remain, and are most discretionary in nature being ultimately determined by judgment of the bank's management.

Once a potential loss has been identified and becomes reasonably probable, the bank will raise a *specific provision* against the loan which is in turn charged to the P&L statement. If the loss is confirmed, derecognition (loan write-off) follows. Finally, some portion of the loan may eventually be recovered. If more than the carrying value of the loan can be recovered, the bank recognizes the excess collected as recovery income often directly to the P&L, respectively sometimes applies it to reduce the ongoing provision charges.

[6] Borio and Lowe (2001, footnote 10, p.46), for instance, dispute the argument that a provision should be created at origination even on correctly priced loans given that default could occur before the interest margin has been earned. They reason that provisioning is about expected outcomes. Loans are not expected to systematically default before the payment of interest. The possibility of an unexpectedly high number of early defaults should be covered by capital. Borio & Lowe's view is also embodied in the new IFRS which does not allow general provisions at the time of initial recognition of the loan.

Figure 2: Life cycle of bad debt accounting - simplified numerical example with T-accounts



3 Constructing proxies for credit loss experience (CLE)

There are number of potential proxies to measure CLE that have been used by earlier studies (see Table 13 in the appendix). Typical CLE proxies employed are ratios with a numerator such as impaired asset charges, the stock of provisions, level of impaired assets or loan write-offs (latter called loan charge-offs in the US terminology of Sinkey Jr. & Greenawalt, 1991). The denominator is mostly chosen as the total balance of loans outstanding and in some cases total bank assets. In general, there is no deliberation in these papers as to why a particular CLE ratio was chosen[7]. An exception is Pain (2003) whose findings are discussed later in this article.

More generally, however, numerous data items in a bank's financial reporting inform about its CLE (see Table 1 for an overview). Loan loss provisions, both as a period expense and as a stock, impaired assets (also called problems loans by some researchers) and write-offs are the most obvious items for the overall loss experience. There are, however, more detailed components of these main CLE data which are also disclosed. The stock of provisions can be split into specific and general components which provide information about the degree of certainty of the expected losses. Likewise, the period loan loss provisions (impaired asset expense) may be separated into a specific and general period expense. As to write-offs, some relate to loans for which previous provisions have been set aside in an earlier period while others, labelled as 'direct write-offs', imply cases of more sudden credit events where loans are written off immediately, without first recognizing provisions.

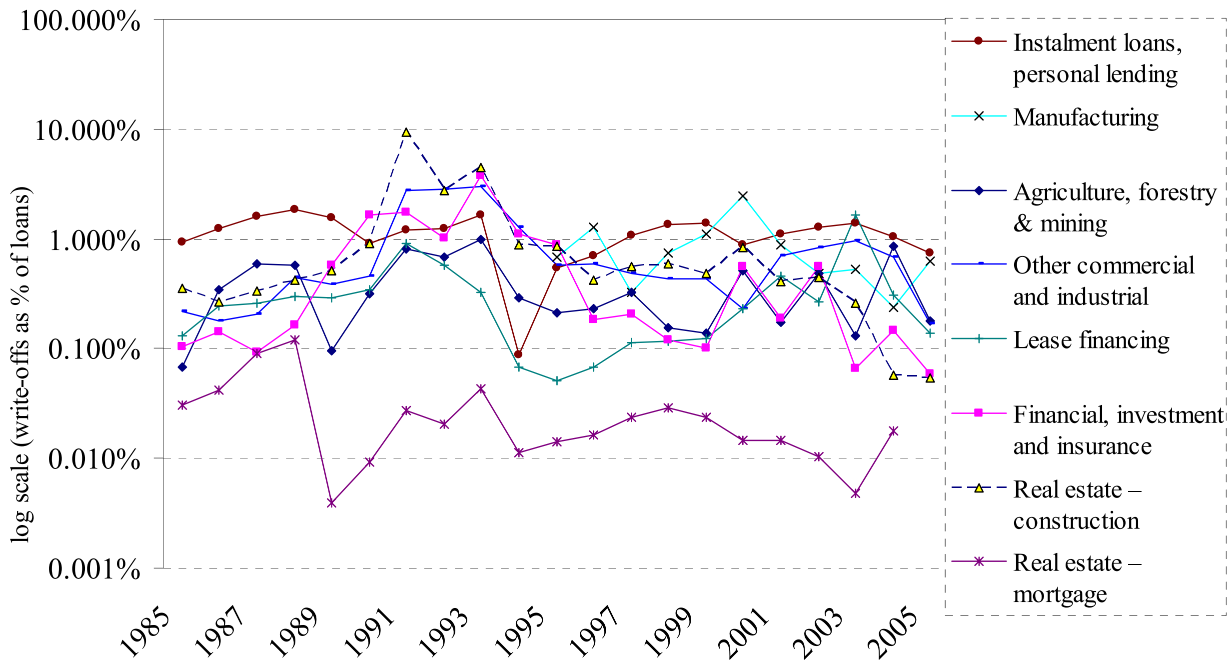
The level of past due loans is another relevant item. Under common accounting definitions past due loans exclude impaired loans, i.e. the bank does not expect to suffer credit losses on

[7] The data in many studies are sourced from third party providers which possibly limits the choice of CLE proxies.

these loans. We include it as a CLE proxy because past due loans might still provide an indication of stress on creditors in the financial system.

Finally, reporting of CLEs by geography and industry segment provides further insights into their characteristics. For illustration, Figure 3 below shows an example of NAB's disclosure of credit losses by lending segment from 1985 to 2005. This segment reporting, however, lacks a standardization of categories across the sample and disclosure in Australasia generally started in the mid 1990s only, i.e. after the major historical peak of credit losses. Moreover, disclosure is non-existent for some smaller banks with limited scope of activities. In the following construction of 13 potential proxies, such segment CLEs have thus not been considered.

Figure 3 NAB: rate of loan write-offs by lending category



Whatever CLE proxy is chosen, it needs to be measured against a reference level. The literature generally sets it against the amount of total loans and sometimes total assets in the bank's balance sheet. For balance sheet CLEs like the stock of provisions it would be the level of loans or assets at same balance sheet date. Conversely, period CLEs like bad debt expense or write-offs are better compared against average levels of loans, respectively assets, observed during the whole accounting period. In practice, however, the choice of exact timing for the denominator will generally be of little consequence.

There are, however, further potential ratio denominators which can be sourced from a bank's P&L statement. We could compare the CLE to the amount of interest income (either gross or net) or total operating income if we wish to consider credit losses stemming from non-balance sheet activities. In the following section (4.2), the properties of some of these potential ratio denominators are further explored.

In theory, the combination of CLE variables and potential ratio denominators would generate innumerable proxy ratios. For the following investigation, we focus on ratios based on loans and assets but also include a measure of bad debt expense against gross and net interest income, i.e. two types of P&L data items. An overview of the 13 CLE proxy ratios constructed for this study is shown in Table 2. It also includes a ratio based on recoveries of bad debts previously written off. Strictly speaking, this is not a CLE proxy but it has been included to test its properties and in particular its correlation with other CLE ratios in the subsequent analysis. Note that all ratios are annualized for comparability, i.e. in cases of shorter or longer accounting periods, CLE data items sourced from the P&L have been adjusted.

Not all ratios constructed could be retrieved for all banks throughout the observation period. Figure 4 illustrates the percentage of banks in our database in existence at the time which reported the particular data item. As reporting of recoveries was patchy until the mid 1990s, net debt write-offs as % of loans provide a much more complete date series. Likewise, ratios based on impaired assets, past due loans and components of bad debt expense are available later in the observation period only. The general picture of CLE data availability does not does change if we create the same figure for the Australian, respectively the New Zealand, sub-sample in Figure 5 and Figure 6. The reporting in Australia has nonetheless been more complete.

Table 1 Potential data to measure credit loss experience (CLE)

CLE variable	Description	General considerations, data availability & issues
Stock of provisions	Total level of specific and general provisions from balance sheet	Widest availability because provisioning level is one of the data items reported very early by most banks. Represents the bank's assessment of the portion of the loan portfolio (or more generally assets) which will be lost due to credit losses. Potential interpretation problems due to effect of write-offs which lower provisioning levels[8]. Some banks did not report general provisions as a component of total provisions which might affect comparability (e.g. many banks earlier in observation period, and NBNZ and Westpac(NZ) in New Zealand until recently)
Stock of specific provisions	Total level of specific provisions from balance sheet	Good data availability. Provides a measure of identified losses which will materialize with a great probability. Potential proxy for expected losses as opposed to unexpected losses which could be proxied by levels of general provisions (see below).
Stock of general provisions	Total level of general provisions from balance sheet	Good data availability. Proxy for the discretionary portion of expected loan losses to test hypotheses regarding behavioural factors driving loan loss provisioning. Proxy for unexpected losses. General provisions partially qualify as capital under current Basel I capital adequacy rules.
Bad debt charges to P&L	Total bad debt expense reported in P&L alternative names are impaired asset expense / ongoing provisions expense.	Generally good data availability but not as good as stock of provisions earlier in the observation period. Provides the bank's assessment of the total credit losses which have occurred during the period. Often requires a manual adjustment in high loss situations when banks were inclined to report such losses as extraordinary or abnormal items.
Specific and general component of bad debt expense to P&L	Bad debt expense to P&L can be disaggregated into a specific component and general component.	Similar consideration as for specific and general component of stock of provisions. Like general provisions above, these two data elements could again be applied to study behavioral aspects when management estimates the discretionary component of provisions. The disaggregation is difficult for some reporting formats and data are incomplete earlier in the observation period.

[8] As discussed in Pain (2003, p. 14, 25)

Table 1 Potential data to measure credit loss experience (CLE) - continued

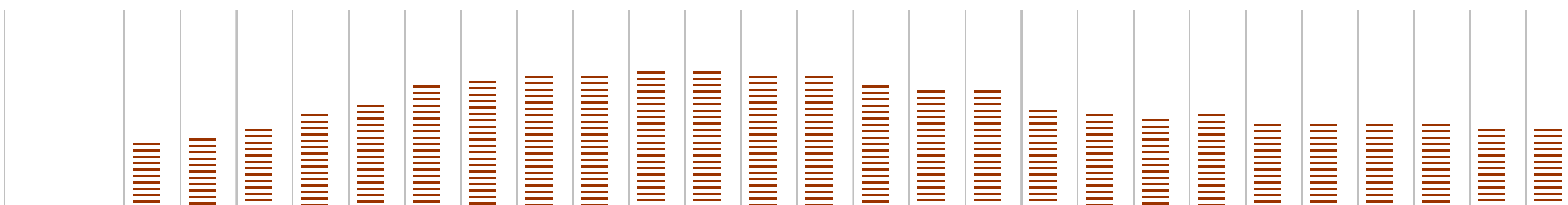
CLE variable	Description	General considerations, data availability & issues
Gross /net debt write-offs	Period write-offs of loan assets (gross) or after deducting recoveries of debts previously written off (net)	Write-offs lag bad debt charges but are "more certain". Anecdotal evidence suggests this is the measure banks consider in their internal performance systems. Earlier in observation period, recoveries of debts previously written-off were often netted (deducted) from this amount. Time series for net write-offs are thus more complete.
Impaired assets (gross before provisions)	Impaired assets include (1) non-accrual assets and (2) restructured assets.	Widespread reporting generally started at the beginning of 1990s. Inconsistent reporting of this data item (if reported at all) before 1990 due to judgment issues as to what constitutes an impaired loan. This is reflected in time series breaks with substantial restatements in subsequent periods.
Past due assets	Servicing on past-due loan assets is typically overdue for more than 90 days	Past due assets consistently reported only after the mid 1990s. They do not necessarily imply impending credit losses as they then would be classified as impaired loans.

Table 2 CLE ratios constructed

Ratio acronym	Full ratio name
IAE_LN	Impaired asset expense as % of average loans
IAE_NI	Impaired asset expense as % net interest income
IAE_GI	Impaired asset expense as % gross interest income
NW_LN	Net debt write-offs as % of average loans
GW_LN	Gross debt write-offs as % of average loans
RC_LN	Recoveries as % of average loans
PRV_LN	Stock of provisions as % of loans
GE_LN	General provisions total as % of loans
SP_LN	Specific provisions total as % of loans
IA_A	Impaired assets as % total assets
PD_A	Past due loans as % total assets
GEE_LN	General provision expense as % of average loans
SPE_LN	Specific provision expense as % of average loans

Figure 4 Percentage of banks reporting CLE proxy ratios during observation period (**full sample**)

AU+NZ	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
IAE_LN	85%	79%	63%	53%	52%	64%	77%	85%	89%	93%	96%	96%	96%	96%	100%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
IAE_NI	62%	64%	50%	42%	43%	60%	81%	89%	89%	93%	96%	96%	96%	96%	100%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
IAE_GI	54%	57%	44%	42%	43%	60%	81%	89%	89%	93%	96%	96%	96%	96%	100%	96%	100%	100%	100%	100%	100%	100%	100%	88%	94%	94%
NW_LN	85%	79%	63%	53%	57%	60%	65%	74%	85%	93%	89%	93%	89%	96%	100%	96%	100%	100%	100%	95%	100%	100%	100%	100%	100%	100%
GW_LN	69%	64%	50%	47%	43%	36%	35%	37%	48%	54%	61%	63%	63%	68%	79%	79%	85%	95%	94%	84%	88%	88%	88%	82%	81%	81%
RC_LN	62%	64%	50%	47%	43%	36%	35%	37%	48%	50%	61%	59%	59%	68%	79%	79%	85%	95%	94%	84%	88%	88%	88%	82%	81%	81%
PRV_LN	92%	93%	75%	68%	71%	72%	88%	96%	96%	96%	96%	96%	96%	100%	100%	96%	100%	100%	100%	95%	100%	100%	100%	100%	100%	100%
GE_LN	69%	79%	69%	58%	57%	60%	69%	81%	81%	82%	89%	85%	93%	92%	96%	92%	95%	95%	94%	89%	94%	94%	94%	100%	100%	94%
SP_LN	54%	57%	56%	53%	48%	40%	50%	67%	59%	86%	89%	93%	93%	96%	96%	92%	95%	95%	94%	89%	100%	100%	100%	94%	94%	94%
IA_A	0%	0%	6%	5%	10%	12%	12%	15%	19%	29%	46%	63%	81%	84%	88%	92%	95%	95%	94%	89%	100%	100%	100%	100%	100%	100%
PD_A	0%	0%	0%	0%	0%	4%	8%	7%	7%	11%	18%	26%	37%	52%	63%	71%	90%	95%	94%	89%	100%	100%	100%	94%	94%	94%
GEE_LN	15%	14%	19%	16%	19%	16%	23%	26%	30%	36%	46%	52%	59%	72%	79%	75%	80%	95%	94%	84%	88%	88%	94%	94%	94%	94%
SPE_LN	15%	14%	13%	11%	14%	12%	19%	22%	37%	43%	54%	63%	70%	80%	83%	88%	90%	100%	100%	95%	100%	100%	100%	94%	94%	94%



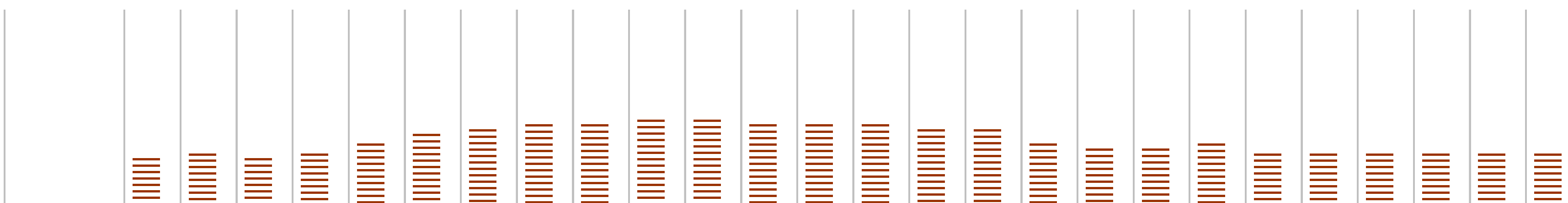
Total banks	13	14	16	19	21	25	26	27	27	28	28	27	27	25	24	24	20	19	18	19	17	17	17	17	16	16

Colour coding:

XX% 0 to 25% XX% 25% to 50% XX% 50% to 75% XX% more than 75%

Figure 5 Percentage of banks reporting CLE proxy ratios during observation period (**Australian sub-sample**)

Australia	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
IAE_LN	90%	82%	80%	73%	62%	80%	88%	88%	100%	100%	100%	100%	100%	100%	100%	94%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
IAE_NI	70%	73%	70%	64%	54%	80%	94%	94%	100%	100%	100%	100%	100%	100%	100%	94%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
IAE_GI	60%	64%	60%	64%	54%	80%	94%	94%	100%	100%	100%	100%	100%	100%	100%	94%	100%	100%	100%	100%	100%	100%	100%	91%	91%	91%
NW_LN	90%	82%	80%	73%	62%	73%	81%	88%	94%	94%	94%	94%	94%	94%	100%	94%	100%	100%	100%	92%	100%	100%	100%	100%	100%	100%
GW_LN	80%	73%	70%	64%	54%	47%	44%	47%	53%	56%	61%	65%	65%	71%	81%	75%	85%	100%	100%	85%	91%	91%	91%	82%	82%	82%
RC_LN	80%	73%	70%	64%	54%	47%	44%	47%	53%	50%	61%	59%	65%	71%	81%	75%	85%	100%	100%	85%	91%	91%	91%	82%	82%	82%
PRV_LN	90%	91%	80%	82%	85%	87%	94%	94%	94%	94%	94%	94%	94%	100%	100%	94%	100%	100%	100%	92%	100%	100%	100%	100%	100%	100%
GE_LN	60%	73%	80%	73%	69%	73%	75%	82%	82%	89%	94%	88%	94%	94%	100%	94%	100%	100%	100%	92%	100%	100%	100%	100%	100%	91%
SP_LN	40%	45%	50%	55%	46%	40%	50%	59%	53%	83%	89%	94%	94%	100%	100%	94%	100%	100%	100%	92%	100%	100%	100%	100%	100%	91%
IA_A	0%	0%	10%	9%	15%	20%	19%	24%	29%	39%	56%	76%	94%	94%	94%	94%	100%	100%	100%	92%	100%	100%	100%	100%	100%	100%
PD_A	0%	0%	0%	0%	0%	7%	13%	12%	12%	17%	28%	41%	59%	71%	75%	69%	85%	92%	92%	85%	100%	100%	100%	91%	91%	91%
GEE_LN	10%	9%	20%	18%	15%	13%	19%	24%	29%	33%	44%	53%	65%	76%	75%	81%	85%	100%	100%	85%	91%	91%	100%	91%	91%	91%
SPE_LN	10%	9%	10%	9%	8%	7%	19%	24%	29%	33%	44%	53%	65%	76%	75%	81%	85%	100%	100%	92%	100%	100%	100%	91%	91%	91%



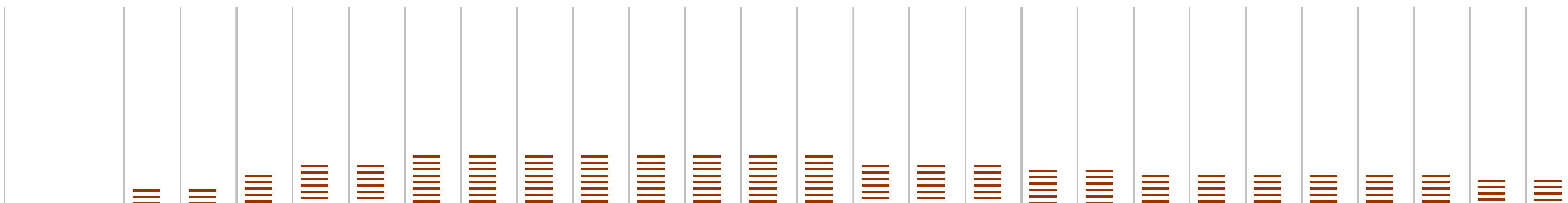
Total banks	10	11	10	11	13	15	16	17	17	18	18	17	17	17	16	16	13	12	12	13	11	11	11	11	11	11

Colour coding:

XX% 0 to 25% XX% 25% to 50% XX% 50% to 75% XX% more than 75%

Figure 6 Percentage of banks reporting CLE proxy ratios during observation period (**New Zealand sub-sample**)

NZLD	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
IAE_LN	67%	67%	33%	25%	38%	40%	60%	80%	70%	80%	90%	90%	90%	88%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
IAE_NI	33%	33%	17%	13%	25%	30%	60%	80%	70%	80%	90%	90%	90%	88%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
IAE_GI	33%	33%	17%	13%	25%	30%	60%	80%	70%	80%	90%	90%	90%	88%	100%	100%	100%	100%	100%	100%	100%	100%	100%	83%	100%	100%
NW_LN	67%	67%	33%	25%	50%	40%	40%	50%	70%	90%	80%	90%	80%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
GW_LN	33%	33%	17%	25%	25%	20%	20%	20%	40%	50%	60%	60%	60%	63%	75%	88%	86%	86%	83%	83%	83%	83%	83%	83%	80%	80%
RC_LN	0%	33%	17%	25%	25%	20%	20%	20%	40%	50%	60%	60%	50%	63%	75%	88%	86%	86%	83%	83%	83%	83%	83%	83%	80%	80%
PRV_LN	100%	100%	67%	50%	50%	50%	80%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
GE_LN	100%	100%	50%	38%	38%	40%	60%	80%	80%	70%	80%	80%	90%	88%	88%	88%	86%	86%	83%	83%	83%	83%	83%	100%	100%	100%
SP_LN	100%	100%	67%	50%	50%	40%	50%	80%	70%	90%	90%	90%	90%	88%	88%	88%	86%	86%	83%	83%	100%	100%	100%	83%	80%	100%
IA_A	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%	30%	40%	60%	63%	75%	88%	86%	86%	83%	83%	100%	100%	100%	100%	100%	100%
PD_A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	13%	38%	75%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
GEE_LN	33%	33%	17%	13%	25%	20%	30%	30%	30%	40%	50%	50%	50%	63%	88%	63%	71%	86%	83%	83%	83%	83%	83%	100%	100%	100%
SPE_LN	33%	33%	17%	13%	25%	20%	20%	20%	50%	60%	70%	80%	80%	88%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%



Total banks	3	3	6	8	8	10	10	10	10	10	10	10	10	8	8	8	7	7	6	6	6	6	6	6	5	5

Colour coding:

XX% 0 to 25%   XX% 25% to 50%   XX% 50% to 75%   XX% more than 75%

Table 3 Summary statistics CLE proxies (pooled observations of all banks in data sample)

	IAE_LN	IAE_NI	IAE_GI	NW_LN	GW_LN	RC_LN	PRV_LN	GE_LN	SP_LN	IA_A	PD_A	GEE_LN	SPE_LN
Mean	0.57%	14.71%	3.61%	0.46%	0.57%	0.05%	1.37%	0.79%	0.74%	1.42%	0.35%	0.08%	0.51%
Median	0.27%	6.40%	2.17%	0.20%	0.25%	0.03%	0.89%	0.59%	0.35%	0.63%	0.27%	0.05%	0.22%
Maximum	16.51%	790.46%	79.24%	14.35%	14.35%	0.46%	18.75%	16.46%	11.15%	22.60%	4.32%	1.61%	16.66%
Minimum	-7.41%	-59.98%	-28.16%	-0.03%	0.01%	0.00%	0.00%	0.02%	0.00%	0.00%	-0.26%	-1.17%	-7.36%
Std. Dev.	1.38%	50.97%	7.08%	1.10%	1.26%	0.05%	1.80%	1.20%	1.21%	2.40%	0.39%	0.23%	1.31%
Skewness	6.47	11.19	6.30	8.31	7.35	2.55	4.82	8.54	4.44	4.59	5.49	2.14	6.40
Kurtosis	66.84	149.45	59.78	90.57	70.19	13.98	33.44	92.02	29.92	32.13	49.41	20.85	81.08
Jarque-Bera	86265.9	437177.0	66383.3	157235.7	70751.0	2166.3	21707.8	158154.4	14635.5	12202.7	23119.6	4296.2	85806.7
Probability	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	488	478	471	475	359	355	511	462	437	314	244	306	329
Cross sections (banks)	32	31	31	32	26	26	32	30	30	28	25	25	26

4 Properties and evaluation of CLE proxies

This section analyses the properties of the 13 CLE proxy ratios that have been constructed. It is partially inspired by Pain (2003, p. 14-18), who evaluates and explores some of them for his sample of UK commercial and mortgage banks.

4.1 Summary statistics and initial data exploration

The summary statistics of CLE proxies are shown in Table 3. None of the CLE proxies appears normally distributed judging from skewness values and Jarque-Bera statistics. Rather they rather exhibit an extended right tail (positive skewness) as is typical for credit loss distributions where high loss credit events are infrequent. This distribution can be seen in the histogram for some important CLE's in Figure 7. The large number of observations beyond two standard deviations above the median observation are of particular concern for the risk management of a bank. Notable in the histogram is also the fact that there appear no observations of very low levels of net-write-offs (NW_LN), i.e. less then 0.25 standard deviations below median. Unlike provisions, which contain a substantial element of discretion and might be negative (i.e. unwound) in some years, net write-offs appear always to be present at a minimum level. Note that that we have chosen the median instead of the mean in this chart mainly for presentation purposes because mean values of some CLEs are affected by few extreme outliers.

An important aspect in the evaluation of CLE proxies is how they have measured loan losses through time. As shown in the summary statistics Table 3, CLEs proxies vary greatly in their overall sensitivity with standard deviations, ranging from less than 1% for measures based on total loans to over 50% for impaired asset expense as % of net interest income[9]. These differing levels of sensitivity can also be seen in Figure 8 which shows CLE standard deviations

[9] Recoveries with their low standard deviation are not considered as they are not an actual CLE proxy.

through the observation period against a logarithmic scale. Overall the CLE proxies nevertheless all seem to measure the credit loss experience through time with a similar pattern. For this purpose we demean and standardize the observed annual averages of CLE proxies and plot them in Figure 9. Note that standardization means that we divide the demeaned annual average by the standard deviation of the CLE proxy of all banks over the whole sample period, not by the standard deviation of the particular year.

Figure 7 Histogram of selected CLE proxies

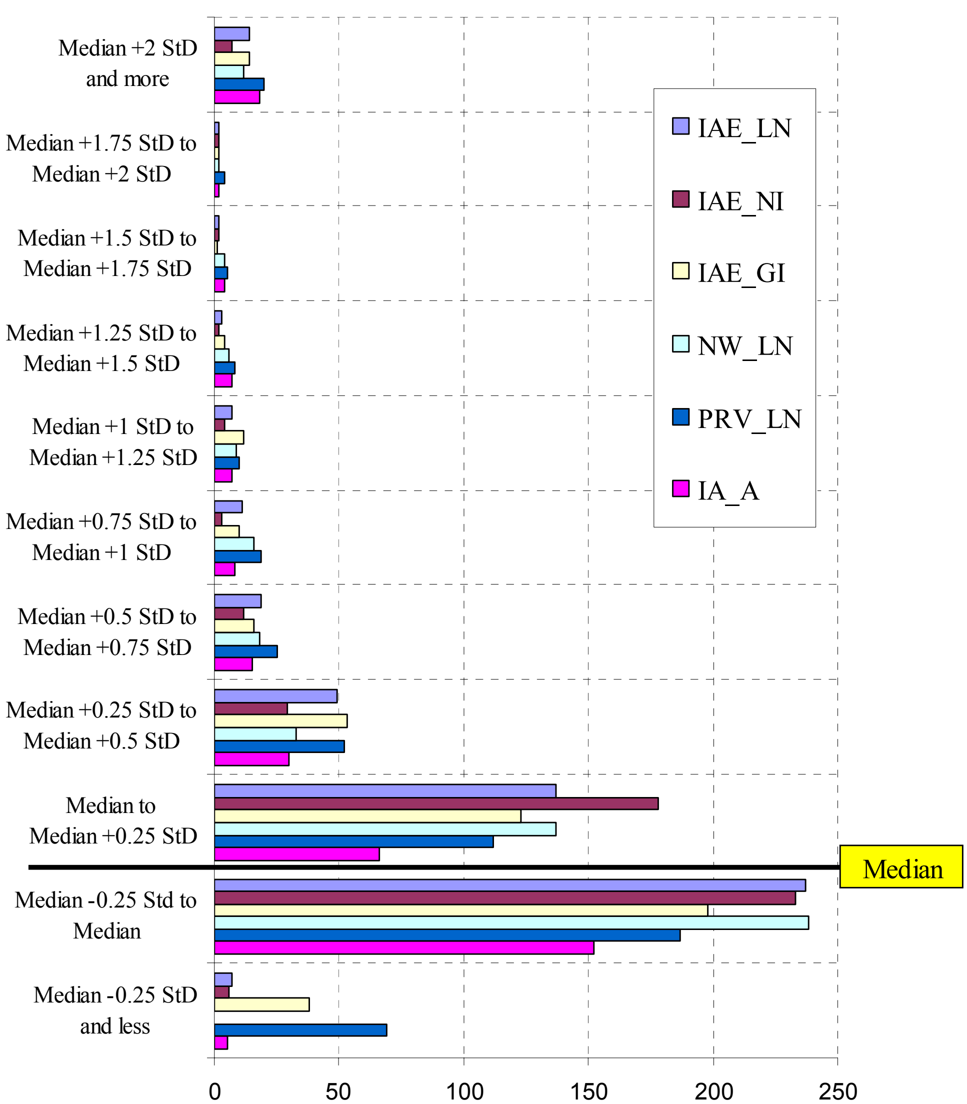


Figure 8 Standard deviation of CLE proxies (all banks) for each year in observation period

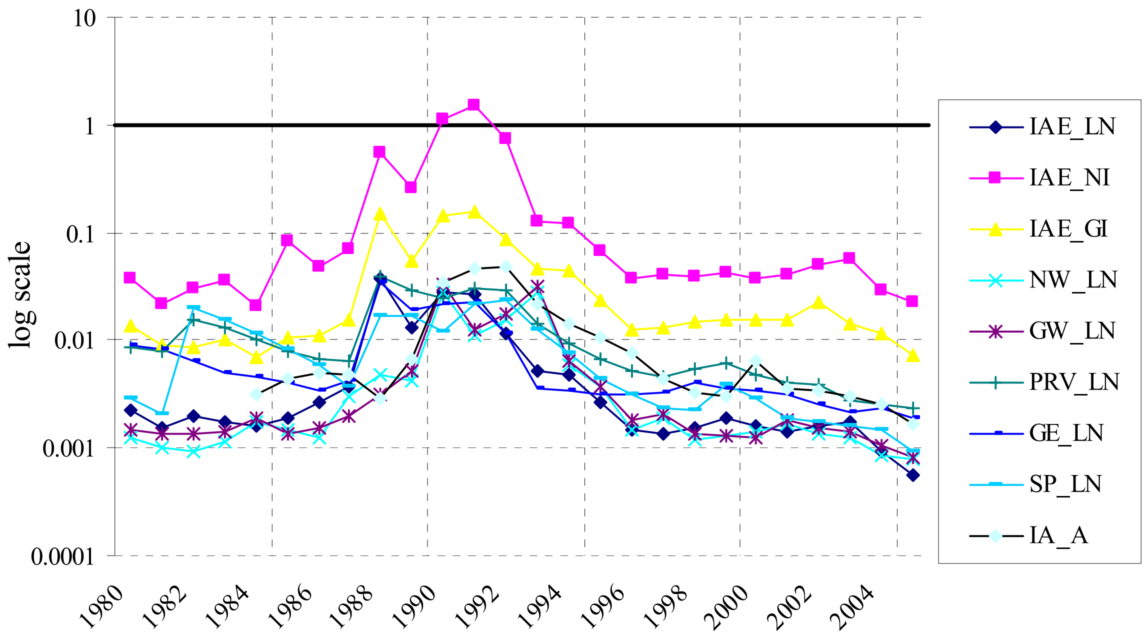
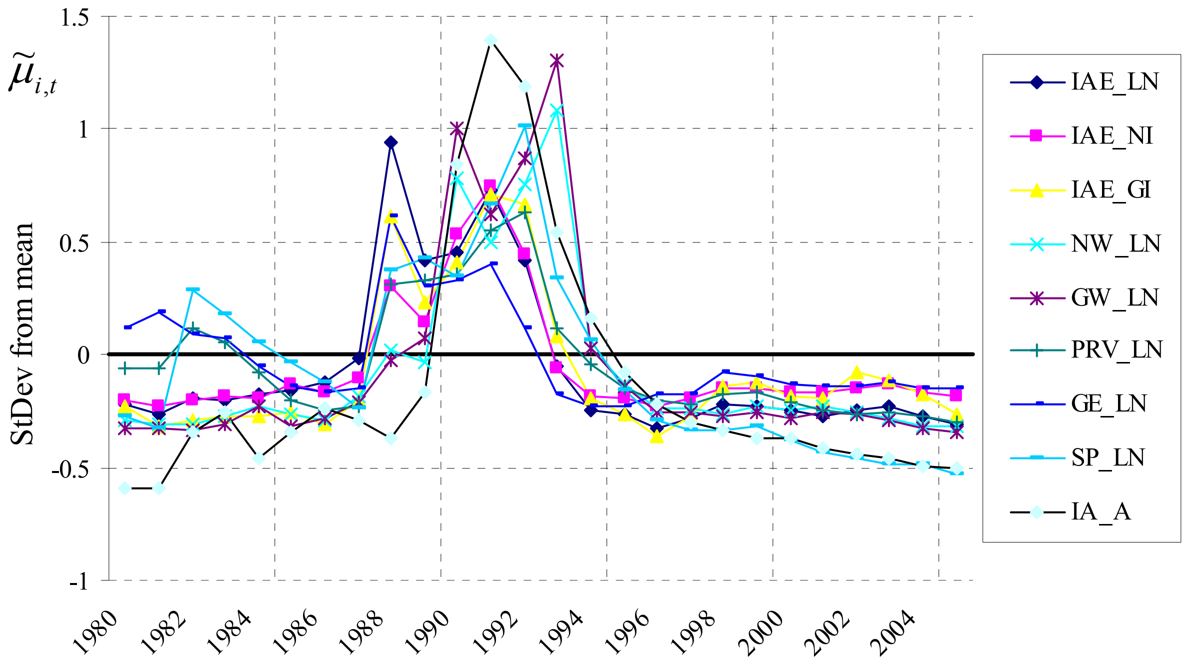


Figure 9 Demeaned and standardized CLE proxies through 1980-2005 observation period



Demeaned, standardized $\widetilde{\mu}_{i,t} = \dfrac{\mu_{i,t} - \overline{\mu}_i}{\overline{\sigma}_i}$,

where $\mu_{i,t}$ is mean of observed pooled CLE i for year t, and $\overline{\mu}_i$ / $\overline{\sigma}_i$ are mean / standard deviation of CLE i for all banks over whole observation period.

4.2 Evaluating the properties of CLE ratio denominators

As stated earlier, most research uses either total loans or assets as a reference to measure credit loan loss experience. For our evaluation we have also chosen net and gross interest income as a denominator for two of the CLE proxies. This sub-section reviews the properties of these denominators and other P&L data items.

Whenever we use a ratio as a variable to be explained, we need to understand factors affecting both numerator and denominator. In the case of CLE ratios, the numerator proxies the loss experience while the denominator provides a reference level against which this loss experience is measured. Ideally we wish this reference level to be a measure of the bank's business activities subject to credit risk. It should be unaffected by other factors, especially not by contemporaneous or lagged explanatory variables of a CLE estimation model.

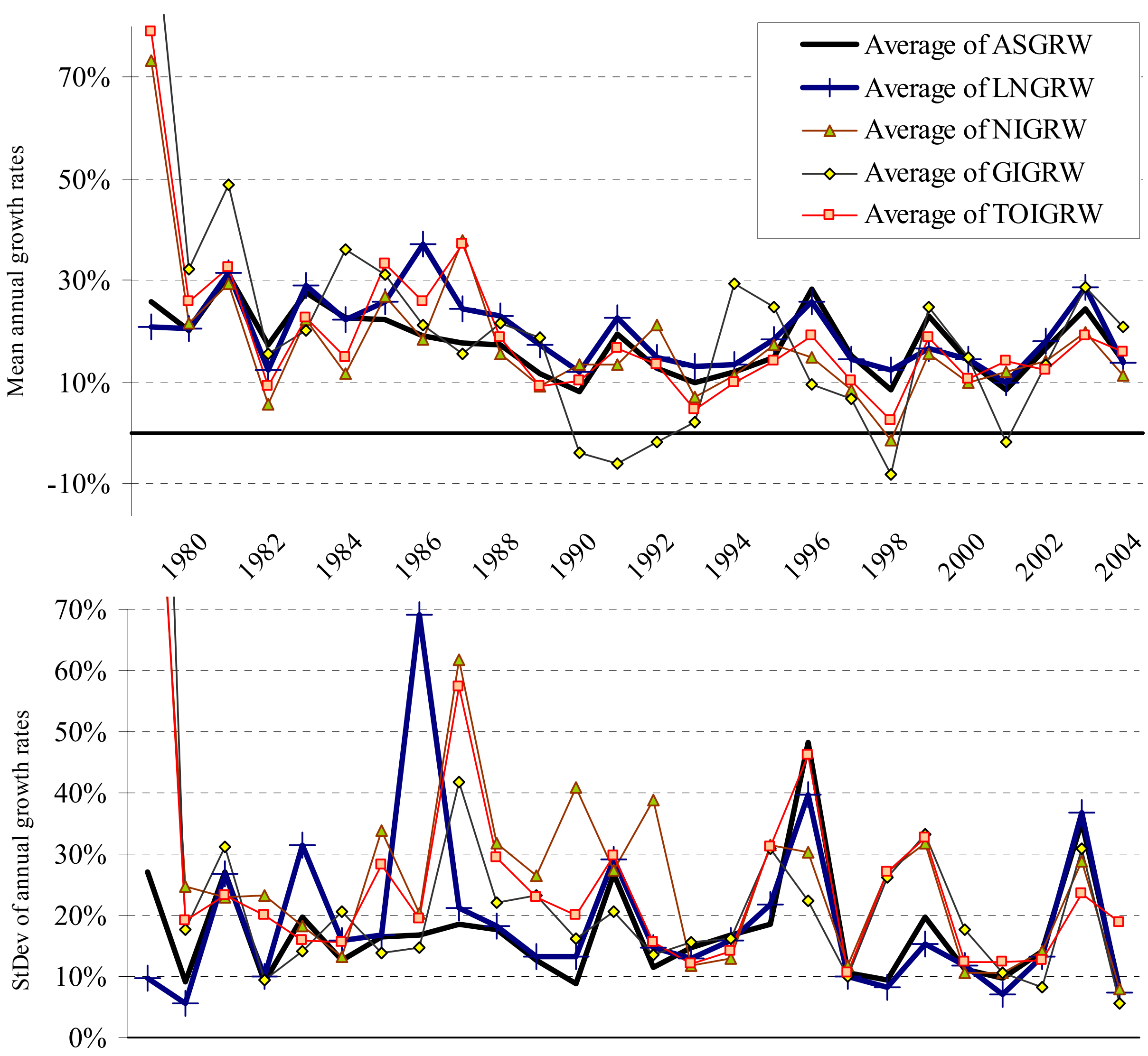
To study their general characteristics, we select 5 potential proxy denominators and analyse their time series of percentage changes, i.e. growth rates of total assets (ASGRW), total loans (LNGRW), net interest income (NIGRW), gross interest income (GIGRW), and, finally, total operating income (TOIGRW) which is defined as the sum of net interest and other operating income. The summary statistics are shown in Table 4 below.

Table 4 Summary statistics of CLE ratio denominators

Growth rate of …	Assets	Loans	Net interest income	Gross interest income	Total operating income
Variable name	ASGRW	LNGRW	NIGRW	GIGRW	TOIGRW
Mean	17.26%	19.73%	16.46%	15.97%	17.56%
Median	14.14%	15.50%	11.14%	14.22%	12.32%
Maximum	180.55%	326.52%	374.24%	507.87%	374.24%
Minimum	-40.07%	-28.33%	-101.59%	-98.57%	-100.15%
Std. Dev.	19.55%	24.63%	33.27%	33.47%	31.16%
Skewness	2.99	5.42	4.59	7.13	5.00
Kurtosis	20.58	55.32	40.53	99.87	47.64
Observations	526	516	498	488	504
Cross sections	32	32	31	31	31

Not unexpected, one observes lower levels of volatility for changes in levels of assets and loans with standard deviations of 19.6% and 24.6% respectively. This compares to more than 30% standard deviation for all three net income items. This lower volatility is visualized in Figure 10 where we show annual mean growth rates for each CLE ratio denominator and the corresponding standard deviations of pooled observations in a particular year (lower part of figure). If one also considers that the CLE ratios based on assets and loans are, on average, much smaller than ratios based on income data items, one can again appreciate the lower overall volatility of asset and loan based ratios found in Table 3. This is illustrated in two numerical examples of Figure 11 below which takes two hypothetical CLE ratios based on impaired assets and firstly applies a $1 million increase to impaired asset expense (Example 1). The absolute change in the ratio based on the larger asset number is much smaller than in the case of CLE ratio 2 based on the smaller net interest income. Likewise equivalent percentage changes of the denominator (Example 2) lead to much greater absolute change in CLE ratio 2.

Figure 10 Average annual growth rates and corresponding standard deviation of CLE proxy denominators



Explanations:
ASGRW – growth of total assets, LNGRW – growth of total loans, NIGRW – growth net interest income, GIGRW – growth gross interest income, TOIGRW – growth total operating income

Figure 11 Numerical examples on sensitivities of CLE ratios

Example 1

($ numbers in million)			Increase				
Impaired asset expense	$	10	+$ 1	$	11		
Total assets	$	1,000		$	1,000		
CLE Ratio 1		1.00%	→		1.10%	absolute change	0.10%
Impaired asset expense	$	10	+$ 1	$	11		
Net interest income	$	100		$	100		
CLE Ratio 2		10.00%	→		11.00%	absolute change	1.00%

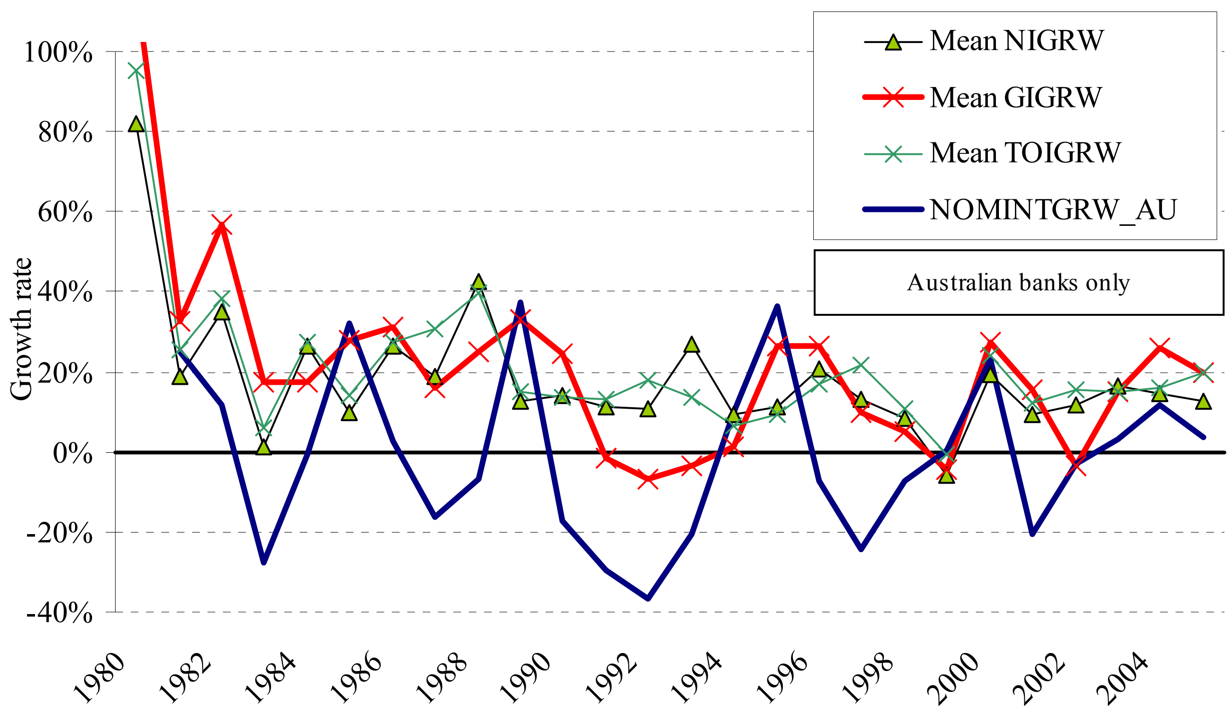
Example 2

($ numbers in million)			Increase				
Impaired asset expense	$	10		$	10		
Total assets	$	1,000	+10%	$	1,100		
CLE Ratio 1		1.00%	→		0.91%	absolute change	-0.09%
Impaired asset expense	$	10		$	10		
Net interest income	$	100	+10%	$	110		
CLE Ratio 2		10.00%	→		9.09%	absolute change	-0.91%

The market interest rate is an obvious factor which one would expect to drive changes in CLE denominators, especially income data items of which interest income is an important component. It will have an immediate impact on gross interest income but in the case of net interest income and total operating income the effect could possibly cancel out due to an offsetting effect on interest expense. We plot the % changes of these three income items against % changes in nominal interest rates for the sub-sample of Australian banks in Figure 12.

As expected, nominal interest rates appear to drive levels of gross interest income, in some cases flowing through with a small delay. On the other hand, any interactions with the other two income items, net interest income and total operating income, do not immediately become apparent. To test this more formally, we estimate changes in CLE ratio denominators as a linear function of contemporaneous and one year lagged nominal interest rate changes for both the Australian and New Zealand sub-samples. The results in Table 5 confirm the visual impression of Figure 12. Gross interest income has been the only item which is significantly affected by contemporaneous and lagged changes in nominal interest rates in both Australia and New Zealand. We also note some significance of the contemporaneous coefficient of asset growth for the New Zealand sub-sample, although at a lower level. This could well be an effect of a reverse causality as strong asset growth in the system, i.e. a strong economy, is often accompanied by tight monetary policies.

Figure 12 Growth rates Australian bank income items compared to growth of nominal interest rates



Explanations:
NIGRW – Growth net interest income, GIGRW – Growth gross interest income, TOIGRW – Growth total operating income, NOMINT_AU_GRW: growth nominal interest rate AUD (short-term rates sourced from Datastream code AUOCFIST)

Table 5 Modelling % changes of CLE ratio denominators as a linear function of point changes in nominal interest rates (NOMINTGRW)

	NOMINTGRW Coefficient (t-Statistic)			Adj. R-square	No of banks	Pool obs.	F-statistic
	Constant C	Contem-poraneous α_0	One year lagged α_{-1}				
Australia							
ASGRW	0.1797	0.5052	-0.0597	-0.0025	22	331	0.587
	(16.646)	(1.288)	(-0.141)				
LNGRW	0.21186	0.0422	0.1479	-0.0060	22	327	0.033
	(15.043)	(0.069)	(0.277)				
NIGRW	0.1598	0.2974	-0.2917	0.0000	21	322	0.190
	(10.716)	(0.587)	(-0.427)				
GIGRW	0.1819	****2.8294**	****3.3047**	0.1789	21	315	****35.214**
	(13.431)	(6.550)	(6.080)				
TOIGRW	0.1769	0.0757	0.0887	-0.0061	21	322	0.021
	(12.117)	(0.147)	(0.152)				
New Zealand							
ASGRW	0.1625	0.8323	0.4174	0.0097	10	182	1.890
	(12.130)	(1.951)	(0.938)				
LNGRW	0.1748	0.5465	0.1944	-0.0046	10	177	0.597
	(11.442)	(1.105)	(0.387)				
NIGRW	0.1440	-1.0929	0.4666	0.0002	10	168	1.013
	(6.689)	(-0.933)	(0.560)				
GIGRW	0.1664	****4.2845**	****2.2619**	0.3208	10	167	****40.199**
	(11.028)	(8.106)	(4.522)				
TOIGRW	0.1500	-0.9963	0.9881	0.0154	10	175	2.365
	(8.267)	(-1.064)	(1.318)				

** significant at 1% level, * at 5% level

Estimation equation for the example of asset growth proxy (ASGRW):

$$ASGRW_{i,t} = C + \alpha_0 NOMINTGRW_{i,t} + \alpha_{-1} NOMINTGRW_{i,t-1} + u_{i,t}$$

with $ASGRW_{i,t} = \dfrac{Assets_{i,t} - Assets_{i,t-1}}{Assets_{i,t-1}}$ and $NOMINTGRW_{i,t} = NOMINT_{i,t} - NOMINT_{i,t-1}$

Estimated with White diagonal standard errors & covariance (d.f. corrected) without fixed or random effects.

In summary, the balance sheet items assets and loans appear to have more desirable characteristics for the purpose of CLE ratio denominators. They are less volatile themselves and, since they are much larger than bad debt expense and write-offs, changes in credit loss experience will be the dominant effect on the overall CLE ratio sensitivity. Gross interest income is also quite large compared to the CLE numerators but it is immediately affected by interest rates in the market. Net interest and total interest income, finally, are rather small and whatever factor drives them will lead to great volatility in the CLE proxy.

4.3 Analysis of contemporaneous and lead/lag characteristics

An important question relates to the correlations among the 13 ratios which all measure aspects of a bank's CLE. Overall one would expect very high correlations, particularly among the ones using stock of provision, impaired assets and impaired asset expense. For this purpose, we follow the methodology of examining contemporaneous and lead/lag correlations as it is, for instance, used in the research on transmission of economic cycles across nations, regions or industries (an example is Grimes, 2005).

The top of Figure 13 shows the matrix of contemporaneous Pearson product moment correlation coefficients among the 13 CLEs. High correlations above 0.8, respectively between 0.6 and 0.8, are highlighted. Not surprising is the very high correlation among the three proxies all using impaired asset expense in the numerator. There is still quite a high correlation of 0.63 between impaired asset expense (as % of loans) and the level of impaired assets (as % of total assets). A little lower (just under 0.6) is the correlation between impaired asset expense and the stock of provisions. As indicated, both ratios have been used by researchers and it is important to test how robust their estimations would be with the alternative measure. Pain (2003) argues in favour of employing impaired asset expense instead of stock of provisions. This is because stock of provisions may give a misleading picture of current developments in (ex post) credit risk as large write-offs in any one period may cause a fall in provisioning levels even though significant new bad debts have arisen[10].

There is very high correlation (0.98) between the overall impaired asset expense and its specific component which thus appears to dominate the general, i.e. discretionary part of total bad debt expense (correlation only 0.4). In the case of the stock of provisions, both general and specific components have similarly high correlations.

A further result is that the past due assets do not appear to correlate with any other CLE ratio. As stated before, assets classified as past due are not considered impaired. The low correlation would thus indicate that past due loans are indeed attributable to technical delays in loan servicing and not due to fundamental quality problems in the portfolio. Due to this low correlation we have omitted past due assets based CLEs in some of the statistics earlier in this article.

Neither write-off proxy (NW_LN, GW_LN) exhibits a high contemporaneous correlation with the other major CLE measures (0.38 – 0.6) but the picture changes if we consider the lead/lag correlation matrix at the bottom of Figure 13. In this matrix, the diagonal elements provide a measure of the degree of persistence of each CLE series. More interesting for study of delayed effects between the series are the non-diagonal elements. Where the lead/lag correlation exceeds the corresponding contemporaneous value, one can say that the CLE proxy in the left column leads the proxy in the top row. Such instances are highlighted in bold in the bottom of Figure 13. As an example, the contemporaneous correlation between the stock of provisions (PRV_LN) and net write-offs (NW_LN) is merely 0.39 while the level of provisions has a higher correlation with write-offs in the subsequent period (0.55). This result is highly intuitive since provisions will eventually lead to definite loan derecognitions. Likewise the matrix indicates that

[10] Formally the accounting relationship between stock of provisions and provision charges is as follows (as shown in the primer on loan loss accounting):
stock of provisions$_t$ = stock of provisions$_{t-1}$ + new charges to P&L$_t$ – [write-offs$_t$ – recoveries$_t$] + other adjustments (i.e. currency translation, provisions of acquired or sold entities)

after high levels of write-offs, the recovery rate will be higher. The correlation of past due assets at time t with other measures at t+1 remains very low, reconfirming that past due assets do not contain material information about future loan losses.

For his sample of UK banks Pain (2003) also explores the lead/lag characteristics of loan write-offs for individual UK banks and finds that lag coefficients are likely to differ among them. Inspired by Pain's approach (Pain, 2003, Table 4, p. 17), we study this question for the major banking institutions in the sample as well as for some smaller ones with extended data series (total of 13 banks). The result of this analysis is shown in Table 6 and Table 7 where we calculate correlations of stocks of provision with subsequent write-offs (Table 6) and correlations of impaired asset expense with subsequent write-offs, respectively (Table 7). Contemporaneous correlations and correlations of up to four leads are shown in these tables.

While Pain finds correlation coefficients of around 0.7 for the first leads and lower coefficients when longer leads are applied to the provisions term[11], these coefficients seem to be substantially higher for many banks in our sample. At the same time we note some extreme outliers with New Zealand's TSB Bank and to a minor extent also Bank of Queensland showing very low and even negative correlations in many instances. Both are smaller, retail focused institutions where one could observe quite erratic provisioning pattern, particularly with regard to general provisioning earlier in the observation period, without subsequent write-offs. Likewise, we find much below average correlations for BNZ whose results are likely affected by substantial provisions after its 1990-91 de facto collapse which were then not all followed by corresponding write-offs but were partially reversed in subsequent years (see Figure 15 for illustration). All in all, it becomes clear that banks exhibit very different write-down patterns of loan loss provisions with some appearing to write them off quicker than others. This can best be

[11] Note that Pain (2003)calculates up to three period lagged correlations but just for impaired assed expense (termed 'new provision charges' in his paper) and not also for stock of provisions.

seen in Figure 14 where we visualize results of Table 7 for the case of major New Zealand banks.

Figure 13 Correlations among CLE proxies (full data sample)

Contemporaneous correlations

	IAE_LN	IAE_NI	IAE_GI	NW_LN	GW_LN	RC_LN	PRV_LN	GE_LN	SP_LN	IA_A	PD_A	GEE_LN	SPE_LN
IAE_LN	1.00	**0.80**	**0.96**	0.46	0.46	0.11	0.60	0.46	0.48	0.63	0.06	0.40	**0.98**
IAE_NI	**0.80**	1.00	**0.88**	0.57	0.56	0.02	0.49	0.20	0.59	0.71	-0.02	0.32	**0.91**
IAE_GI	**0.96**	**0.88**	1.00	0.52	0.51	0.09	0.59	0.40	0.53	0.68	0.04	0.26	**0.95**
NW_LN	0.46	0.57	0.52	1.00	**1.00**	0.20	0.39	0.15	0.46	0.60	0.00	-0.07	0.37
GW_LN	0.46	0.56	0.51	**1.00**	1.00	0.24	0.38	0.15	0.46	0.59	-0.02	-0.14	0.34
RC_LN	0.11	0.02	0.09	0.20	0.24	1.00	0.40	0.30	0.33	0.30	-0.16	-0.17	0.24
PRV_LN	0.60	0.49	0.59	0.39	0.38	0.40	1.00	**0.80**	0.77	0.77	-0.01	0.00	0.64
GE_LN	0.46	0.20	0.40	0.15	0.15	0.30	**0.80**	1.00	0.24	0.38	-0.23	-0.09	0.60
SP_LN	0.48	0.59	0.53	0.46	0.46	0.33	0.77	0.24	1.00	**0.81**	0.04	0.10	0.41
IA_A	0.63	0.71	0.68	0.60	0.59	0.30	0.77	0.38	**0.81**	1.00	0.12	-0.27	0.53
PD_A	0.06	-0.02	0.04	0.00	-0.02	-0.16	-0.01	-0.23	0.04	0.12	1.00	0.02	0.13
GEE_LN	0.40	0.32	0.26	-0.07	-0.14	-0.17	0.00	-0.09	0.10	-0.27	0.02	1.00	0.18
SPE_LN	**0.98**	**0.91**	**0.95**	0.37	0.34	0.24	0.64	0.60	0.41	0.53	0.13	0.18	1.00

0.XX : in range [0.8 – 1.0]   0.XX : in range [0.6 – 0.8]

Lead / lag correlations

	IAE_LN (+1)	IAE_NI (+1)	IAE_GI (+1)	NW_LN (+1)	GW_LN (+1)	RC_LN (+1)	PRV_LN (+1)	GE_LN (+1)	SP_LN (+1)	IA_A (+1)	PD_A (+1)	GEE_LN (+1)	SPE_LN (+1)
IAE_LN	0.27	0.32	0.31	0.42	0.42	**0.33**	0.54	0.27	**0.59**	0.51	0.06	-0.13	0.26
IAE_NI	0.22	0.40	0.29	**0.58**	**0.58**	**0.20**	0.48	0.18	**0.59**	0.60	**-0.01**	-0.15	0.28
IAE_GI	0.26	0.36	0.34	0.49	0.49	**0.31**	0.54	0.25	**0.60**	0.57	0.04	-0.14	0.24
NW_LN	0.08	0.10	0.09	0.47	0.47	**0.43**	0.31	0.12	0.37	0.36	-0.02	-0.13	0.19
GW_LN	0.09	0.08	0.08	0.45	0.47	**0.47**	0.35	**0.18**	0.35	0.35	-0.04	-0.16	0.28
RC_LN	0.01	-0.02	0.01	0.15	0.18	0.79	0.35	**0.43**	0.13	0.25	-0.18	-0.28	0.15
PRV_LN	0.12	0.19	0.16	**0.55**	**0.56**	**0.43**	0.74	0.55	0.62	0.54	-0.03	-0.26	0.11
GE_LN	0.01	0.03	0.02	**0.21**	**0.22**	0.28	0.59	0.59	**0.33**	0.25	**-0.17**	-0.18	0.04
SP_LN	0.16	0.26	0.21	**0.66**	**0.68**	**0.40**	0.55	**0.25**	0.66	0.61	0.02	-0.22	0.15
IA_A	0.34	0.40	0.39	**0.88**	**0.89**	**0.41**	0.69	**0.38**	0.65	0.78	0.07	**-0.23**	0.34
PD_A	**0.10**	**0.03**	**0.09**	**0.02**	**0.01**	-0.16	**0.03**	**-0.22**	**0.09**	**0.14**	0.59	0.01	0.12
GEE_LN	0.00	0.00	0.02	-0.11	**-0.09**	**0.07**	**0.02**	-0.15	**0.19**	-0.32	**0.05**	-0.09	0.04
SPE_LN	0.32	0.35	0.35	**0.40**	**0.41**	**0.40**	0.58	0.42	**0.53**	0.40	0.09	-0.12	0.37

0.XX : > than corresponding contemporaneous correlation

Table 6 Correlation of stock of provision (PRV_LN) with subsequent loan net write-offs (NW_LN) for selected banks in sample

	NW_LN	NW_LN (+1)	NW_LN (+2)	NW_LN (+3)	NW_LN (+4)
AU ANZ	0.68	0.92	0.76	0.42	0.20
AU CoWthBk	0.68	0.85	0.66	0.31	0.12
AU NAB	0.86	0.78	0.49	0.30	0.08
AU StGeorge	0.74	0.67	0.46	0.10	-0.40
AU Westpac	0.80	0.81	0.41	0.09	-0.19
AU BOQ	-0.09	0.60	0.29	-0.16	-0.11
AU BkWest	0.78	0.85	0.85	0.50	0.20
NZ ANZ	0.71	0.85	0.66	0.40	0.17
NZ ASB	0.71	0.97	0.66	0.49	0.16
NZ BNZ	0.50	0.59	0.70	0.61	0.44
NZ NBNZ	0.40	0.81	0.43	0.22	0.03
NZ Westpac	0.34	0.51	0.16	0.13	-0.02
NZ TSB Bank	-0.09	0.15	0.17	-0.61	-0.37
Overall	0.39	0.55	0.42	0.23	0.15

Table 7 Correlation of impaired asset expense (IAE_LN) with subsequent loan net write-offs (NW_LN) for selected banks in sample

	NW_LN	NW_LN (+1)	NW_LN (+2)	NW_LN (+3)	NW_LN (+4)
AU ANZ	0.53	0.86	0.89	0.50	0.27
AU CoWthBk	0.67	0.80	0.86	0.46	0.25
AU NAB	0.73	0.87	0.73	0.54	0.26
AU StGeorge	0.64	0.75	0.44	0.25	-0.14
AU Westpac	0.69	0.97	0.75	0.51	0.21
AU BOQ	0.72	0.26	0.42	-0.06	-0.12
AU BkWest	0.72	0.63	0.76	0.47	0.20
NZ ANZ	0.72	0.85	0.72	0.53	0.37
NZ ASB	0.49	0.82	0.70	0.71	0.59
NZ BNZ	0.20	0.09	0.22	0.35	0.52
NZ NBNZ	0.33	0.80	0.72	0.46	0.29
NZ Westpac	0.78	0.80	0.51	0.20	0.02
NZ TSB Bank	0.31	-0.08	0.33	-0.78	-0.37
Overall	0.46	0.42	0.46	0.20	0.17

Figure 14 Correlation of impaired asset expense with subsequent loan net write-offs for major New Zealand banks

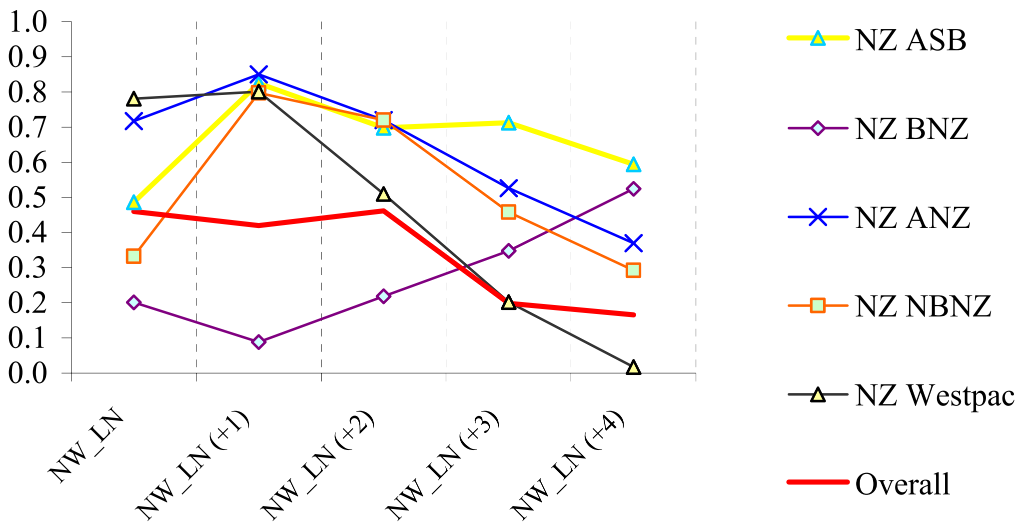
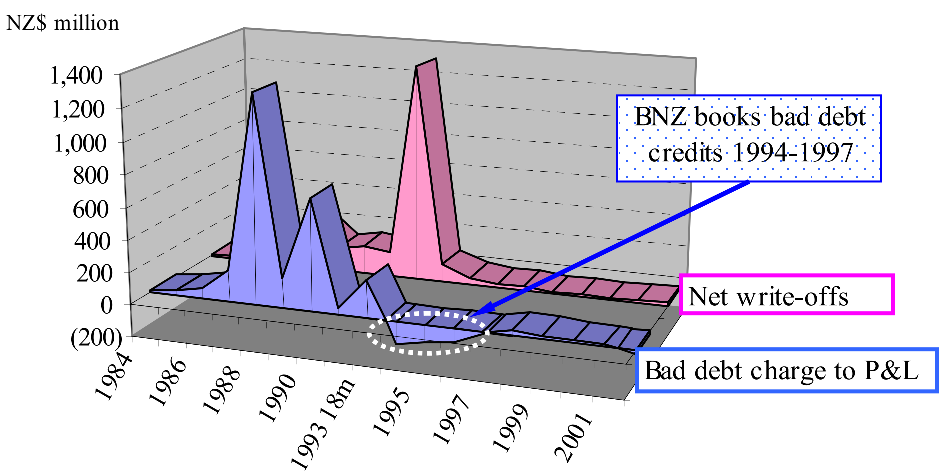


Figure 15 Bank of New Zealand: bad debt provisioning and write-offs 1984 to 2002



Pain (2003) also employs an alternative approach for studying the lag characteristics of write-offs. In particular, he estimates the write-offs following provisions booked in earlier periods by means of a pooled regression model in which write-offs are a linear function of past provision charges. The approach more specifically answers questions related to write-down patterns of loan loss provisions. This analysis has been conducted in Table 8 for the full sample as well as for a number of smaller sub-samples (Australia, New Zealand). For the UK, Pain (2003, p. 17, Table 3)[12] determines that around 80% of provisions appear to be reflected in write-offs after around 3 to 4 years with a mean lag of around 1½ years. While most of Pain's coefficients up to three periods turn out significant, the results are not as clear-cut for the sample of Australasian banks. While the F-statistics of the multiple regression are all highly significant for all estimations, only the first two lag coefficients show some significant T-Statistics (Table 8). The results thus indicate that for the overall sample about a quarter (25%) of the provision expense is written down in the subsequent year, another 30%, 6% and 14% in the following three years. This means that, similar to what was found by Pain, on average three quarters of a year's provisions expense is extinguished from the balance sheet in the subsequent four years.

The regression results for various Australian and New Zealand sub-samples again point to distinctive bank specific or possibly country specific write-down patterns. Australian banks write off half their provisions expense in the following year while the same coefficient for New Zealand banks is lower than 10%.

It is difficult to interpret these results. For one this could be an effect of banks using their discretion when writing down loans. This is shown by the fact that the first two lagged

[12] Pain applies his regression to the log transforms of net write-offs/loans and impaired asset expense/loans (provision charge in Pain's terminology). There are numerous observations of negative impaired asset expense which would be lost under this approach. These mainly originate from reversals of excessive provision stocks after the crisis of the early 1990s.

provisions expense terms become consistently significant[13] if we just use the specific component of provisions expense (SPE_LN) while there is no significance for the lagged general component (GEE_LN). The results of these estimations for the full sample are shown in Table 9. Note that the sample period was shortened for this second analysis (1988 to 2005) as a satisfactory reporting of components of impaired asset expense became available only around the end of the 1980s (see Figure 4 as a reference for the availability of CLE proxies).

If one assumes that impaired asset expense represents management's best estimate of credit losses that have occurred during a period, one would have to question its ability to do so based on above results. For instance, less than half of these bad debt provisions translate into actual later write-offs for New Zealand banks. This finding would confirm anecdotal information that write-offs are considered as true losses by banks for internal purposes whereas provisions are deemed uncertain. On the other hand, one has to consider the extended period of generally benign economic climate since the mid 1990s. It is difficult to estimate a credit loss distribution without observing extreme events. This can be seen for the example of New Zealand ASB Bank's annual impaired asset expense compared to its loan write-offs in Figure 16. The absolute dollar amount of loan write-offs has hardly changed from 1995 through to 2005 while ASB has maintained provisioning levels just under 0.4% of total assets which themselves have more than quadrupled during the same time period. This means ASB has in fact been over-provisioning since 1995 with additional provisions not being followed by corresponding higher write-offs. In view of long-term lending loss experience in comparable banking systems, ASB's provisions may nevertheless be prudent.

[13] When estimating the regression with fixed effects, one finds that the coefficients lose some of their significance, however. Note that in this case T-values are still much higher than for the corresponding coefficients of the GEE_LN regression.

Table 8 Results of pooled regression of net write-offs/loans as a function of preceding impaired asset expense/loans

	Full sample	Australia all banks	Australia 4 major banks	New Zealand all banks	New Zealand 5 major banks
Dependent variable			Net debt write-offs as % of average loans (NW_LN)		
Constant	0.0004	-0.0006	-0.0001	****0.0015**	***0.0012**
(t-statistics)	(0.552)	(-1.260)	(-0.256)	(3.171)	(2.593)
IAE_LN(-1)	***0.2694**	****0.5425**	****0.5686**	****0.0710**	0.0786
(t-statistics)	(2.476)	(4.410)	(5.731)	(3.670)	(1.251)
IAE_LN(-2)	0.3136	****0.6856**	0.2926	***0.1095**	0.0632
(t-statistics)	(1.772)	(5.017)	(1.698)	(2.509)	(1.167)
IAE_LN(-3)	0.0630	***-0.1226**	-0.0528	0.0953	0.1505
(t-statistics)	(0.879)	(-2.134)	(-0.826)	(1.731)	(0.737)
IAE_LN(-4)	****0.1404**	-0.1372	0.0402	0.1383	****0.3003**
(t-statistics)	(3.252)	(-1.366)	(1.261)	(1.864)	(10.003)
Adj. R-squared	0.3290	0.5821	0.8481	0.2626	0.3340
Cross sections / Observations	29 / 362	20 / 249	4 / 88	9 / 113	5 / 91
F-statistic	****45.247**	****87.377**	****122.473**	****10.970**	****11.782**

Notes: ** significant at 1% level, * at 5% level

Model:
$$\text{NW\_LN}_{it} = \alpha + \sum_{s=1}^{4} \beta_s \ \text{IAE\_LN}_{i(t-s)} + u_{it}; \ \text{i : bank cross sections 1,....., N; t : year}$$

NW_LN: net debt write-offs as % of average loans is dependent variable.
IAE_LN: impaired asset expense as % of average loans.
Above table estimated with White diagonal standard errors & covariance (d.f. corrected) for full observation period 1980 to 2005 without fixed or random effects.

Table 8 Results of pooled regression of net write-offs/loans as a function of preceding impaired asset expense/loans **(continued)**

Estimations with fixed bank-specific effects

	Full sample	Australia all banks	Australia 4 major banks	New Zealand all banks	New Zealand 5 major banks
Dependent variable	Net debt write-offs as % of average loans (NW_LN)				
Constant	0.0002	-0.0005	-0.0001	0.0008	***0.0015**
(t-statistics)	(0.327)	(-0.777)	(-0.268)	(1.033)	(2.454)
IAE_LN(-1)	****0.2485**	****0.5072**	****0.5689**	0.0977	0.0609
(t-statistics)	(3.095)	(4.157)	(5.551)	(1.943)	(0.813)
IAE_LN(-2)	***0.3072**	****0.6670**	0.2926	****0.1265**	0.0527
(t-statistics)	(2.472)	(5.522)	(1.648)	(3.369)	(0.778)
IAE_LN(-3)	0.0679	-0.1354	-0.0528	0.1377	0.1399
(t-statistics)	(0.585)	(-1.808)	(-0.803)	(1.499)	(0.678)
IAE_LN(-4)	****0.1957**	-0.0775	0.0405	****0.1679**	****0.2828**
(t-statistics)	(2.928)	(-0.837)	(1.209)	(3.652)	(8.321)
Adj. R-squared	0.3945	0.6018	0.8430	0.3209	0.3337
Cross sections / Observations	29 / 362	20 / 249	4 / 88	9 / 113	5 / 91
F-statistic	****8.349**	****17.293**	****67.754**	****5.410**	****6.635**

Explanations: see Table 8
Estimated with fixed cross-sectional (bank) effect to control for bank-specific levels of net write-offs.

Table 9 Results of pooled regression of net write-offs/loans as a function of preceding total, specific and general impaired asset expense/loans

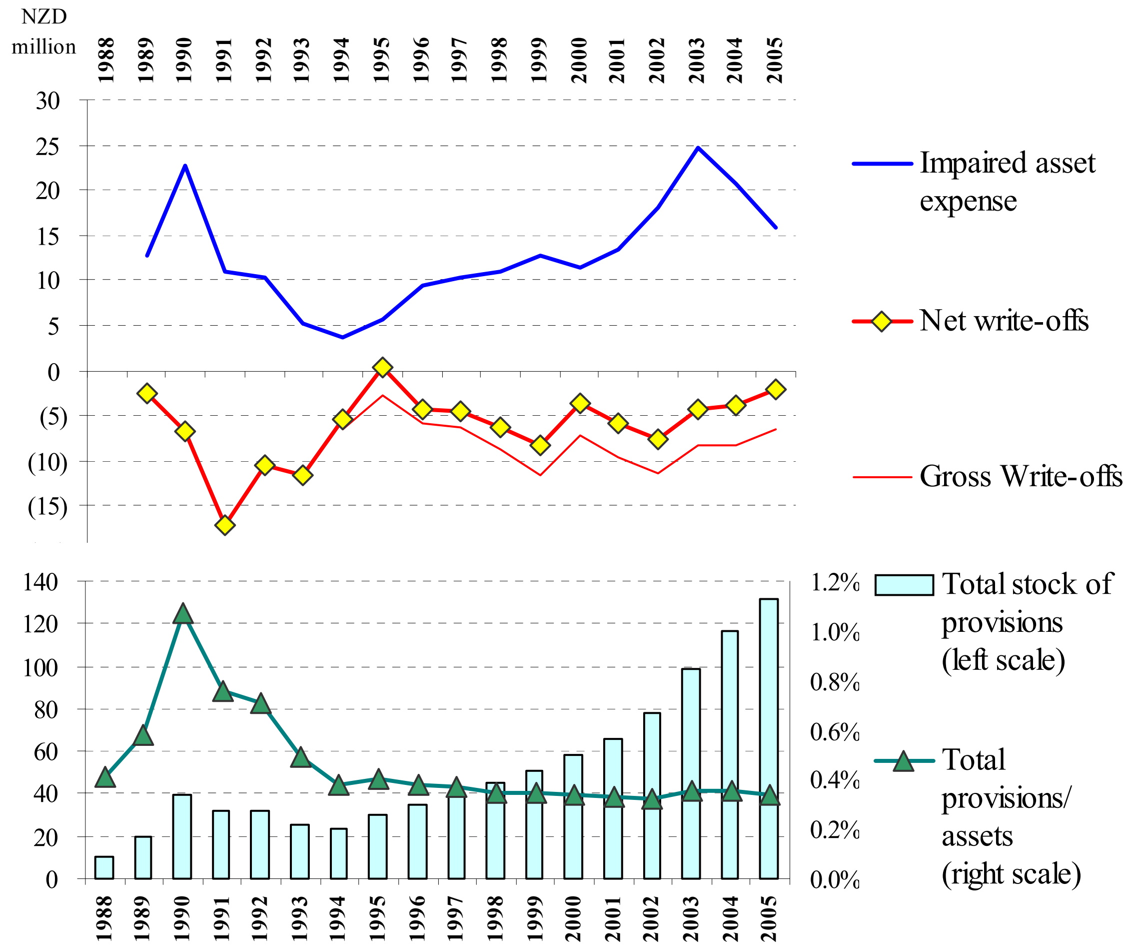
Explanatory variable	Total impaired asset expense/average loans IAE_LN	Specific component of impaired asset expense/ average loans SPE_LN	General component of impaired asset expense/ average loans GEE_LN
Dependent variable	Net debt write-offs as % of average loans (NW_LN)		
Constant	0.0006	0.0005	****0.0042**
(t-statistics)	(0.689)	(1.487)	(3.303)
Lag (-1)	***0.2685**	***0.2834**	-0.2087
(t-statistics)	(2.466)	(2.319)	(-0.361)
Lag (-2)	0.3126	****0.2227**	0.2804
(t-statistics)	(1.761)	(2.615)	(0.433)
Lag (-3)	0.0619	0.1083	-0.0600
(t-statistics)	(0.866)	(0.703)	(-0.092)
Lag (-4)	****0.1386**	0.1125	0.7738
(t-statistics)	(3.158)	(1.842)	(1.842)
Adj. R-squared	0.3234	0.4707	0.0508
Cross sections	29	22	20
Observations	324	221	196
F-statistic	****39.593**	****49.901**	****3.610**

Notes:
** significant at 1% level, * at 5% level
Model and estimation as in Table 8 for all Australasian banks in sample but data range from 1988 onwards. Reporting of SPE_LN and GEE_LN started only around this time. Estimated without fixed or random effects.

Explanatory variable	Total impaired asset expense/average loans IAE_LN	Specific component of impaired asset expense/ average loans SPE_LN	General component of impaired asset expense/ average loans GEE_LN
Dependent variable	Net debt write-offs as % of average loans (NW_LN)		
Constant	0.0005	0.0007	****0.0044**
(t-statistics)	(0.665)	(1.400)	(3.318)
Lag (-1)	****0.2310**	0.2630	-0.2056
(t-statistics)	(3.306)	(1.906)	(-0.398)
Lag (-2)	***0.3038**	0.2036	0.2540
(t-statistics)	(2.417)	(1.492)	(0.419)
Lag (-3)	0.0601	0.1063	-0.1375
(t-statistics)	(0.525)	(0.643)	(-0.215)
Lag (-4)	****0.1912**	0.1118	0.6968
(t-statistics)	(2.882)	(1.052)	(1.834)
Adj. R-squared	0.4509	0.4423	0.1453
Cross sections	29	22	20
Observations	324	221	196
F-statistic	****9.288**	****7.980**	****2.442**

As above but estimated with fixed cross-sectional (bank) effect to control for bank-specific levels of net write-offs.

Figure 16 ASB Bank: Impaired asset expense, write-offs and provisioning



4.4 Recoveries of debts written off

For completeness, we conclude this section on properties of CLE proxies with a deeper review of bad debt recoveries. Unlike provisions, write-offs mean losses with a high degree of probability. Subsequent recoveries should thus be comparably small. We find that over the pooled sample, on average, recoveries amount to 10.9% (median value[14]) of same year gross debt written off (see Table 10). This value will however understate true loan loss recovery rates as recoveries are from loans written off in previous years. Due to the underlying growth in the

[14] The median value is more useful as some extreme outliers distort the pooled sample mean.

loan portfolio, these past derecognitions would thus be comparably lower. Accordingly, Table 10 below also shows summary statistics of recoveries as a proportion of gross write offs with a one and two year lag. The median values of the share of bad debts subsequently recovered then amounts to 13.6% (1 year lag), respectively 15.4% (2 year lag).

Table 10 Summary statistics of recoveries as % of current and past years gross write-offs

	Recoveries as % of same year gross write-offs	as % of previous year gross write-offs	as % of 2 year lagged gross write-offs
Mean	16.33%	16.95%	19.77%
Median	**10.90%**	**13.61%**	**15.38%**
Maximum	116.60%	104.48%	252.99%
Minimum	0.00%	0.35%	0.29%
Std. Dev.	16.95%	15.15%	20.66%
Skewness	2.37	1.99	5.24
Kurtosis	10.86	9.11	53.17
Observations	353	339	325
Cross sections	26	26	24

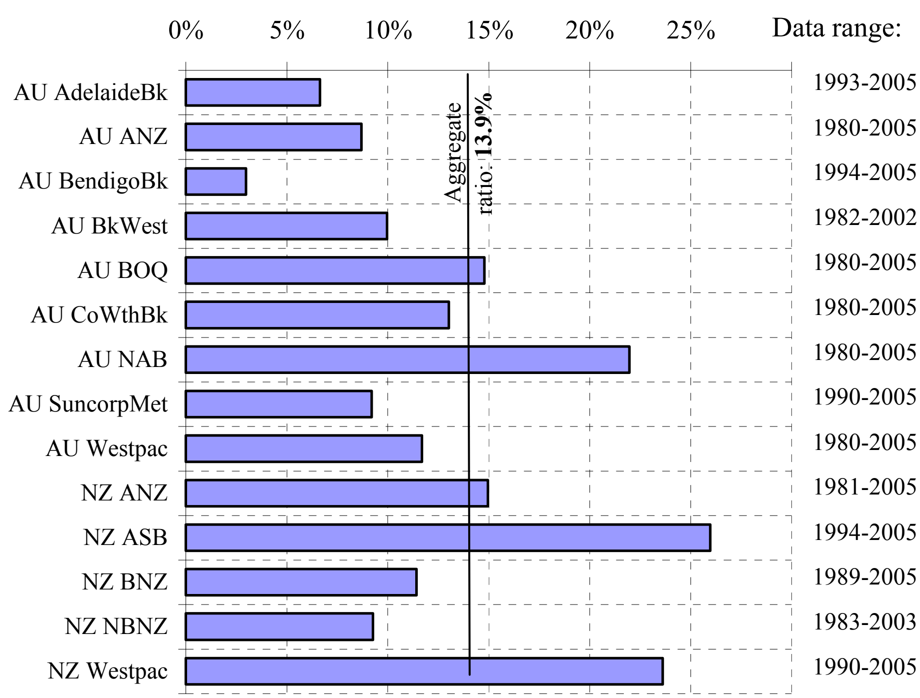
An alternative approach to gauge this ratio is used by Pain (2003, Chart 9, p. 18). He divides the aggregate recoveries by total gross write-offs over his whole 1978 to 2000 observation period and finds that around 10% of write-offs incurred by 6 leading UK commercial banks[15] were subsequently recovered. His bank specific analysis reveals that this ratio has values ranging from around 6% to 13%.

We replicate Pain's method for this sample. We limit this analysis to 14 banks with series of 12 or more contiguous observations of recoveries and gross write-offs. The results are shown in Figure 17 below. The overall cumulative recovery ratio for this sub-sample is 13.9%, i.e. comparable to the median value of recoveries over one year lagged gross write-offs found in

[15] Due to data quality problems, Pain cannot extend his analysis to UK mortgage banks in this case.

Table 10. The bank specific values are quite erratic and range from a mere 3% for Bendigo Bank to ASB's 26%. One notices ratios are higher for New Zealand banks on average. Even entities of the same banking group such as ANZ have recovered vastly different amounts as a consolidated group (8.7%) compared to 15% in its New Zealand operations. Some banks like ASB and NAB appear to use write-offs liberally only to subsequently recover them in substantial amounts. Write-offs in their case thus have the characteristic of specific provisions with a high degree of uncertainty attached to them. For some other banks, it seems rare to recover any amount of a loan once it is written off. It is likely that the latter banks will take more time between booking a loan provision and finally writing it off. To our knowledge, there is no research that has tested this hypothesis yet.

Figure 17 Cumulative bad debt recoveries as a percentage of cumulative write-offs for selected banks with extended time series observation

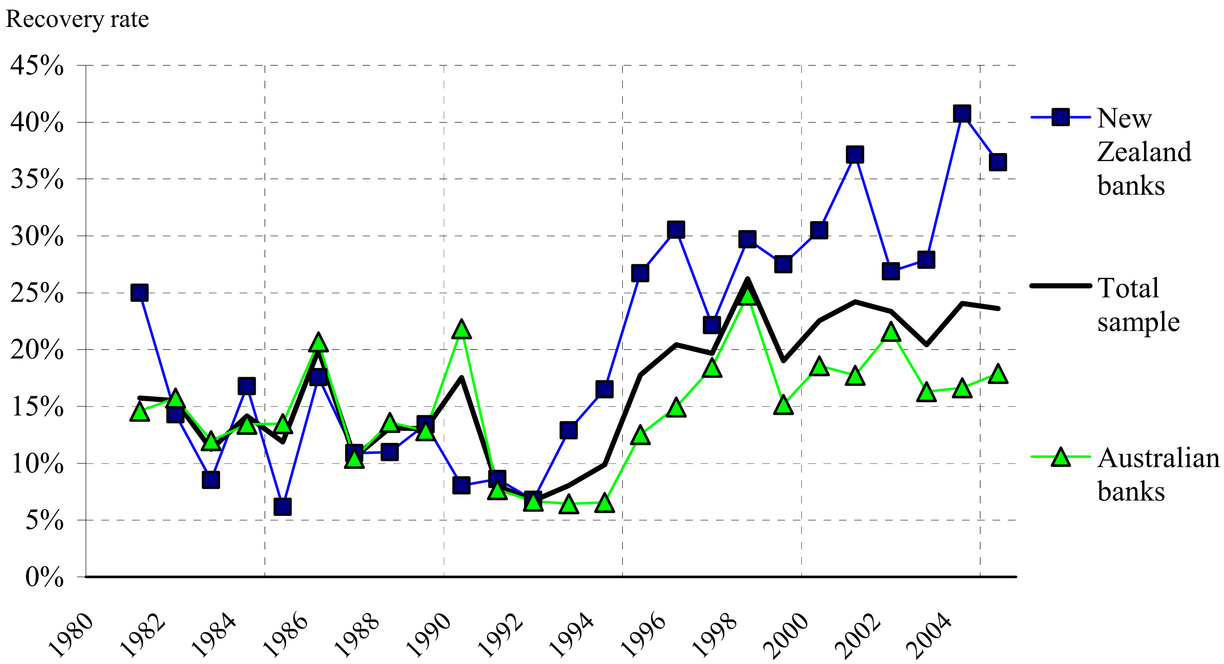


The time window aspect of loan recovery patterns has not been discussed so far. The bank specific cumulative recovery rates in Figure 17 above also show the range of years used to derive them. We have selected only banks with extended time series. Most have been operating to the end of the observation period but some of them with roots as building societies supplied recovery data from the early 1990s only. It might thus be the case that the diverging ratios are the result of differences in the observation window.

To study this phenomenon in more depth, one can follow recoveries as % of current or past years' gross write-offs through time. This is done for the ratio of recoveries over one year lagged year write-offs in Figure 18 below which reveals some surprising variability (analysis of full data sample). For the comparably smaller number of banks in the sample from 1980 to the onset of the 1990 financial crisis, this ratio remained in the 10-15% range. It reaches a nadir at the height of the crisis and subsequently peaks when part of these loan losses are recovered in a more benign economic climate. Such a trough in recoveries during bad times is also found in research which studies 'Loss Given Default' (LGD)[16], which equals one minus the recovery rate. For New Zealand banks recovery rates do not seem to revert to pre-crisis levels, however, and have been hovering in the 25-35% range since the mid 1990s.

[16] See Allen & Saunders (2002, p. 18-20) for a review of literature related to the cyclicality of LGD.

Figure 18 Australasian banks: average bad debt recoveries as % of one year lagged gross-write-offs through time



A look at the universe of major banks in Australia (Figure 19) and New Zealand (Figure 20) provides further insights. The trough discussed above becomes clearly visible for the sample of Australian banks. NAB's high average loan recoveries contrast with much lower seemingly less variable recoveries at AU ANZ. Data quality for New Zealand banks is not as good with only NZ ANZ reporting recoveries back to 1980. There is again a striking difference between high and very volatile recovery rates at ASB and lower and more stable ratios for NBNZ. Bank of New Zealand's time series also exhibits great volatility from 1995 to 2000 when some of the past large write-offs are reverted. This time period also partially coincides with substantial releases of provisions at BNZ when it showed impaired asset credits in its P&L for five years from 1993 and 1997 (as shown in Figure 15).

Figure 19 Major Australian banks: average bad debt recoveries as % of one year lagged gross-write-offs through time

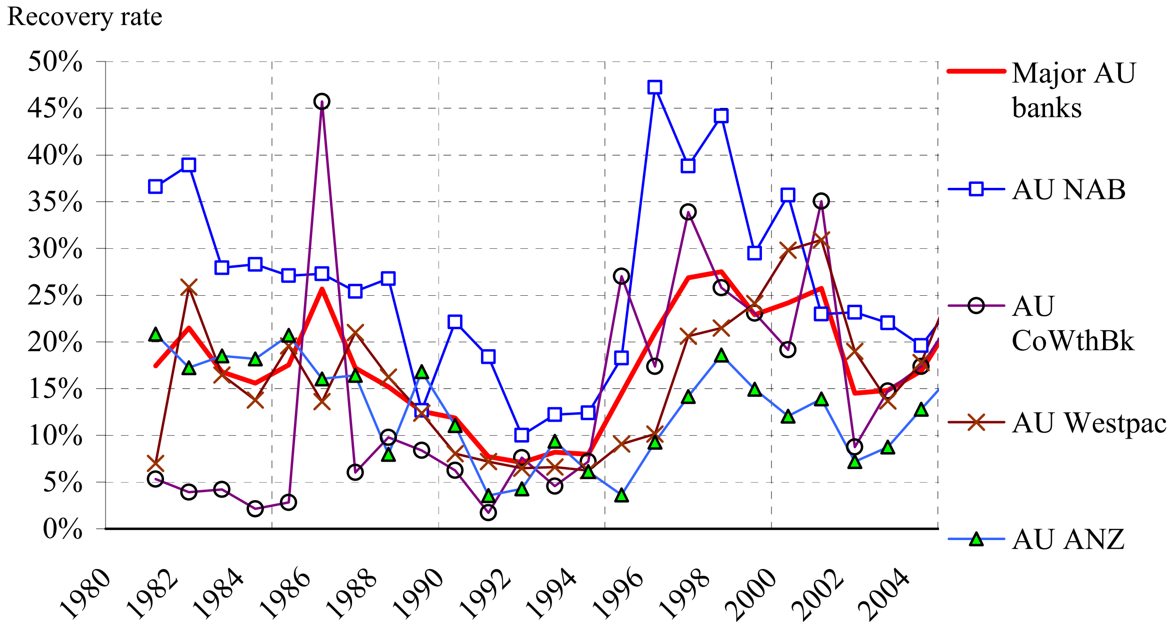
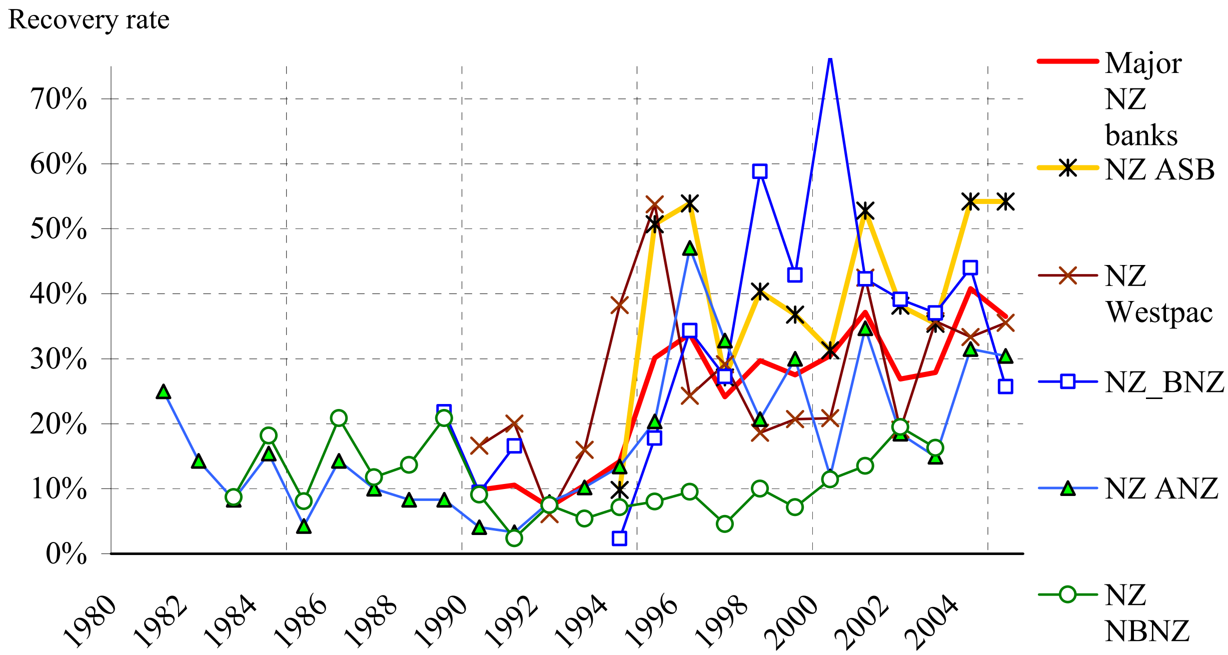


Figure 20 Major New Zealand banks: average bad debt recoveries as % of one year lagged gross-write-offs through time



It is not the immediate core subject of this article to search for factors which drive such a divergence in recoveries across cross sections and time. Faced with a lack of relevant earlier literature which has analyzed such data[17], we can nevertheless posit some hypotheses as ideas for continued research on the subject. Much like CLEs in general, they are possibly driven by external macro-economic, behavioural and bank specific micro-economic factors.

With regard to macro factors, we have already mentioned the procyclicality of recoveries. Less obvious are possible behavioural drivers as a result of the industry's operating environment. A first one relates to tax effects of loan write-offs. Some bad debt provisions expense might not necessarily qualify for tax relief, particularly if it is of the general type, e.g. determined by

[17] Note that literature on recovery rates is typically based on bond market data and not accounting data sourced from bank annual reports.

statistical methods. Conversely, banks will find it easier to convince tax authorities that debt write-offs are a genuine, tax-deductible business expense. By generously writing off their debts just to “recover” them again some years later, banks effectively push tax obligations into the future. Write-offs then take on the character of provisions without the definite nature one would expect them to have.

Another factor could be differences in the motivation to signal via loan write-offs. Unlike provisions, write-offs remove impaired assets from the bank’s books which could be important for a prudential regulator. On the other hand, write-offs have no impact on reported earnings (assuming they have been provided for in earlier periods). Reported earnings are most important for stock listed companies who thus have less incentive to use this ‘communication tool’. This admittedly rather speculative theory would explain lower recovery rates for the Australian, (mostly exchange listed) sub-sample while non-listed New Zealand banks would emphasize communication with the prudential regulator. Note that the increase in recoveries in New Zealand coincides with the introduction of the country’s 1995 Registered Bank Disclosure Regime (RBNZ, 1995). Likewise, new accounting standards relevant for financial instruments and institutions came into force at the time[18] but none of them contained specific rules regarding derecognitions of loan assets.

Moving on to bank specific factors, earlier research has found recoveries to depend on the type of loans written off. Evidence is usually from the bond markets where unsecured claims will recover less than collateralized obligations.[19] Recoveries disclosed by banks are not immediately comparable, however. If a loan is written down in the first place, it should only be to the extent that it is unlikely to be recovered. Management should thus consider quality and asset backing of a claim both when it first provides for losses and subsequently writes it off.

[18] Examples are AASB 1033 / FRS-31 (information about financial instruments) and AASB 1032 / FRS-33 (disclosure of information by financial institutions).

[19] See for example Altman & Brady (2001) as quoted in Allen & Saunders (2002, Table 9, p. 18).

There is reporting of sectoral recoveries for the 4 major Australian banks back to 1995 and even to 1988 in the case of NAB. The results of a preliminary analysis of these data is shown in Table 11 for the ratio of cumulative recoveries over cumulative write-offs by lending segment and in Table 12 for the average ratio of recoveries over same year write-offs. The loan segmentation is not uniform across the sub-sample but all four banks show real estate lending through mortgages separated from lending for construction and development, lending to primary industries as well as consumer type personal lending as separate categories. Table 12 shows both mean and median ratio to highlight the erratic character of observations for some segments. A few large recoveries lift the mean ratio even though minimal amounts were recovered in most years. Note also that the analysis for banks with the shorter time windows starting in 1995 is likely to be biased as they are able to book comparably large recoveries on write-offs of the preceding crisis. This is reflected in some extreme ratios in Table 12, e.g. 83.8% mean recovery in Commonwealth Bank's finance and insurance segment.

The most consistent result can be found for the personal lending segment which exhibits high recoveries in the 15 to 30% range. This is likely the result of generic policies to write-down small consumer loans in default to zero while larger loans, possibly with collateral, are assessed on a more individual basis. This would explain generally lower recovery rates for other segments which, however, often display diverging ratios between banks. An example is the sector of mortgage lending where ANZ and Commonwealth Bank recovered less than half as much as NBA and Westpac. We attribute this mainly to a lack of common standards as to how to classify loans into segments. An example are construction loans where Westpac notes in its report that 'lending in the commercial and financial sectors in Australia is for the purpose of the financing of construction of real estate and land development projects which cannot be separately identified from other lending to these borrowers' (Westpac 2005 Annual Financial Report). Another example would be mortgaged lending to the agricultural sector which, for instance, Westpac includes with mortgage loans while Commonwealth bank characterizes mortgage loans as 'principally owner occupied housing' (Commonwealth Bank 2005 Financial Report). More concise definitions are missing in the banks' segment reporting.

Table 11 Major Australian banks – rates of bad debt recoveries by lending segment

Cumulative recoveries as % of cumulative write-offs

Segment recovery data (domestic)	AU ANZ 1992 – 2005	AU CoWthBk 1995 – 2005	AU NAB 1988 – 2005	AU Westpac 1995 – 2005
Government and public authorities	0.0%	0.0%	n.a.	n.a.
Agriculture, forestry, fishing and mining	6.5%	23.7%	15.1%	23.9%
Financial, investment and insurance	12.0%	26.7%	22.0%	n.a.
Real estate – mortgage	3.5%	5.0%	13.1%	11.8%
Real estate – construction	5.5%	6.9%	5.0%	6.0%
Personal	15.1%	20.9%	29.8%	24.1%
Retail and wholesale trade	4.5%	n.a.	n.a.	n.a.
Lease financing	13.0%	18.8%	9.0%	n.a.
Other commercial and industrial	1.0%	14.6%	12.3%	n.a.
Entertainment, leisure and tourism	7.0%	n.a.	n.a.	n.a.
Manufacturing	7.7%	n.a.	9.5%	n.a.
Overseas lending	9.9%	23.4%	24.5%	6.2%
Overall domestic and overseas	8.6%	20.6%	21.8%	19.9%

Table 12 Major Australian banks – rates of bad debt recoveries by lending segment

Average recoveries as % of previous year write-offs

Segment recovery data (domestic)	AU ANZ 1993 – 2005 Mean	Median	AU CoWthBk 1996 – 2005 Mean	Median	AU NAB 1989 – 2005 Mean	Median	AU Westpac 1996 – 2005 Mean	Median
Agriculture, forestry, fishing and mining	15.1%	2.8%	37.2%	23.6%	28.7%	20.0%	14.2%	0.0%
Financial, investment and insurance	24.8%	13.2%	83.8%	41.0%	34.5%	21.9%	n.a.	n.a.
Real estate – mortgage	8.4%	5.9%	6.6%	5.0%	19.2%	14.3%	5.6%	0.0%
Real estate – construction	14.7%	15.4%	18.3%	5.9%	10.5%	10.0%	6.2%	0.0%
Personal	17.3%	18.2%	27.0%	27.6%	44.9%	34.6%	27.5%	28.2%
Retail and wholesale trade	5.1%	4.8%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Lease financing	24.4%	17.9%	23.9%	22.7%	12.7%	13.6%	n.a.	n.a.
Other commercial and industrial	n.a.	n.a.	15.3%	15.7%	17.7%	12.2%	n.a.	n.a.
Entertainment, leisure and tourism	11.6%	6.9%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Manufacturing	16.0%	4.8%	n.a.	n.a.	11.3%	9.7%	n.a.	n.a.

Overall, we find that recovery rates vary greatly between institutions and also through time. This shows that despite common accounting and prudential standards, banks have discretion not only with regard to providing for credit losses but also in the second step when loans are finally derecognized. There are interesting hypotheses relating to tax aspects, signalling and types of lending which could be used as a starting point to research this issue further. For the study of the overall credit loss experience, recoveries are nevertheless of secondary importance. The focus in this research is thus rather on provisions and net write-offs. This means that the relatively small recoveries, in line with most other empirical work, are removed from same year gross write-down experience. This is theoretically inferior to adjusting write-offs with subsequently reported recoveries but is easier to implement and brings the advantage of extended data series as earlier in the observation period the banks often just reported write-off figures net of recoveries.

5 Conclusion

Previous literature has hardly explored the characteristics of various proxies available which can be used to gauge a bank's CLE. The historical data gathered for the Australasian banking system would however indicate that correlations among some of them are rather weak even though they have been employed by earlier research. It is found that CLE ratios using balance sheet items like total assets or loans as a reference appear more suitable as CLE proxies. They should be preferred over ratios based on income items (such as total operating income) because they are less sensitive to the vagaries of the denominator which is comparably large in the case of total loans or assets.

The review of CLE ratios also includes an analysis of loan write-off patterns. In theory, impaired asset expense (loan provisioning) should eventually be followed by corresponding loan write-offs. Unlike results found by Pain (2003) for a sample of UK banks, it is difficult to recognize a consistent lag pattern of loan write-offs for banks in Australasia. Due to the benign economic climate since the banking crisis of the early 90s, some banks have steadily increased their provisioning in line with growing loan portfolios but have not been faced with a corresponding need for write-offs.

A final analysis is conducted on the properties of recoveries as the last stage in the life cycle of bad debts. 13.9% of bad debts written off are subsequently recovered but there is again a significant variability of this value among banks. Some appear more inclined for quicker write-offs (which then leads to higher recoveries) while others delay write-offs until a loss becomes virtually certain. Recovery rates also differ for various types of loans which could relate to the differences in the predictability of losses in the various segments. A detailed exploration of causes which are at the root of such heterogeneity in debt write-off and recovery patterns could be an interesting area of continued research. It could potentially provide interesting insights into behavioural factors affecting financial reporting by banking institutions.

All in all, the results of this article highlight the need for caution in the use of historical credit loss data proxies commonly used by researchers. If feasible, data should be adjusted for effective ex-post credit losses and models estimated for more that just one CLE proxy.

6 Appendix tables

Table 13 Summary information on data samples of selected loan loss provisioning studies with a bank regulatory focus

Authors (Year)	**Title**	**Time Range/ Scope**	**Geographic Focus**	**Data Source**	**n**
Arpa et al. (2001).	The influence of macroeconomic developments on Austrian banks: implications for banking supervision	1990-1999 (quarterly data) / approx. 950 banks operating in Austria	Austria	Non-public acct. data reported to super-visory authority; IMF	Ongoing provisions as % of total assets
Bikker & Hu (2001, p. 10-13)	Cyclical patterns in profits provisioning and lending of banks and procyclicality of the new Basel capital requirements	21 banking systems (26 for other models in the paper)	Global	OECD Bank profitability: financial statements of banks,	Addition to provisions for credit losses in proportion to loans outstanding.
Cavallo & Majnoni (2001)	Do Banks Provision for Bad Loans in Good Times? Empirical Evidence and Policy Implications	1988-1999 / 5957 bank years of 1176 large commercial banks (372 of which from non-G10 countries)	Gobal, incl. LDC	Bankscope IMF, Worldbank data from La Porta et al. (1998)	Ongoing provisions as % of total assets
Fernández de Lis et al. Martínez (2000)	Credit growth, problem loans and credit risk provisioning in Spain	1983-1999 / not specified	Spain	not specified	Ongoing provisions as % oftotal loans
Kearns (2004)	Loan Losses and the Macroeconomy: A Framework for Stress Testing Credit Institutions' Financial Well-Being	mostly early 90s to 2003/ 14 banks with 132 observations	Ireland	Original annual accounts	Ongoing provisions (as % of total income); stock of provisions

Authors (Year)	Title	Time Range/ Scope	Geographic Focus	Data Source	Provision Data Analysed
Keeton (1999)	Does Faster Loan Growth Lead to Higher Loan Losses?	1982-1996 / sample size not disclosed	USA	Quarterly call reports of commercial banks	Share of delinquent loans
Pain (2003)	The provisioning experience of the major UK banks: a small panel investigation	1978-2000 / 7 commercial banks & 4 mortgage banks	UK	Published annual accounts	Ongoing provisions, write-offs, recoveries; stock of provisions (all as % of loans & advances)
Quagliariello (2004).	Banks' Performance over the Business Cycle: A Panel Analysis on Italian Intermediaries	207 financial intermediaries for a period of 1985 to 2002	Italy	Non-public reports to the Bank of Italy to compile supervisory statistics	Loan loss provision ratio; flow of new bad debts to performing loans
Salas & Saurina (2002)	Credit Risk in Two Institutional Regimes: Spanish Commercial and Savings Banks	1985 – 1997, 597 observations for commercial banks and 784 for savings banks	Spain	Statistical Year Book of Private and Savings Banks	Problem loan ratio
Sinkey & Greenawalt (1991)	Loan-loss experience and risk-taking behaviour at large commercial banks	explain 1987 loan loss rates with 1984-86 data / 154 money-center & regional banks	USA	Regulatory reporting (NTIS)	Net charge-offs as % of total loans pre-charge-off
Valckx (2004)	What determines loan loss provisioning in the EU?	System specific for EU-15 from 1979 to 2001. Bank specific for 21 large EU banks 1988-2001.	EU	OECD (system data), CreditDisk / Bankscope	Ongoing provisions as % oftotal loans

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