

The early 1990s small banks crisis: leading indicators

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Bank failure is fortunately a rare event in the UK. The last time it was widespread was in the small banks' crisis of the early 1990s. This article assesses whether the banks that would go on to fail during this period shared any common characteristics. Identification of such 'leading indicators' should assist the Bank of England in its surveillance work on the banking sector.

THE MOST RECENT CASES of official emergency liquidity support to UK banks occurred in the early 1990s, when the Bank lent to a few small banks in order to prevent wider loss of confidence in the banking system. A rather larger group of small banks got into difficulty and was subject to intensified regulatory monitoring; 25 banks failed or closed due to problems during this period.

In terms of policy debates about preserving stability, this near crisis has attracted less attention than the failures of individual banks, such as Bank of Credit and Commerce International (BCCI) and Barings, which were individually larger and more prominent but whose problems did not in fact threaten the system. Nor has the episode featured in research on banking sector crises, perhaps principally because the actions taken by the UK authorities succeeded in arresting the spread of problems. It is important, though, to try to learn lessons from near-crisis episodes. Recent research in the Bank has, therefore, investigated whether there were warning signs that the small bank sector was heading into difficulty from the late 1980s, when the economy as a whole was overheating¹.

Based on information in mid-1991, the most important leading indicators of failure were a high dependence on net interest income, low profitability, low leverage, low short-term assets relative to liabilities and low loan growth. Taken together, these

indicators suggest that the banks that failed over the following three years were already weak by the early 1990s. By then, it might have been difficult for regulators to do more than manage down the scale of the problems. A stronger test of the ability to predict failures – and so perhaps prevent crises – uses information in the period prior to the weakening in balance sheets. This finds that rapid loan growth in the late 1980s boom was a good longer-term indicator of failure. A cyclical comparison indicates that the banks that subsequently failed tended to exhibit a pronounced boom and bust cycle in lending growth, unlike those banks that survived.

The article begins by describing the UK small banks' sector in the early 1990s, the evolution of the crisis and the Bank's liquidity support operation. The next section provides an overview of the statistical analysis: the definition of failure used, the data sources employed and the types of variable that were tested to assess their leading indicator properties. The results based on data in 1991 Q2 follow (this being the last quarter before the closure of BCCI on 5 July 1991, an event which escalated the difficulties at several small banks). The following section repeats the analysis using variables for earlier periods – mainly 1990 Q2, the quarter prior to the start of the early 1990s recession. Finally, the value of the leading indicators of failure for small banks are compared with those of corresponding measures for some larger retail banks.

¹ The work has some similarities with early warning systems employed by bank regulators in some countries as part of their off-site surveillance of banks. Reidhill and O'Keefe (1997) give an overview of the development of such systems since the mid-1970s by the federal banking regulators in the United States. The history of the development of early warning systems by European banking regulators is more recent. Laviola, Reedtz and Trapanese (1999) and Peter (2000) provide details of those constructed by the Banca d'Italia and the Banque de France. An overview of the early warning systems used by member institutions of the Basel Committee on Banking Supervision (BCBS) and of system development are given in Van den Bergh and Sahajwala (2000) and Logan (2000). See also Cole, Cornyn and Gunther (1995), Espahbodi (1991), Korobow, Stuhr and Martin (1977), Martin (1977), Korobow and Stuhr (1975) and Sinkey (1975).

Table 1: Authorised banks in the UK (at end February)

	1990	1991	1992	1993	1994
UK commercial and merchant banks	75	70	72	73	71
<i>Of which members of the MBBG^(a)</i>	<i>n.a.</i>	<i>n.a.</i>	38	37	34
UK branches and subsidiaries of foreign banks	340	336	328	332	360
Small and medium-sized UK banks	125	116	111	96	80
Total	540	522	511	501	511

Source: Bank of England.

(a) See footnote 3 for details on membership of the Major British Banking Groups (MBBG). Figures for 1990 and 1991 are unavailable because the MBBG classification did not exist until April 1991.

Background

The UK small bank sector in 1991

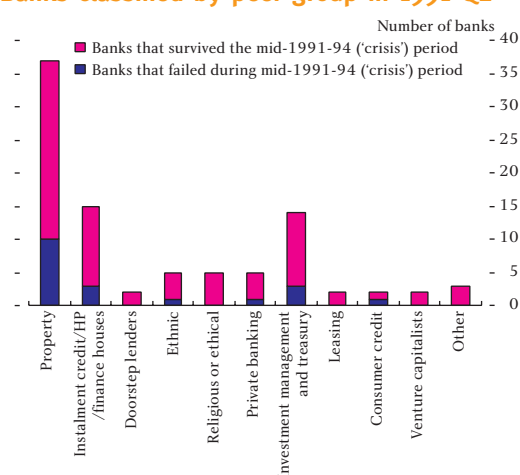
The UK banking system can be split into three broad groups: large UK-incorporated commercial and merchant banks, small and medium-sized UK-incorporated institutions², and UK branches and subsidiaries of foreign banks. Table 1 shows the number of banks in each category from end-February 1990 up to end-February 1994. At the end of February 1991, 116 small and medium-sized UK banks were authorised. It was possible to compile a full dataset for 92 of them.

Chart 1 splits the small and medium-sized banks operating in 1991 Q2 into peer groups according to their main activity. The largest cohort was the (residential and non-residential) property lenders, which accounted for 37 out of the 92 banks analysed. The next two most significant cohorts were the instalment credit/hire purchase (HP) lenders/finance houses and the investment management/treasury groups, which each included 15 banks. The remainder of the sector undertook a diverse range of activities.

Chart 2 shows a histogram of the 92 banks' balance sheet size in 1991 Q2. The smallest bank in the sample had total assets of £1.0 million and the largest had £3.2 billion. The mean and median were £166.4 million and £38.2 million, respectively. To put these figures into perspective, the mean balance sheet size of the banks in the Major British Banking Groups (MBBG) was £11.8 billion at end-1991, with Barclays PLC alone, the largest UK bank at the time, having a balance sheet of £138.1 billion³. Both figures dwarf

Chart 1:

Banks classified by peer group in 1991 Q2^(a)

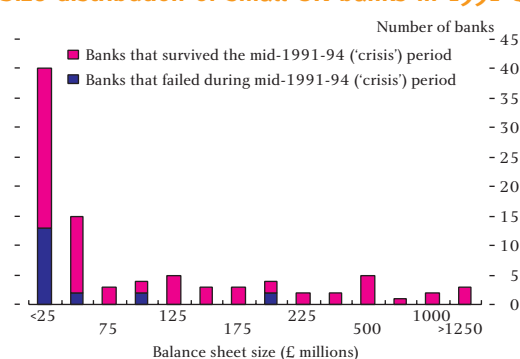


Source: Bank of England.

(a) See text on the definition of failure used for the duration of the 'crisis' period.

Chart 2:

Size distribution of small UK banks in 1991 Q2^(a)



Source: Bank of England.

(a) See text on the definition of failure used for the duration of the 'crisis' period.

2: The small and medium-sized banks group includes all UK-incorporated banks that were not large commercial or merchant banks. The banks within this catchall category were labelled small and medium-sized because of the scale of their balance sheets relative to the two other sectors.

3: Data on the size of Barclays PLC's and Major British Banking Groups' balance sheets are from British Bankers' Association (BBA) (1992). At 1991 Q2, the MBBG comprised the Abbey National Group, the Bank of Scotland Group, the Barclays Group, the Lloyds Group, the Midland Group, the National Westminster Group, the Royal Bank of Scotland Group, the Standard Chartered Group and the TSB Group.

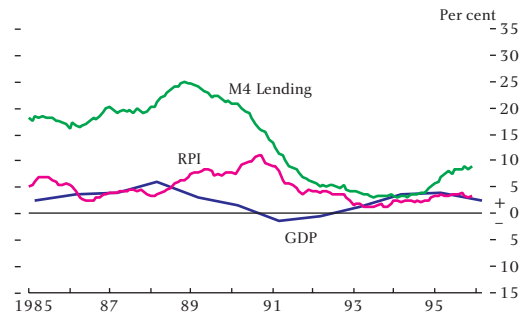
the average size of the individual banks in the small and medium-sized sector. In fact, the *total* assets of the small and medium-sized banks' sector were equivalent to only 11 per cent of Barclays' assets and 3.2 per cent of those of the MBBG sector as a whole. Most of the banks that failed had footings of under £25 million.

The small banks' crisis

The small banks' crisis unfolded against a background of macroeconomic boom and bust⁴; for the economy as a whole, 'boom and bust' is an instructive metaphor, for some of the small banks it was literally true. The growth in output, credit and asset prices, particularly commercial and residential property, rose sharply reaching a peak in 1988. Subsequently, as monetary policy was tightened, the real economy moved into recession, asset prices fell and the growth in aggregate bank and building society credit declined sharply. Against this background, the fragility of the banking system increased, culminating in the failure of 25 banks – mainly smaller ones – in the first half of the 1990s.

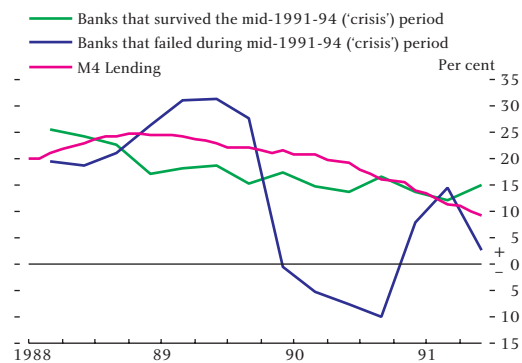
This interaction of boom and bust in the real and financial sectors is often described in terms of a financial accelerator effect⁵. In an economic upturn, credit expands and asset values rise, creating further valuable collateral on which to lend. In a downturn, the process goes into reverse: asset prices and thus the value of collateral decline, credit risk rises, lenders become more cautious, loan-financed spending falls, and the recession may be made worse. Bank behaviour may accentuate this financial accelerator effect. Banks (and other financial intermediaries) have imperfect information about the quality of their borrowers. In consequence, they try to protect against moral hazard and adverse selection by taking collateral, charging higher interest rates for unsecured loans, or channelling funds to borrowers with high net worth. Nonetheless, during boom periods banks may make mistakes through overestimating the quality of their assets and/or the value of collateral taken. Credit assessment can, moreover, be more difficult in a rapidly expanding

Chart 3:
Annual growth in real GDP, banks' and building societies' (M4) lending and retail prices



Sources: Bank of England and ONS.

Chart 4:
Annual growth in lending to the UK non-bank private sector by all banks and building societies (M4) and the small banks^(a)



Source: Bank of England.

(a) Split into subsequent failures and survivors. See text on the definition of failure used for the duration of the 'crisis' period.

economy because of increases in the number of both new providers and users of credit. This stylised account is not, in fact, a bad picture of the stability problems in the UK in the early 1990s⁶.

At the risk of prejudging the results of the subsequent analysis, Chart 4 shows that the pattern of lending growth of the small banks that went on to fail between mid-1991 and 1994 was much more cyclical in the boom and bust period (1988-1991) than that of either the small banks that survived or of the bank and building society sector as a whole⁷. Even by the standards of the time, the 30 per cent or so growth of the 'failed banks' was very high.

4: Schwartz (1998) discusses the links between financial stability and price stability. She comments "if inflation and price instability prevail, so also will financial instability".

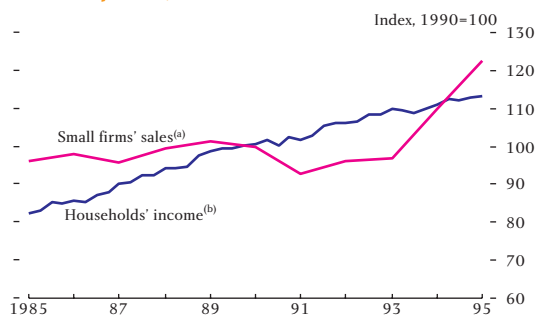
5: See Bernanke and Gertler (1995) and Mishkin (1995).

6: See King (1997).

7: The data in Chart 4 refer to lending to the UK non-bank private sector, whereas the small banks' lending data used in the following analysis also include lending to the overseas non-bank private sector.

By the early 1990s, the small and medium-sized UK banks faced pressure on both sides of their balance sheets⁸. On the assets side, the recession adversely affected the ability of bank customers to service their debts. This was particularly true of customers in the small business and household sectors. Data on small firms' real income are not available, but Chart 5 shows that the real value of total sales, a proxy for income, by small firms (those employing less than a hundred people) fell by 1.4 per cent in 1990 and by 7.1 per cent in 1991. Households' real disposable income continued to rise, but at a much reduced rate: by 3.7 per cent in 1990 and 1.5 per cent in 1991, compared with an average of 4.2 per cent in the second half of the 1980s.

Chart 5:
Households' income and small businesses' sales (at constant prices)



Sources: Bank calculations and ONS.

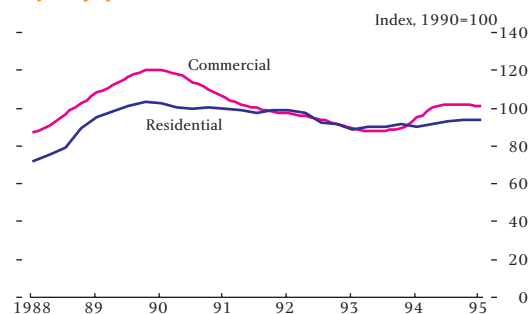
(a) The value of manufacturing firms employing less than a hundred staff's total sales and work done deflated by the GDP deflator.

(b) Households' real disposable income.

The impact of the recession was particularly severe on the property market. As Chart 6 shows, commercial property prices fell between peak and trough by 27 per cent (1989 Q4 and 1993 Q2), whilst residential property prices declined by 14 per cent (1989 Q3 and 1992 Q4). Many of the small banks had traditionally been heavily involved in the property market, both as direct lenders to commercial and residential property companies and by taking property as security for mortgage and consumer lending.

On the liabilities side, the small banks were, as a group, heavily dependent on wholesale deposits from

Chart 6:
Property prices



Sources: Bank of England and DETR.

foreign banks, building societies, local authorities and big non-financial corporations, as well as other UK banks. A gradual withdrawal of this type of funding was prompted by the deterioration in the quality of their assets, the failure of British & Commonwealth Merchant Bank plc in the summer of 1990 and of four small banks in late 1990 and early 1991, and difficulties that some foreign bank lenders were experiencing in their home markets. Then, on 5 July 1991, the UK banking system was hit by the announcement that the Bank of England, acting with bank regulators in a number of other jurisdictions, were closing down BCCI due to fraud. This news accelerated the rate at which wholesale deposits were withdrawn from the smaller UK banks. Over the next three years, one quarter of the smaller UK banks would (according to the definition set out below) fail.

The Bank of England's actions

From the middle of 1991 the Bank⁹ kept 40 small banks under particularly close review. The initial criterion for review was reliance on wholesale market funding, but monitoring was quickly extended to banks giving rise to other concerns, particularly exposure to the property sector. In all cases, management was required to provide regular additional information, especially relating to liquidity and cash flow, and to undertake detailed forward planning. The Bank's intensive monitoring included oversight of a re-ordering of their affairs. In some cases, banks achieved this by securing fresh longer-term funding on a commercial basis, by seeking greater reliance on retail funding, or by adjusting their activities to the reduced funding

⁸: This description of the crisis and the supervisory measures the Bank took follows Bank of England (1993) and Bank of England (1994) very closely.

⁹: The Bank of England was the bank supervisor in the UK until 1 June 1998. The regulatory function was transferred to the newly created Financial Services Authority.

available to them. The Bank oversaw the orderly winding down of the affairs of others.

In addition to that action undertaken by the supervisors, the Bank of England established arrangements from the middle of 1991 to provide liquidity support to a few small banks. The decision to intervene was motivated by a concern within the Bank that, although small, closure of these banks would have caused the wholesale markets to tighten further, spreading the liquidity problems to other parts of the UK banking system¹⁰. Emergency liquidity assistance therefore was aimed at safeguarding the financial system as a whole and hence preventing damage to the wider economy. It is, of course, not possible to be certain what would have happened if support had not been provided, but the Bank believes that its intervention was successful in averting what could have been a much wider systemic disturbance.

The liquidity support was provided with the Government's knowledge but without a Government guarantee. The operation was not without risk to the Bank. It had to make provisions in respect of the indemnities it gave in relation to the small number of banks that received support. These reached a maximum of £115 million in 1993. In 1994, one bank – The National Mortgage Bank PLC – became insolvent. It was acquired by the Bank for £1. This was to facilitate control over the process of realising its assets. It was finally sold on 28 January 2000¹¹.

Research on leading indicators

Definition of failure

Since the work by Beaver (1966) and Altman (1968) many studies have tried to use balance sheet and other information to predict corporate distress¹². Most define failure as occurring when a firm's liabilities exceed its assets. This definition is not immediately transferable to the banking industry because bank regulators (at least in the UK) have the power to close a bank if the interests of depositors or potential depositors are threatened even if it still has positive net worth. A definition of bank failure is required, therefore, that incorporates regulatory action.

Regulators' powers are usually governed by legislation, the terms of which vary from country to country. Different national authorities also use slightly different crisis resolution techniques. Studies of bank failure therefore tend to use country specific definitions of what constitutes a bank failure.

In this study, a bank is classified as having failed if it underwent any of the following events between 1 July 1991 and 30 June 1994:

- i) entered administration;
- ii) entered liquidation;
- iii) received liquidity support from the Bank of England;
- iv) had its authorisation revoked by the Bank of England for reasons that could potentially be predicted by the balance sheet and other information used in this study;
- v) voluntarily surrendered its authorisation, except when motivated by corporate restructuring (typically following take-over) or by a strategic review of the benefits of a banking licence (because the entity no longer needed to receive deposits to conduct its consumer credit or lending activity).

The three-year period was chosen because it is when the Bank maintained its heightened scrutiny of the sector; but there is of course some arbitrariness about any particular cut-off point.

Data sources and types of variables

The balance sheet and other characteristics that were investigated as potential leading indicators of failure were drawn largely from the banks' regular (confidential) statistical returns to the Bank of England. The scope of the returns increased with the size of the bank and the number of activities it undertook. Data are available on small banks for most key items – the liquidity position, balance sheet, P&L, off-balance-sheet items, large depositors and large exposures. The major gaps are information on the sectoral pattern of their lending and the interest rates

¹⁰: Further information on the motivation behind the Bank's judgement to provide emergency liquidity assistance was set out by the Governor in a speech in 1993. This is reproduced in Bank of England (1994). For a more recent extensive survey on lender of last resort see Freixas, Giannini, Hoggarth and Soussa (1999).

¹¹: See Hoggarth and Soussa (2001) for additional details on the Bank's liquidity support operation.

¹²: See Benito and Vlieghe (2000) for a brief overview of this literature.

on their liabilities and assets. As discussed above, given the coincidence at the time of a cycle in both lending growth and assets prices, data on exposures to the property sector is likely to be a particularly important omission.

These data have been supplemented by non-statistical information available to the bank regulators and by some of their qualitative assessments. These included the peer groups in which banks were categorised, a judgment over whether or not a bank had a strong parent, and the regulatory capital target ratio the regulators set for each bank¹³.

In recent years, considerable research has been undertaken on market participants' ability to judge the soundness of banks. Flannery (1998) argues that data on the financial market's assessment of a bank's condition should be formally integrated into the monitoring and early warning systems used by bank regulators. Unfortunately, it is not possible to test whether some of the more frequently used market indicators would have had predictive power in the small banks' crisis. These banks' equity and debt tended not to be publicly traded. Only one of the 92 banks in the study had a credit rating at the time, so it is also not possible to use ratings as a proxy for the market's assessment.

The definitions of all the variables considered as potential leading indicators of bank failure are given in Box 1. They were selected on the basis that they appeared important in previous similar empirical studies or reflected the prior beliefs of those working on this exercise within the Bank. The characteristics can be categorised into two types. The first aims to measure the potential for a bank to make losses; the second seeks to capture the bank's ability to withstand adverse shocks.

The variables measuring the potential for losses can in turn be split according to the type of risks: credit,

liquidity, concentration and miscellaneous¹⁴. Credit risk is proxied in three ways. Rapid loan or total balance sheet growth (LG91 and TA91, respectively) may suggest a bank is taking on less creditworthy customers¹⁵. A high level of provisions as a share of total assets (POA) may suggest the bank has been a poor judge of credit risk in the past and this may continue in the future. A high ratio of risk-weighted assets to unweighted assets (RWTTA) indicates that the bank has a high proportion of risky assets as categorised by the 1988 Basel Accord¹⁶. All three measures of credit risk would be expected to be positively correlated with failure.

Three variables are proxies for the risk of making losses due to illiquidity. On the assets side, the ratio of (non-marketable) private sector loans to total assets (LOA) should be relevant to a bank's ability, or inability, to realise cash at negligible cost. On the liabilities side, the share of total deposits made up by deposits from other banks (BAD) may indicate the vulnerability of a bank to a wholesale deposit run. Both of these variables should be positively correlated with failure. Liquidity mismatch (STED) is captured by the difference between short-term (up to eight day) assets and liabilities. It should be negatively correlated with failure.

Four proxies were considered to measure risk due to balance sheet concentration. Two are on the assets side of the balance sheet. A high dependence on claims on relatively few individuals or associated customers (LE) increases risk. Likewise, being classified by the bank regulators within the property sector peer group (PROP) was thought to heighten risk. The dependence on one source of income – net interest income (NII) – could also increase the likelihood of losses because it indicates lack of functional diversification. On the liabilities side, a heavy reliance on a few large depositors (DEPC) might increase the likelihood of liquidity problems.

13: The target ratio is set to provide a cushion above the minimum capital requirement ('the trigger ratio') each bank is required to observe. It is set at a level which the bank regulators judge sufficient to prevent an accidental breach of the trigger ratio. If a bank's capital ratio falls below its target, the regulators would open discussions with the institution's management to ensure that the trigger ratio is not breached. In contrast with many other countries, the trigger and target ratios in the UK are bank-specific, and set above the across-the-board 8 per cent Basel minimum.

14: The Bank's statistical return on market risk was not introduced until the beginning of 1996, so no proxies for this type of risk are included because of lack of data. As the small and medium-sized banks were not for the most part heavily involved in trading, this seems unlikely to be a substantial loss.

15: All the variables measuring the change in a particular indicator (rather than its level) are calculated over a year's time horizon. This is to help isolate the particular point in the cycle in which the variable's behaviour is important. A longer time interval may mask whether the signal occurs in the boom or the recession.

16: See Basel Committee on Banking Supervision (1988). Since the risk weights under the current Basel Accord are very broad, the ratio of risk-weighted to unweighted assets should be regarded only as a rough guide to credit risk.

Box 1: Variable description

This box details the construction of the variables used in the statistical analysis in this paper for the first period considered (1991 Q2). Where available they are constructed in the same way for earlier years.

Credit Risk

LG91	Growth in loans to the private sector in the year to 1991 Q2.
Δ LG91/90	Growth in loans to the private sector in the year to the second quarter of 1991 minus the growth in the year to 1990 Q2 (expressed in percentage points).
POA	Specific provisions against bad and doubtful debts and provisions against the value of investments other than trading investments as a percentage of total assets.
RWTTA	Risk-weighted assets expressed as a percentage of total assets.
TA91	Percentage growth in total assets in the year to the second quarter of 1991.
Δ TA91/90	Growth in total assets in the year to the second quarter of 1991 minus the growth in the year to second quarter of 1990 (expressed in percentage points).

Liquidity Risk

BAD	The percentage of a bank's deposits placed by other UK banks.
LOA	Loans to the private sector as a proportion of total assets (expressed as a percentage).
STED	Total assets of less than eight days residual maturity minus total liabilities due over the same time horizon. The net figure is then expressed as a percentage of total assets.

Concentration Risk

DEPC	The size of the ten largest deposits expressed as a percentage of total deposits.
LE	Ten largest exposures as a percentage of total assets.
NII	Net interest income earned over the past year expressed as a percentage of total income earned over the past year.

PROP	A dummy variable that takes the value 1 if the bank was a member of the banking supervisors' first charge residential mortgage lenders and other property secured lenders peer groups. Otherwise it takes the value 0.
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Miscellaneous Risk

AGE	Number of years the bank had been authorised to accept deposits under the Banking Act 1979.
SIZE	The natural logarithm of the sterling value of the bank's total assets.
TAR	The target ratio the banking supervisors set the bank.

Ability to Withstand Losses

CAP	Growth in net capital (the numerator of the risk assets ratio) in the year to 1991 Q2.
ITCR	Total income earned over the past year expressed as a percentage of total costs incurred over the past year.
LEV	Total liabilities minus total net capital expressed as a percentage of total net capital.
Δ LEV	The difference in the level of the leverage ratio between 1991 Q2 and 1990 Q2 (expressed in percentage points).
PAR	A dummy variable that takes the value 1 if the bank was owned by a large parent. Otherwise it takes the value 0.
PROF	Profits earned over the past year expressed as a percentage of total assets.
XRAR	The risk-assets ratio minus the target ratio set by the banking supervisors within the Bank at the time (expressed in percentage points).
Δ XRAR	The difference in the level of the excess of capital over the regulatory capital requirement (XRAR) between 1991 Q2 and 1990 Q2 (expressed in percentage points).
XRARP	The risk-assets ratio minus the target ratio expressed as a percentage of the target ratio.

Three further miscellaneous variables were employed. First, the length of time a bank has been authorised (AGE) may be a proxy for the experience of the bank's management. Second, bank size (SIZE) may reflect the opportunities for diversification (either by type of business or geographical location of their customers) or the sophistication of management. Finally, the regulators' judgment of a bank's riskiness is proxied by the target capital ratio they set (TAR)¹⁷.

A number of variables were experimented with to capture a bank's ability to withstand unanticipated losses (regardless of the type of risk exposure from which they originate). A bank's first line of defence is traditionally regarded as current earnings. These are proxied by two variables – revenue as a percentage of costs (ITCR) and profits as a percentage of total assets (PROF). The capital cushion is the second line of defence. This is measured in two ways: the excess capital ratio over the target ratio set by the supervisors (XRAR and XRARP) and a leverage ratio – unweighted assets divided by capital – (LEV), which supervisors in the United States use as a backstop to the Basel risk-weighting framework. A possible third line of defence, the presence of a large parent that may bail out a troubled bank, is also included as a dummy variable (PAR).

Unfortunately, one of the statistical forms used to construct many of the variables was only introduced in 1989 (reflecting the Bank's implementation of the 1988 Basel Accord). This means that it is possible to construct most of the variables for only the two years prior to the start of the crisis period. A cross-sectional study, using data constructed in 1991 Q2, was therefore undertaken. The results suggest that most of the variables that are helpful in predicting failure also showed that the banks that went on to fail were already weak by then. To see whether there are any useful longer leading indicators of failure, the analysis was repeated using variables constructed for 1990 Q2, and back to 1988, the height of the boom, for a few variables where data were available (illiquidity mismatch, the share of assets that can easily be turned into cash, loan/asset growth, size and the share of total deposits from banks).

Results using data in 1991 Q2

A preliminary investigation of the data was undertaken by comparing the median values in

1991 Q2 of each variable for the group of survivor banks and for those that subsequently failed. These are reported in Table 2. Column 5 shows the results of a non-parametric test evaluating the hypothesis that the two groups' medians are equal against the alternative that they differ. A positive number indicates that more than half of the survivor banks are above the two groups' common median (and by implication that less than half the failed banks were). A negative number suggests that the opposite is true.

It is evident from Table 2 that it is possible to reject the assumption of equal medians at the 90 per cent confidence level or above for seven of the variables. Virtually all of these indicators show that, on the eve of BCCI's closure, the condition of those banks that subsequently went on to fail had already begun to deteriorate relative to those that remained in business. The failed banks had made more provisions as a proportion of total assets (POA): their median level was 4.6 per cent against 1.4 per cent for the survivors. Their median profit as a percentage of total assets (PROF) was 0 per cent compared with 0.7 per cent for the survivors. The failed banks' capital – the numerator of the risk assets ratio – fell in the year to 1991 Q2 (CAP), while for the survivors it rose (-1.1 per cent against 7.7 per cent).

It is also possible to reject the null hypothesis of a common median for the two groups' loan growth in the year to 1991 Q2 (LG91) and, similarly, of a common median for the rate of change of loan and asset growth between 1990 Q2 and 1991 Q2 ($\Delta LG_{91/90}$ and $\Delta TA_{91/90}$). These data indicate that balance sheet growth was both *lower* and *fell* more rapidly for the failures than the survivors.

However, the non-parametric test of the equality of the two groups of banks' medians is a univariate test. It therefore does not hold constant the other characteristics of the two groups of banks. Nor does it provide information on their relative importance in predicting bank failure. For that, logit regression analysis was undertaken.

Problems arise in regression analysis if the explanatory variables are not independent of one another. For this study, multiple measures of credit, liquidity and concentration risk and the bank's ability to absorb losses have been constructed. More than one measure

¹⁷: For confidentiality reasons, Table 2 excludes the target ratios that the banking regulators set the banks.

Table 2: Median values of explanatory variables for the failed and survivor banks (1991 Q2)

	All	Survivors	Failures	Test statistic ^(a)
Col (1)	(2)	(3)	(4)	(5)
Measures of credit risk				
LG91	7.1	10.8	2.1	1.80*
ΔLG91/90	-5.6	0.2	-15.1	3.35***
POA	1.7	1.4	4.6	-2.32**
RWTTA	71.8	71.5	76.6	-0.77
TA91	6.5	9.8	-2.2	1.29
ΔTA91/90	-5.5	-3.2	-13.2	1.80*
Measures of liquidity risk				
BAD	4.7	1.4	11.1	-0.26
LOA	94.2	93.2	96.4	-1.29
STED	1.0	1.0	1.9	-0.26
Measures of balance sheet concentration				
DEPC	50.8	51.4	49.5	0.26
LE ^(b)	31.9	28.6	47.9	-1.65
NII	83.9	81.3	89.3	-1.29
Measure of general risk				
SIZE ^(c)	38.2	44.0	17.3	2.32**
Measures of banks' ability to withstand losses				
CAP	5.4	7.7	-1.1	2.83***
ITCR	186.4	184.4	210.6	-0.26
LEV	425.2	443.8	367.4	1.29
ΔLEV	0.2	-0.1	1.7	-0.47
PROF	0.6	0.7	0.0	2.32**
XRAR	10.6	11.2	8.7	0.77
ΔXRAR	-0.1	0.0	-0.3	0.26
XRARP	63.3	69.4	47.4	0.77

Source: Bank calculations.

(a) Where ***, ** and * in Table 2 indicate significance using the t-distribution at the 99 per cent, 95 per cent and 90 per cent confidence interval.

(b) Constructed using just the 67 banks for which this information is available.

(c) In this table figures for size variable (SIZE) are in £ millions, but elsewhere in this article it is constructed as explained in Box 1.

of each type of risk or of the bank's current income and capital cannot be used simultaneously in a regression analysis, as they are designed to quantify

the same thing and therefore should not be independent. The choice between these variables was made on the basis of a model selection criterion (which trades off how well the estimated equation fits the sample data against the number of variables it uses). Where this produced ambiguity, judgment was imposed on which variable had the least overlap with the others (informed partly by simple correlations) and was most likely to boost the accuracy of the within-sample fit for the failed banks.

The regressions were initially estimated using 84 of the 92 banks available. Eight banks were 'held back' to see how the model performed out of sample. In direct proportion to the sample as a whole, these included six banks that continued in business and two that failed. The selection of the six and two banks respectively, within the survivor and failure groups, was random.

The general specification of the regression based on 1991 Q2 is shown in Regression 1 in Table 3. The parsimonious form is shown in Regression 2. Loan growth in the year to 1991 Q2 (LG91) is the statistically most important short-term leading indicator of bank failure in Regression 2. The sign on the coefficient is negative, suggesting that in the early 1990s, small banks with lower annual loan growth were more likely to fail in the subsequent three year period. This may reflect supply-side factors: for example, the weakened banks may have been writing off past loans, reallocating their staff resources away from sales and marketing towards nursing existing customers, or facing difficulties in attracting deposits. Some support for the latter possibility comes from the median growth rate in deposits of the two groups of banks: the failed banks' deposits increased by just 1.1 per cent in the year to 1991 Q2, while the survivors' deposits rose by almost 10 per cent. However, slow loan growth of the failing banks is unlikely to be explained by a capital constraint¹⁸: as shown in Table 2, their median risk-assets ratio was 8.7 percentage points above the supervisors' target ratio (XRAR). There is also no evidence of failing banks substituting away from assets with high risk weights (under the 1988 Basel Accord capital framework) into lower weighted ones. In fact, the converse is true: unweighted assets fell by more (2.2 per cent) in the year to 1991 Q2 than did risk-weighted assets (1.0 per cent).

¹⁸: See Bank of England (1991) for the Bank's written evidence to the Treasury and Civil Service Committee on whether more generally there was a credit crunch in the UK recession at the time.

Table 3: Regression results based on 1991 Q2 data^{(a)(b)}

	Regression 1	Regression 2
CONSTANT	-7.5165 <i>(-1.5816)</i> **	-7.0476 <i>(-2.0455)</i> **
AGE	0.2248 <i>(1.0277)</i>	0.2379 <i>(1.0953)</i>
DEPC	-0.0105 <i>(-0.7244)</i>	
LG91	-0.0635 <i>(-2.9811)</i> **	-0.0606 <i>(-3.0259)</i> ***
SIZE	0.0465 <i>(0.1618)</i>	
NII	0.0708 <i>(2.1817)</i> **	0.0644 <i>(2.2390)</i> **
PROP	0.6236 <i>(0.8055)</i>	
STED	-0.0353 <i>(-2.2373)</i> **	-0.0303 <i>(-2.1100)</i> **
LEV	-0.0034 <i>(-2.2525)</i> **	-0.0030 <i>(-2.3554)</i> **
PAR	-1.5474 <i>(-1.4663)</i>	-1.4738 <i>(-1.6690)</i>
PROF	-0.4015 <i>(-2.4883)</i> ***	-0.3868 <i>(-2.5003)</i> ***
Log-likelihood	-25.7309	-26.3500
Akaike information criteria	-36.7309	-34.3500
Schwarz Bayesian criterion	-50.1004	-44.0733
Pseudo R ²	0.3918	0.3772

Source: Bank calculations.

(a) T statistics appear in italics in parenthesis below the coefficient.

(b) Where ***, ** and * indicate statistical significance at the 99 per cent, 95 per cent and 90 per cent confidence interval.

Low loan growth may also have reflected demand-side factors. Borrowers from the banks that went on to fail may have been hurt more by the recession than the customers of survivor banks. This, in turn, may have

reflected inadequate screening by the banks of potential borrowers in the past.

Using the estimated coefficients shown in Regression 2, it is possible to calculate the marginal impact on the probability of failure of a unit change in the value of each of the continuous explanatory variables. For ease of comparison these figures have been manipulated to show what scale of movement would be necessary in each of the variables to increase the likelihood of failure by 1 per cent. The results are shown in Table 4. It is evident from these calculations that the likelihood of failure was 1 per cent higher for every 3.2 percentage point decline in annual loan growth.

Table 4: What would increase the likelihood of failure by 1 per cent and the medians of the failed and survivor banks

Indicator	Median of the two groups		
	Movement	Failures	Survivors
Loan growth in the year to 1991 Q2 (LG91)	-3.2	2.1	10.8
Dependence on net interest income (NII)	3.0	89.3	81.3
Liquidity mismatch (STED)	-6.5	1.9	1.0
Leverage ratio (LEV)	-66.1	367.4	443.8
Profits as a percentage of total assets (PROF)	-0.5	0.0	0.7

Source: Bank calculations.

Bank failure is also found to be positively related to dependence on net interest income (NII). This may reflect the reduction in risk gained from undertaking activities that earn uncorrelated income streams. In addition, the earnings stream from traditional lending activity may have been more volatile than other types of income¹⁹. Either way, hindsight suggests that a management strategy of diversifying into different types of business to earn fees, commission or trading income may have been more prudent.

The other measure of risk found to be statistically significant is the liquidity mismatch between short-term assets and liabilities (STED). As expected, the coefficient suggests that the more short-term liabilities exceed short-term assets, the greater the likelihood of

¹⁹: See Denney, Staikouras and Wood (2000) for an investigation into the financial stability implications of banks' increasing reliance on non-interest income.

failure. In quantitative terms, however, a large increase in the share of short-term net assets as a proportion of total assets (6.5 percentage points) is required to lower the probability of failure by 1 per cent.

The other four variables that attempt to capture risks – length of authorisation (AGE), deposit concentration (DEPC), size (SIZE) and the exposure-to-property dummy (PROP) – were all found to be statistically insignificant. Given the importance attached to property lending by the bank supervisors at the time, the insignificance of this variable is somewhat surprising. It may reflect problems over the variable's construction: the use of a dummy does not allow differentiation between the extent of banks' exposures to the property sector within the property peer group, nor does the variable distinguish whether a bank's exposures were to residential or commercial property. Chart 6 suggests that the absence of data on the exposure of small and medium-sized banks to commercial property could be a considerable loss²⁰.

Two out of the three variables that attempted to measure a bank's overall ability to resist shocks are statistically significant. The other is borderline. The sign of the coefficient on the profitability variable (PROF) is in line with expectations: lower profitability is associated with a higher probability of failure. In quantitative terms, Regression 2 suggests the likelihood of failure is 1 per cent lower for every 0.5 percentage point increase in the return on assets.

At first sight the coefficient on the leverage ratio (LEV) is counter-intuitive and contradicts the findings in the majority of other studies (see for example, Estrella, Park and Peristiani (2000) for evidence on US banks). It is negatively signed, suggesting that lower rather than higher leverage is associated with failure. The explanation does not appear to lie in the bank regulators forcing the weakened banks to hold high capital in relation to assets – the inverse of leverage. There was little difference in the actual risk-asset ratios of the failed and survivor banks. To the extent that the private sector had sufficient information to monitor the small and medium-sized banks' leverage ratios, it might reflect market discipline. If the banks that subsequently failed were

already perceived by the market as being weak, they may have been required to hold high levels of capital before potential counterparties would lend to them. Alternatively, an insufficient number of counterparties may have been willing to deal with them (or in the desired volume), making them unable to expand their balance sheet and raise their leverage.

Other researchers, for example, Thompson (1991) have also found capital variables to be statistically significant, but counter-intuitively signed in predicting bank failure over a short time horizon (but not longer). They have attempted to justify the result in two ways. First, it may reflect attempts by banks beginning to experience difficulties to improve cosmetically their capital position by selling assets on which they have capital gains and deferring the sale of assets on which they have capital losses. Second, it may reflect strong banks being more aggressive in recognising and making provisions and writing off problem loans than their weaker counterparts; or, conversely, weak banks being slow in doing so, so that assets are effectively overvalued in accounts and capital adequacy flattered by capital ratios²¹. Both these explanations, and also the market discipline one discussed above, rely on the premise that the banks that went on to fail were already fundamentally weak.

The large parent dummy borders on statistical significance at the 90 per cent confidence interval. The sign of the coefficient is as expected, suggesting that small and medium-sized banks were more likely to fail if they were not owned by large corporates. Those that had large parents may have benefited from actual parental support or, at least, avoided depositor withdrawals because of an expectation of parental support. Other researchers, for example Belongia and Gilbert (1990), have also found that the presence of a parent – in their case a bank holding company – reduces the likelihood of bank failure.

The coefficients estimated in Regression 2 can be combined with the values of the explanatory variables to construct a 'failure potential' index for each bank. This takes a value between zero and one, where the extremes correspond to survival and failure with certainty, respectively. By selecting a cut-off point

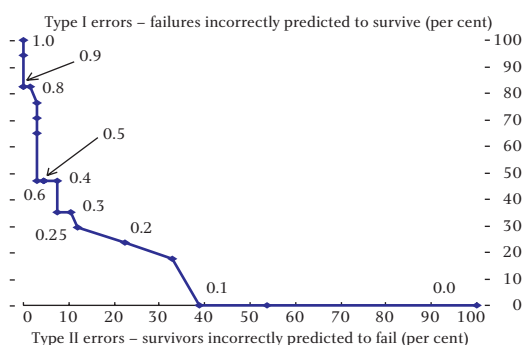
20: In the early 1990s, banks with total assets of less than £100 million were not required to complete the statistical return on the industrial composition of their exposures to UK residents. This return included information on exposures to the property sector. At the time, bank regulators would have been able to request management accounts information, which filled the gap. Any such information is not readily available to the author.

21: See the article by Jackson and Lodge in the previous edition of this *Review* for a discussion of the financial stability implications of the banking industry's use of historical cost versus fair value accounting.

below which a bank is classified as a survivor and above which it is classified as a failure, the index can be used to evaluate the accuracy of Regression 2.

In this type of analysis, predictive performance is usually evaluated in terms of Type I and Type II errors. A Type I error occurs when a hypothesis is mistakenly rejected when in fact it is true; a Type II error occurs when a hypothesis is accepted when in fact it is false. In the current context, therefore, a Type I error occurs when an erroneous prediction of bank survival is made and a Type II error is when a bank is falsely predicted to fail. Chart 7 shows the performance of Regression 2 in terms of the two types of errors. The size of each type of error alters with changes in the cut-off point to determine whether a bank is classified as a survivor or a failure. At one extreme (at a cut-off point of 1) all banks are classified as survivors, so Type I errors are at 100 per cent and Type II errors at 0 per cent; and at the other (a cut-off point of 0) all banks are classified as failures, so Type I errors are at 0 per cent and Type II errors are at 100 per cent.

Chart 7:
Type I and II errors of Regression 2 over various cut-off points



Source: Bank calculations.

Overall, the model performs well. At a cut-off point of 0.25 it predicts 12 out of the 17 (71 per cent) failures and 59 of the 67 (88 per cent) survivor banks on which the regression was estimated²². This equates to Type I and Type II errors of 29 per cent and 12 per cent, respectively. At this cut-off point it correctly predicts the destiny of the six withheld banks that survived and the two withheld banks that failed. The

within-sample error rates are similar to those found in previous studies.

While the performance of Regression 2 is encouraging, it is not particularly helpful from a policy perspective. Most of the statistically significant leading indicators of bank failure in the small and medium-sized bank sector in mid-1991 discussed in this section – namely, low loan growth, low profitability, low short-term assets relative to liabilities and, arguably, low leverage – show that by the time of BCCI's closure the banks that went onto fail were already showing signs of fragility. They confirm the results found in the univariate tests. While they may be helpful in identifying subsequent failures, these indicators cannot be used by regulators or central banks to take pre-emptive policy actions to avoid bank or banking system weakness in the first place. In order to find indicators of future failure before banks actually weakened, data from an earlier (pre-recession) period were analysed.

Econometric results for 1990 Q2 and before

Regressions 3 and 4 in Table 5 show the general and parsimonious forms respectively of the model estimated on data constructed at 1990 Q2 or earlier for the few variables for which this was possible. The most statistically significant variable from the earlier period regression is loan growth in the year to 1988 Q2 – the peak of both the GDP and lending growth cycles in the previous boom. Unlike the analogous variable in the 1991 Q2 regressions, its coefficient is positively signed, suggesting that banks that failed in the subsequent recession had higher loan growth at the height of the boom than their competitors that survived²³.

Table 6 shows the median rate of growth of loans of the survivor and future failures groups during the closing stages of the late 1980s boom and beginning of the early 1990s recession. It is evident that the failed banks' median loan growth was greater, even if slowing, than that of the survivors in the year to 1989 Q2 and 1990 Q2. Both of these other two years were tried in turn in the regression analysis, but the 1988 loan growth variable dominated. The banks with

²²: This cut-off point produced the second lowest sum of the percentage of Type I and Type II errors. It was preferred to the global minimum because the latter had a high level of Type II errors. See the article by Bell and Pain in this *Review* for a discussion of the trade off policymakers face in selecting a cut-off point in this type of model. They suggest policymakers must weigh up the relative costs of a surprise failure (the consequence of a Type I error) versus the resource and other costs of unnecessary intensification of supervision and/or preventative action (the consequence of a Type II error).

²³: Office of the Comptroller of the Currency (1988) also finds an overly aggressive or growth-minded strategy (relative to their circumstances) prevalent in national banks that went on to fail in the United States.

Table 5: Regression results based on data at 1990 Q2 or before^{(a)(b)}

	Regression 3	Regression 4
CONSTANT	-4.9298 <i>(-1.2968)</i>	-2.9159 <i>(-1.0678)</i>
AGE	0.4027 <i>(1.7802)*</i>	0.3157 <i>(1.5746)</i>
DEPC	0.0245 <i>(1.6389)</i>	0.0194 <i>(1.4665)</i>
LG88	0.2883 <i>(2.7228)***</i>	0.2837 <i>(3.0908)***</i>
SIZE	-0.3328 <i>(-1.0808)</i>	-0.3194 <i>(-1.7037)*</i>
NII	0.1223 <i>(0.6913)</i>	
PROP	0.6200 <i>(0.9159)</i>	
STED	-0.0073 <i>(-0.7776)</i>	
LEV	-0.0000 <i>(-0.0568)</i>	
PAR	-0.3650 <i>(-0.3659)</i>	
PROF	-0.0511 <i>(-0.3300)</i>	
Log-likelihood	-31.1530	-32.3463
Akaike information criteria	-42.1530	-37.3463
Schwarz Bayesian criterion	-55.5225	-43.4234
Pseudo R ²	0.2637	0.2355

Source: Bank calculations.

(a) T statistics appear in italics in parenthesis below the coefficient.

(b) Where ***, ** and * indicate statistical significance at the 99 per cent, 95 per cent and 90 per cent confidence interval respectively.

the fastest loan growth in this year – at the height of the boom – were particularly likely to fail in the subsequent downturn. This can be seen from Table 7. In 1988 almost 40 per cent of banks within the highest loan growth quartile went on to fail compared with 17 per cent or less of banks in the lower growth quartiles. However, as economic growth declined, so

Table 6: The median rates of annual loan growth (per cent) for the survivor and failed banks 1988 Q2-1991 Q2

	1988 Q2	1989 Q2	1990 Q2	1991 Q2
Survivors	14.1	18.3	11.0	10.8
Failures	28.8	25.5	17.0	2.1

Source: Bank of England.

did the loan growth of the failed banks relative to that of the survivors. By mid-1991 not a single bank within the then highest loan growth quartile went on to fail.

Table 7: The share (per cent) of future bank failures in each loan growth quartile 1988 Q2-1991 Q2

	percentage of banks in each quartile that would fail (between 1991 Q2-94 Q2)			
Loan growth by quartile	1988 Q2	1989 Q2	1990 Q2	1991 Q2
Quartile 1 – lowest	17.4	17.4	13.0	26.1
Quartile 2	13.0	17.4	13.0	30.4
Quartile 3	13.0	13.0	43.5	26.1
Quartile 4 – highest	39.1	34.8	13.0	0.0

Source: Bank of England.

The change in sign of the loan growth variable at different parts of the cycle (and the corresponding movement of the concentration of future failures between loan growth quartiles) may well be linked. Over-expansion in the boom phase by selecting poor credit risks may have caused the subsequent loan write-offs, or a customer base that fared particularly badly (and hence had low demand for loans) in the ensuing recession. This explanation is consistent with the life cycle of a bank failure view of Reidhill and O'Keefe (1997) from the Federal Deposit Insurance Corporation (FDIC) in the United States. In the first stage, there is rapid loan growth, concentrations may emerge, underwriting standards may weaken, and it may be financed by more volatile funding sources. In the second stage, loan quality problems begin, profits start to decline and inadequate provision levels emerge. In the final stage, the deterioration in asset quality becomes a serious problem, and loan losses and write-offs reach high levels. The bank makes substantial steps to cut its expenses and assets are sold off. In some cases, these measures may allow the bank to survive; in others it will fail.

Size also seems to be important in the earlier period regression. Smaller banks within the small and medium-sized bank sector tended to fail more often than larger ones. This is consistent with the more general picture that failures in the post-BCCI period were concentrated in that sector. It may reflect their lower opportunities for diversification (either by business type or by location of their customers), the abilities of management, or their peripheral position in the market. It is puzzling, however, that the size variable was not statistically significant in the later 1991 Q2 regression.

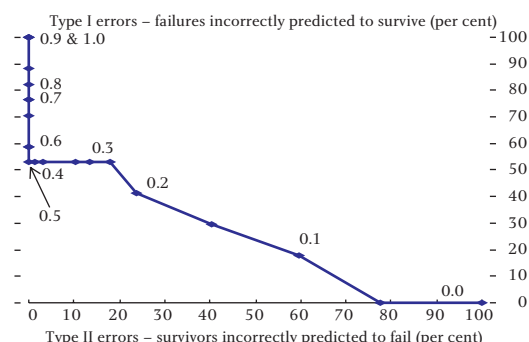
Two other variables – length of authorisation (AGE) and deposit concentration (DEPC) – are almost statistically significant. It is interesting that the sign on the coefficient of AGE is positive, suggesting that the longer a bank had held its banking licence the more likely it was to fail. This runs contrary to the original rationale for including the variable – as a proxy for the experience of the management – and suggests that the interactions involved are not well-specified. One possible, albeit speculative, explanation may be that the authorisation criteria used by the bank regulators became more rigorous over time.

Chart 8 shows the accuracy of Regression 4 in classifying the banks on which it was estimated as survivors or failures across the spectrum of cut-off points. At the preferred cut-off point of 0.5, Regression 4 correctly predicts half – eight out of the 17 – of the within-sample failures and all of the survivors²⁴. Out of sample, it accurately predicts the outcome for the six banks that survived but does not predict the two that failed. At the preferred cut-off points, Regression 4 performs less well than Regression 2. This should not come as a surprise: as the interval between the measurement of the explanatory variables and the timing of the crisis (or failure) increases, a deterioration in predictive performance is a common finding in the literature.

Comparison with large banks

The objective of this study was to develop leading indicators of small bank failure. It focuses on the late 1980s – early 1990s because it was during this period that small bank failures in the UK became relatively widespread. For those interested in the crisis and the UK banking industry at the time, it is of interest to

Chart 8:
Type I and II errors of Regression 4 over various cut-off points



Source: Bank calculations.

see how the indicators that appear relevant for small banks perform in relation to the larger UK banks. It should be noted, however, that it would be surprising to find a simple read-across from the results for small banks to larger ones, given their different scale, scope and product mixes.

Table 8 shows the median value of each leading indicator that was found to be significant for small banks, computed for the group of large UK banks (the Major British Banking Groups (MBBG)) at the time. The most obvious difference is the scale of the MBBG banks' balance sheets: their median size is £56 billion

Table 8: MBBG banks, failed and survivor group medians for the variables found statistically significant^(a)

	Survivors	Failures	MBBG
<i>Variables found statistically significant in Regression 2 (1991 Q2)</i>			
LG91	10.8	2.1	1.4
NII	81.3	89.3	59.4
STED	1.0	1.9	-43.2
LEV	443.8	367.4	1351.0
PROF	0.7	0.0	0.4
<i>Variables found statistically significant in Regression 4 (1990 Q2 and earlier)</i>			
L88	14.1	28.8	22.4
SIZE ^(b)	46.5	15.0	56041.4

Sources: Bank of England and BBA.

(a) Includes some estimates for MBBG where information is unavailable.

(b) In this table figures for size variable (SIZE) are in £ millions, but elsewhere in this article it is constructed as explained in Box 1.

²⁴: This cut-off point was selected because it minimises the sum of Type I and Type II errors.

relative to the small survivor and failure banks' medians of £46.5 million and £15.0 million, respectively. The main British banks also had far higher leverage, lower dependence on net interest income (reflecting the wider range of business activities), and appear far less liquid (reflecting retail deposits at call or short notice). There does not appear to be much difference in their loan growth during the year to 1991 Q2. The larger banks' return on assets is half way between those of the small banks that subsequently went on to fail and those of the survivors.

Therefore, the characteristics of the small and medium-sized banks that failed in the early 1990s, distinguishing them from other UK banks, including the large ones, were that they tended to be very small, experienced rapid growth in the previous boom and tended to exhibit low profits, low leverage, low liquidity, and a high dependence on net interest income.

Conclusion

It is important to distil lessons from the crisis that beset the UK's small and medium-sized banking sector in the early 1990s. An informal characterisation of those small banks experiencing problems was that they had expanded too rapidly, had badly concentrated loan exposures (particularly to the property sector), and were overdependent on fragile sources of wholesale market funding.

Some of the lessons are, therefore, about the importance to financial stability of the monetary authorities providing a stable macro-economic environment. Others – those addressed in the research summarised here – concern the value of examining developments in subsectors of the banking industry, rather than just looking at firms atomistically. It is hard to find robust relationships between characteristics of banks' business, balance sheets and income and their subsequent failure. Moreover, information on the characteristics of smaller banks is limited. In particular, the unavailability of data on exposures to the property sector is a drawback that affected the research. Nevertheless, in this particular episode it seems that a high dependence on net interest income, low profitability, low leverage, low short-term assets relative to liabilities and low loan growth were good *short-term* leading indicators of failure. Most of these indicators show that the banks that went on to fail were already weak by mid-1991, and so an early-warning system based on them would not obviously have contributed to preventing the crisis. Going back further in time, rapid loan growth in the previous boom was found to be a good *longer-term* indicator of failure. Unlike the survivors, banks that subsequently failed exhibited a particularly pronounced boom and bust cycle in lending growth. That is, then, something to look out for – a familiar lesson, but important nonetheless.

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