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Did U.S. Bank Supervisors Get Tougher during the Credit Crunch? Did They Get Easier during the Banking Boom? Did It Matter to Bank Lending?

Allen N. Berger, Margaret K. Kyle,
and Joseph M. Scalise

9.1 Introduction

The main goals of bank supervision are generally to act as a delegated monitor on behalf of insured depositors or other stakeholders, to protect the safety and soundness of the financial system, and to counteract the moral hazard incentives created by the government safety net. However, changes in supervisory policy also may have significant effects on macroeconomic or regional economic health if banks respond by altering their lending behavior. These additional effects may be intended or unintended. For example, supervisors may intend for some risky institutions to reduce their lending. However, if too many institutions reduce their supplies of credit simultaneously, this may create an unintended credit crunch or recession. Alternatively, supervisors may try to stimulate lending through supervisory easing. We discuss below some reasons to suspect that supervisory changes over the last decade or so may have had significant effects on the overall lending of the U.S. banking industry.

The purpose of this research is to investigate this possibility by testing

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three hypotheses about whether supervisors changed their policies and whether these policy changes affected bank lending behavior:

Hypothesis 1: U.S. bank supervisors got tougher on banks during the credit crunch period of 1989–92, treating banks of a given financial condition more harshly than in previous years.

Hypothesis 2: U.S. bank supervisors got easier on banks during the boom period of 1993–98, treating banks of a given financial condition less harshly than in prior periods.

Hypothesis 3: Changes in supervisory toughness, if they did occur, changed bank lending behavior in the predicted directions.

We test these hypotheses using information on the supervisory process, confidential data on classified assets and CAMEL ratings from bank examinations, bank balance sheet and income data, and other variables for the condition of the bank, its state, and its region over the period 1986–98.

Although we test these hypotheses separately, they are all intertwined in the overall question of the effects of changes in supervision. Under the first two hypotheses, there are significant changes in supervisory policy, and under the third hypothesis, these changes had a significant effect on bank lending. If these hypotheses are true, they may help explain part of the observed wide swings in bank lending to business during the 1990s, and may imply a larger role for financial supervision in the performance of the economy than was previously thought.

To put these issues into context, the period around 1989–92 is often referred to as a credit crunch in the United States, in which commercial banks substantially reduced their lending to business customers, although some researchers choose slightly different dates for the credit crunch period. From 1989 to 1992, domestic commercial and industrial (C&I) loans held by U.S. banks fell by about 23 percent in real terms. This decline may have been particularly difficult for bank-dependent small and medium-sized businesses, which often have few alternatives for external finance. Rough estimates suggest declines in business loans to borrowers with bank credit less than $1 million on the order of 38 percent (Berger, Kashyap, and Scalise 1995). Surveys of small business owners also suggest that it was more difficult for these firms to obtain credit during this time (e.g., Dunkelberg and Dennis 1992; Avery, Bostic, and Samolyk 1998). As discussed in the literature review in section 9.4, a number of hypotheses for this decline in bank credit have been tested, but very few of the tests used supervisory data.

An increase in supervisory toughness could explain a reduction in lending as follows. An unfavorable examination rating may be burdensome to a bank because supervisors may require poorly rated institutions to take costly actions to improve their condition (e.g., raising additional equity

capital), or because poorly rated banks may be prohibited from engaging in some profitable activities by prompt corrective action rules or supervisory discretion. Banks may try to reverse the supervisory burdens of an unfavorable rating by reducing their perceived risk, and one way to do so is to reduce lending.

This explanation may be broader than it first appears because it may incorporate some of the changes in capital requirements and other regulatory changes during the credit crunch period. To the extent that these regulatory changes were enforced through the supervisory process by assigning worse CAMEL ratings for the same risk-based capital ratios, leverage capital ratios, and other financial ratios, they may be captured by our tests.

In addition, more classified assets or more serious classifications from an unfavorable examination may force a bank to shift funds from equity to its allocation for loan and lease losses (ALLL). Because equity counts in full as Tier 1 equity under risk-based capital guidelines and ALLL counts only as Tier 2 capital up to 1.25 percent of risk-weighted assets, the shift may directly reduce regulatory capital and require the bank to reduce lending or shrink to comply with capital regulations.

There may also have been a reduction in supervisory toughness during the banking boom period of 1993–1998, consistent with hypothesis 2. In 1993, the main federal supervisors of banks and thrifts (Office of the Comptroller of the Currency [OCC], Federal Deposit Insurance Corporation [FDIC], Federal Reserve Board [FRB], and Office of Thrift Supervision [OTS]) formally recognized a problem of credit availability and began a joint program directed at dealing with this problem. The program focused on five areas in which agencies would take actions to alleviate institutions' apparent reluctance to lend. The program (a) removed impediments to lending to small- and medium-sized businesses, (b) reduced appraisal requirements for real estate lending, (c) eased the appeals of examination decisions, (d) streamlined examination processes and procedures, and (e) reduced paperwork and regulatory burden associated with the supervisory process (Interagency Policy Statement on Credit Availability, 10 March 1993). As a specific example of the implementation of this program, banks that were well or adequately capitalized with satisfactory CAMEL ratings of 1 or 2 (most banks) were allowed to make and carry some loans to small- and medium-sized businesses (loans to borrowers with bank credit less than $900,000) with only minimal documentation, exempt from examiner criticism for doing so up to some limits (e.g., up to 20 percent of the bank's capital). Beyond these limits and for institutions not qualifying because of insufficient capital or CAMEL ratings, deviations from standard documentation could be made without examiner criticism for loans to some customers with past experience with the bank (Interagency Policy Statement on Credit Availability, 1993). This policy may be interpreted as an easing of supervision that may increase lending to

relationship-type small and medium-sized business borrowers. In 1993, bank Call Report forms were also amended to begin collecting data each June on small business loans.

From 1993 through the end of our sample in 1998, lending by the U.S. banking industry increased substantially, and the industry enjoyed record profitability. Total domestic C&I loans rose by about 50 percent in real dollars, more than recovering from its 23 percent drop during the credit crunch period. However, small business loans may not have recovered quite as well, with business loans to borrowers with bank credit less than $1 million (as collected on the June Call Reports) rising only about 14 percent in real terms, and falling as a percentage of bank gross total assets from about 4.4 percent to about 3.8 percent.[1]

A number of hypotheses for the improvements in bank profitability during the 1993–98 boom period have been advanced, including favorable macroeconomic conditions, exercise of market power in pricing, a shift toward higher risk–higher expected return investments, and improvements in the quality of banking services (Berger et al. 2000; Berger and Mester 2001). However, little attention has been paid to the possible role of changes in the supervisory process on bank lending behavior. The increase in lending may have occurred in part because of the supervisors' joint program or because supervisors became easier in their assessments in other ways. If banks were assigned more favorable CAMEL examination ratings and lower classified assets for a given financial condition, this may have encouraged banks to increase their lending. To our knowledge, hypotheses 2 (decline in toughness during the boom) and 3 (it mattered to bank lending) have not previously been tested using data from the boom period.

To test for changes in supervisory toughness (hypotheses 1 and 2), we control for bank financial condition and other information that might be used by supervisors. We run weighted least squares regression equations for classified assets and ordered logit equations for CAMEL ratings, and test whether supervisors changed their classified assets or assigned different CAMEL ratings during the credit crunch and boom periods, controlling for the bank's financial condition and economic environment.

Our econometric models mimic as closely as possible the information used in the supervisory process, including the levels, trends, and peer group percentile ranks of all the key balance sheet and income variables specified in the off-site and on-site supervisory procedures. It is important to include these variables, because if any important items used by supervisors in setting the ratings are excluded, the test results may be biased. For

1. These numbers may slightly overstate the growth in small business lending. Although we are able to deflate the dollar values of loans to put them in real terms, the cutoff of bank credit less than $1 million remains in nominal terms on the Call Report form.

example, if a key balance sheet variable that worsened during the credit crunch period were excluded from the analysis, this may give a false reading of a toughening of supervisory treatment, since the rating may have changed because of the excluded variable rather than a change in supervisory toughness.

To test whether any changes in supervisory toughness affected bank lending behavior (hypothesis 3), we run ordinary least squares regression equations for changes in the proportions of bank assets invested in different types of loans and test whether these were affected by changes in classified assets and CAMEL ratings. We also include dependent variables for other changes in bank risk to determine whether any changes in supervisory toughness may have affected bank risk taking in other ways.

By way of preview, the data provide some statistically significant support for all three hypotheses, as well as supporting the argument that supervisory assessments affect bank risk-taking behavior. However, our evaluation of economic significance suggests that all of these effects are likely to be quite small. The data suggest that changes in supervisory toughness likely do not explain much of the dramatic changes in overall bank lending over the last decade or so.

Section 9.2 describes the supervisory process, including descriptions of the classified assets and CAMEL ratings, and the off-site and on-site procedures used to arrive at these assessments. Section 9.3 looks at the raw data from bank examinations, illustrating how supervisory ratings have changed over time, and pointing out some sample selection issues. Section 9.4 briefly reviews the literature on the credit crunch and other prior research uses of supervisory data. Section 9.5 presents the data and methodology employed, section 9.6 contains results and their implications, and section 9.7 concludes.

9.2 The Supervisory Process

Current supervisory practice based on the FDIC Improvement Act of 1991 (FDICIA) requires that banks be examined at least once every twelve months for most banks or at least every eighteen months for some small banks in good condition, although prior practice often resulted in significantly lower frequency (Gilbert 1993, 1994). Examination frequency is generally higher for troubled banks—those that are perceived to be in poor condition based on off-site monitoring of their balance sheet ratios, past examination ratings, and so on. Supervisors also speed up the schedules when there are indications of fraud, embezzlement, or other criminal activity. Most examinations are of the full-scope type—an in-depth evaluation of all areas of a bank's operation. A limited-scope exam is less intensive but reviews the same areas, whereas a targeted exam focuses on one or two areas intensively. In most cases, banks receive advance notification

so that they can have the necessary documents and information prepared.

After the on-site examination, supervisory assessments in the form of CAMEL ratings and classified assets are determined. However, much of the information used in the evaluation of the bank is gathered in advance off-site. In this section, we first describe the CAMEL ratings and classified assets, and then discuss the off-site tasks and on-site procedures.

9.2.1 CAMEL Ratings and Classified Assets

Based on their assessments of information collected both off-site and on-site, supervisors assign each bank a composite CAMEL rating, which reflects their overall assessment of bank condition. CAMEL ratings are integers ranging from 1 to 5, with 1 being the strongest condition and 5 being the weakest. Most banks have ratings of 1 or 2 and are considered to be in satisfactory condition. Banks with ratings of 3, 4, or 5 are generally encouraged or required to take actions to improve their conditions. Table 9.1 gives more complete descriptions of the composite ratings. The CAMEL ratings are confidential, although some of the research reviewed below suggests that the information in ratings changes becomes incorporated into market prices.

For most of our sample, the composite CAMEL rating was based on five components of supervisory concern—capital adequacy (C), asset quality (A), management (M), earnings (E), and liquidity (L)—each of which also receives a rating on the 1 to 5 scale. Since 1997 supervisors have added a component for sensitivity to market risk (S), and altered the acronym to CAMELS. Although we do use the CAMELS rating for the end of our data set, we continue to refer to the CAMEL acronym throughout for convenience. Table 9.2 gives some of the details about these components.

The other main assessment made by supervisors is the determination of classified assets. In order from highest quality to lowest quality, commercial and industrial (C&I) and commercial real estate (CRE) loans are rated as pass, special mention, substandard, doubtful, or loss. Assets in the three most severe categories are often referred to as classified assets, although this term is sometimes meant to include the special mention category. Table 9.3 gives definitions of the special mention, substandard, doubtful, and loss categories.

Examiners use the following formula to determine the minimum required level of the allocation for loan and lease losses (ALLL), which is based on probability of default for each asset classification:

$$\begin{aligned} &15\% * \text{substandard assets} + 50\% * \text{doubtful assets} + 100\% * \text{loss assets} \\ &\quad + (\text{discretionary percentage}) * (\text{pass} + \text{special mention}), \end{aligned}$$

where the discretionary percentage the bank is required to hold against nonclassified assets is usually about 1 to 2 percent. If this minimum level exceeds the bank's actual reserve, the bank must add to its reserve from

Table 9.1 Descriptions of Composite CAMEL Ratings

Rating	Description
1	Institutions in this group are basically sound in every respect; any critical findings or comments are of a minor nature and can be handled in a routine manner. Such institutions are resistant to external economic and financial disturbances and more capable of withstanding the vagaries of business conditions than institutions with lower ratings. As a result, such institutions give no cause for supervisory concern.
2	Institutions in this group are also fundamentally sound, but may reflect modest weaknesses correctable in the normal course of business. The nature and severity of deficiencies, however, are not considered material and, therefore, such institutions are stable and also able to withstand business fluctuations quite well. While areas of weakness could develop into conditions of greater concern, the supervisory response is limited to the extent that minor adjustments are resolved in the normal course of business, and operations continue satisfactorily.
3	Institutions in this category exhibit a combination of financial, operational, or compliance weaknesses ranging from moderately severe to unsatisfactory. When weaknesses relate to financial condition, such institutions may be vulnerable to the onset of adverse business conditions and could easily deteriorate if concerted action is not effective in correcting the areas of weakness. Institutions which are in significant noncompliance with laws and regulations may also be accorded this rating. Generally, these institutions give more cause for supervisory concern and require more than normal supervision to address deficiencies. Overall strength and financial capacity, however, are still such as to make failure only a remote possibility.
4	Institutions in this group have an immoderate volume of serious financial weaknesses or a combination of other conditions that are unsatisfactory. Major and serious problems or unsafe and unsound conditions may exist which are not being satisfactorily addressed or resolved. Unless effective action is taken to correct these conditions, they could reasonably develop into a situation that could impair future viability, constitute a threat to the interests of depositors, and/or pose a potential for disbursement of funds by the insuring agency. A higher potential for failure is present but is not yet imminent or pronounced. Institutions in this category require close supervisory attention and financial surveillance and a definitive plan for corrective action.
5	This category is reserved for institutions with an extremely high immediate or near term probability of failure. The volume and severity of weaknesses or unsafe and unsound conditions are so critical as to require urgent aid from stockholders or other public or private sources of financial assistance. In the absence of urgent and decisive corrective measures, these situations will likely require liquidation and the payoff of depositors, disbursement of insurance funds to insured depositors, or some form of emergency assistance, merger or qcquisition.

Source: Commercial Bank Examination Manual, A.5020.1, pp. 3–4: Uniform Financial Institutions Rating System, effective 3/84.

Table 9.2 Components of the CAMEL Ratings

Component	Description
Capital adequacy	A bank's Tier 1, total capital, and leverage ratios in relation to its peer group are the most important factors in assigning a preliminary rating. Peer groups are based on bank asset size, number of offices, and location in a metropolitan or nonmetropolitan area. More capital is required for banks with deficiencies in any other area of the examination, particularly in asset quality. Examiners also pay close attention to how equity and asset growth affect the capital ratios, and look at retained earnings as a ratio of average total equity to determine whether a bank's equity growth is through retained earnings or an unsustainable outside source, and to the size of the dividend payout.
Asset quality	The asset quality rating is an indicator of future losses to the bank and affects the ratings of other areas of examination, which must be considered in light of their adequacy to absorb anticipated losses. The most important factor in the asset quality rating is the bank's weighted classified asset ratio, which is computed as (15% * substandard assets + 50% * doubtful assets + 100% * loss assets)/(Tier 1 capital + allocation for loan and lease losses). Examiners also consider the level, trend and composition of classified assets and nonaccrual and renegotiated loans, loan concentrations, lending policies, and effectiveness in monitoring past-due loans, insider loans, and the types of risks inherent in the banks on- and off-balance sheet portfolios.
Management	Management is evaluated on a number of criteria, including compliance with applicable laws and regulations, whether there is a comprehensive internal or external review audit, internal controls to safeguard bank assets, and systems for timely and accurate information. Examiners also consider the other components of the CAMEL rating, shareholder return, and the extent to which the bank is serving all sectors of its community.
Earnings	Earnings are assessed for ability to absorb future losses, so this rating is affected by asset quality, a bank's level, trend and relation to peer of net interest income, noninterest income, overhead expense and provision for loan and lease losses, extraordinary items, additional required provision for loan and lease losses or other nonrecurring items, and dividend payouts.
Liquidity	The liquidity rating is a determination of a bank's ease in obtaining money cheaply and quickly, and a bank's management of interest rate risk. Considerations include the bank's loan commitments and standby letters of credit, the presence of an "unstable core" of funding, access to capital markets, the ratios of federal funds purchased and brokered deposits to total assets and the ratios of loans to deposits.
Sensitivity to market risk (since 1997 only)	Rating is based on, but not limited to, assessments of the sensitivity of the financial institution's earnings or the economic value of its capital to adverse changes in interest rates, foreign-exchange rates, commodity prices, or equity prices, the ability of management to identify, measure, monitor, and control exposure to market risk given the institution's size, complexity, and risk profile, the nature and complexity of interest-rate risk exposure arising from nontrading positions where appropriate, the nature and complexity of market-risk exposure arising from trading and foreign operations.

Source: Commercial Bank Examination Manual.

Table 9.3 Classified Asset Categories

Component	Description
Special mention	This category includes loans that are potential problems, but that are currently of adequate quality. Loans with inadequate documentation and loans particularly vulnerable to a change in economic conditions may be classified as such. Loans to borrowers with deteriorating but still acceptable financials are another example.
Substandard	Loans in this category are judged to have a well-defined weakness that may result in losses to the bank if left uncorrected. Characteristics include significant deviations from scheduled payments, delinquency, carried-over debt, numerous extensions or renewals without statement of source of repayment, decreased borrower profitability or poor borrower cash flow.
Doubtful	Doubtful loans have problems similar to those of substandard loans, but also have a loss exposure considered severe enough to jeopardize full collection of the loan highly unlikely. However, the loan is not yet considered a loss due to the possibility of mitigating circumstances, such as a proposed merger, capital injection, or refinancing plans. A loan should not be classified as doubtful for two consecutive exams, since it is assumed the status of the loan should be resolved during the time between exams.
Loss	A loan considered uncollectible is classified a loss. Although some probability of partial recovery may exist, it is considered preferable to write off the loan in the current period. Such loans are characterized by severe delinquency.

Source: Commercial Bank Examination Manual.

equity capital. Thus, the greater the fraction of assets classified as substandard, doubtful, or loss, and the more serious the classification, the more the bank may have to shift funds from equity to ALLL. This may require the bank to reduce lending, shrink, or raise capital to comply with capital regulations.

In our empirical analysis, we use both total classified assets (substandard + doubtful + loss) and weighted classified assets (15% * substandard assets + 50% * doubtful + 100% * loss). An increase in supervisory toughness may occur when supervisors shift loans from pass or special mention to substandard, doubtful, or loss, which would raise total classified assets. Alternatively, supervisors might get tougher by shifting already-classified assets into more serious classifications, such as from substandard to doubtful or from doubtful to loss, which would raise weighted classified assets. We include both measures of classified assets in our analysis to allow for these possibilities.

9.2.2 Off-Site Supervisory Tasks

In general, one individual is named Examiner-in-Charge (EIC), and is responsible for coordinating most aspects of an exam and has a number of assistants, depending on the size and complexity of the bank. Prior to an on-site visit, examiners perform several analyses off-site. These include review of past examination reports and the correspondence file for that bank, as well as its Call Report and Uniform Bank Performance Report (UBPR). The UBPR, produced for every U.S. commercial bank by the Federal Financial Institutions Examination Council, summarizes several years of Call Report data for a bank and presents both dollar amounts and financial ratios for most areas of bank operations. The UBPR also includes information on the trends of these variables as well as the peer group average for each variable and the bank's rank within its peer group for that variable. Peer groups are based on bank asset size, number of offices, and location in a metropolitan or nonmetropolitan area. Analysis of the UBPR provides initial evaluations of the individual components of the CAMEL rating (although no preliminary rating is given for the management component), which may be changed during the on-site examination if conditions are not consistent with what was reported or expected (Commercial Bank Examination Manual, 1020.1, p. 1). Generally, the off-site monitoring is helpful in determining potential problems that examiners should scrutinize during the on-site visit, allowing on-site resources to be allocated more efficiently. Off-site monitoring is also useful for identifying troubled banks or those with indications of criminal activity to speed up the examination schedule for these institutions.

Our econometric models control for bank condition by proxying for the information used by supervisors as well as possible. This includes forming the levels, trends, and peer group percentile ranks of the key balance sheet

and income variables specified in the UBPR from the appropriate Call Report quarter. Failure to include these variables could bias our tests, because any change in classified assets or CAMEL ratings may reflect changes in the UBPR variables, rather than changes in supervisory harshness.

9.2.3 On-Site Examination Procedures

The most important aspect of the on-site examination is the evaluation of the bank's loan portfolio. This process begins with a review of the institution's loan policies, which should include a description of the bank's market, targeted customers, lending guidelines, documentation, and restrictions or requirements on loans to insiders. Examiners also read the minutes of the bank's loan committee meetings, the credit department's procedures and files regarding the acquisition of borrower financial information, and internal reports on past due or problem loans.

Examiners evaluate a certain proportion of the loan portfolio, depending on the bank's most recent composite and asset quality ratings. This proportion ranges from 40 percent for banks with composite ratings of 1 or 2 and an asset quality rating of 1, to 60 percent or more for banks with worse ratings or other areas of concern.

There are several steps in determining the loan sample. Examiners must review all C&I and CRE loans that are past due, nonaccrual, restructured, renegotiated, made to an insider, internally classified by the bank, or classified at the last exam. Large loans—loans greater than a dollar cutoff determined by the EIC to be appropriate for the bank—must also be reviewed. This set of C&I and CRE loans is considered the core group for review. To achieve the desired coverage of the portfolio (i.e., the 40 to 60 percent or more), additional loans are selected for review in a variety of ways. The dollar cutoff for large loans might be lowered; recent loans or specific loan types might be selected; or random sampling or some other technique may be applied, according to examiner discretion.

Examiners assign ratings of pass, special mention, substandard, doubtful, or loss to each loan sampled. Examiners may assign distinct classifications to different parts of a loan depending on the likelihood of collection of each particular part. Examiners may also assign split classifications, such as substandard/doubtful, in appropriate circumstances. The loan ratings are checked against the bank's own internal ratings as a check of how well bank management is monitoring its own portfolio. Installment loans, residential mortgages, and other consumer credits are classified as pass, substandard, or loss based solely on the number of days past due, not by examiner discretion.

After the examination, the final supervisory assessments are made. The composite CAMEL rating is based on all the components of supervisory

concern—capital adequacy, asset quality, management, earnings, liquidity, and (more recently for the CAMELS rating) sensitivity to market risk—and the information incorporated into the rating comes from the data gathered off-site and on-site. The composite CAMEL rating is not an unweighted mean of these components; an examiner may use personal judgment as to the importance of each component for a particular bank. However, quality of the assets in terms of likely future losses and the ability of the bank's capital to absorb these losses are usually the most important components. The composite rating is generally not supposed to be more than one rank better than the capital (C) or asset quality (A) rank.

9.3 A Look at the Raw Data from Bank Examinations

Table 9.4 shows some summary statistics from bank examinations over the entire 1986–98 period. Panel A shows the number of banks with examination data for each year, the mean ratios of total classified assets to loans and weighted classified assets to loans, the mean composite CAMEL rating, and the fractions of banks receiving composite CAMEL ratings of 1, 2, 3, 4, and 5. Panel B of table 9.4 summarizes the information for the precrunch, credit crunch, and boom periods. Figure 9.1 plots the fractions of banks with the different CAMEL ratings over time.

We include exactly one observation for each bank that was examined in each year. Because not every bank is examined in every year, the total number of banks examined in each year is fewer than the number of banks in the nation. In the relatively infrequent cases in which more than one examination was made of the same bank in the same year, we simply include the results of the final examination of the year to avoid double counting. As will be seen, changes over time in the sample of banks that were selected by supervisors to be examined are important in interpreting the data.

In some respects the raw data are consistent with expectations, and in other respects the data are quite surprising. Consistent with expectations, the supervisory assessments are unambiguously the best during the boom period. As shown in Panel A, in each of the boom period years 1993–98, the mean total classified asset ratio, mean weighted classified asset ratio, mean composite CAMEL rating, and fraction of banks receiving CAMEL ratings of 1 (the best rating) were better than the corresponding figures for each of the credit crunch years 1989–92, and better than each of the precrunch years 1986–88 as well. The data in Panel B show that on average during the boom period, the classified asset ratios were on the order of about half—and the fractions of banks assigned CAMEL ratings of 1 were on the order of about double—those in the precrunch and credit crunch periods. The figure shows a steep increase in CAMEL ratings of 1 and steep decreases in CAMEL ratings of 3, 4, and 5 beginning in 1993. These

Table 9.4 **Summary Statistics from Bank Examinations over Time**

	Number Examined	Total Classified Assets	Weighted Classified Assets	Mean CAMEL	Fraction CAMEL 1	Fraction CAMEL 2	Fraction CAMEL 3	Fraction CAMEL 4	Fraction CAMEL 5
				Panel A					
1986	6,042	0.098	0.028	2.402	0.152	0.480	0.217	0.117	0.034
1987	6,763	0.086	0.024	2.291	0.177	0.515	0.182	0.093	0.034
1988	7,729	0.082	0.022	2.257	0.188	0.521	0.170	0.089	0.033
1989	8,352	0.082	0.022	2.216	0.206	0.525	0.153	0.077	0.039
1990	8,316	0.072	0.018	2.207	0.207	0.519	0.165	0.078	0.031
1991	8,377	0.070	0.017	2.194	0.202	0.523	0.178	0.075	0.023
1992	9,040	0.063	0.015	2.089	0.215	0.566	0.149	0.056	0.014
1993	9,594	0.051	0.012	1.869	0.297	0.580	0.088	0.029	0.007
1994	8,867	0.041	0.010	1.758	0.346	0.575	0.058	0.016	0.005
1995	7,821	0.036	0.008	1.676	0.396	0.547	0.045	0.010	0.002
1996	7,273	0.033	0.008	1.609	0.445	0.509	0.037	0.007	0.001
1997	6,381	0.033	0.008	1.591	0.467	0.488	0.036	0.009	0.001
1998	5,578	0.032	0.008	1.624	0.444	0.500	0.046	0.008	0.002
				Panel B					
Precrunch period	20,534	0.088	0.024	2.311	0.174	0.507	0.187	0.098	0.034
Credit crunch period	34,085	0.072	0.018	2.175	0.208	0.534	0.161	0.071	0.026
Boom period	45,514	0.039	0.009	1.704	0.389	0.539	0.054	0.014	0.003

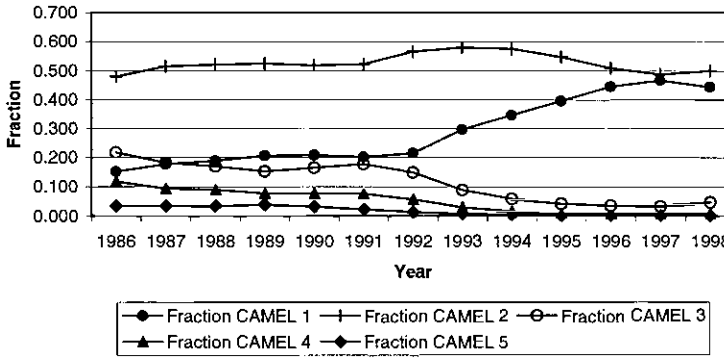

Fig. 9.1 CAMEL Distribution, 1986–98

strong improvements in supervisory assessments during the boom period may reflect the improved condition of banks, any supervisory easing that may have occurred, or a combination of the two. We try to disentangle these effects below in our multivariate empirical analysis.

Contrary to expectations, the supervisory assessments generally did not deteriorate during the credit crunch period. As is shown in Panel A, in each of the credit crunch years 1989–92, the mean total classified asset ratio, mean weighted classified asset ratio, mean composite CAMEL rating, and CAMEL 1 fraction were better than the corresponding figures for each of the precrunch years 1986–88 (although the figures for 1989 are very close to those for 1988 and round to the same three digits for the classified asset ratios). The data in Panel B show that the mean classified asset ratios, mean composite CAMEL, and CAMEL 1 fraction for the credit crunch period are all closer to the precrunch period figures than to the boom period figures, indicating a much smaller improvement in the credit crunch period than in the boom period. This slight improvement in supervisory assessments or failure to deteriorate is surprising given both the recession of the early 1990s and widespread belief that supervisors may have become tougher.[2]

At first blush it might seem unlikely that hypothesis 1 (increase in toughness) could be supported. Banking industry conditions did improve slightly during the credit crunch period in terms of capital ratios and problem loans, but it would not be expected ex ante that controls for bank condition would improve enough to offset a substantial increase in supervisory toughness. As we show next, the improvements in supervisory assessments

2. The classified assets figures may have been held down temporarily for some banks during the high bank failure years in the late 1980s and early 1990s in order to allow for orderly bank closures, because high classified assets may have reduced capital to below closure levels for too many banks at the same time.

during the credit crunch period may largely be an artifact of changes in the selection of banks that were examined.

Table 9.5 illustrates the sample selection issue by comparing examined banks with the banking industry as a whole over time. As is shown in Panel A, the fraction of banks with examination data rises each year from 1986 to 1993 and then falls each year thereafter to 1998. The changes are quite dramatic: The percentage of banks with recorded examinations nearly doubles from 42.6 percent to 85.4 percent, and then drops to 62.3 percent. As is shown in Panel B of table 9.5, only 49.4 percent of banks have examination data on average during the precrunch years, versus 69.5 percent during the credit crunch years and 75.4 percent during the boom years. These dramatic changes in the fraction of banks examined may in part reflect changes in supervisory policy, changes in regulation (such as FDICIA, which mandates examinations every twelve or eighteen months), or changes in bank condition.

Importantly, a change in the fraction of banks examined may change the quality pool of the banks examined relative to the industry as a whole. As discussed above, banks that are perceived to be in worse condition based on off-site monitoring of their balance sheet ratios, past examination ratings, and so on are more likely to be examined in a given year. As a consequence, if the fraction of banks examined rises over time, one may expect that the average quality of the pool of banks that are examined will rise relative to the industry as a whole, as better-quality institutions are added to the examination pool. That is, there may be no improvement or even a deterioration in supervisory assessments on average relative to prior examinations, but the addition of better banks to the examination pool makes it appear from the raw data that assessments have improved. This may help explain why the classified asset ratios and CAMEL ratings of examined banks improved during the credit crunch period.

Additional data in table 9.5 are designed to examine this issue further. The table shows the mean total capital ratio and mean nonperforming loan ratio calculated from the Call Report for the year prior to the examinations versus these same ratios for the industry as a whole. For the total capital ratio, the difference between the mean for examined banks and the mean for the industry narrows considerably during the credit crunch period. As is shown in Panel A, the capital ratio for examined banks is 2.4 percentage points lower on average than the industry as of 1986, and this difference narrowed to below 1 percentage point by 1990. As is shown in Panel B, the average difference fell by about one-half from 1.9 percentage points during the precrunch years to 0.9 percentage points during the credit crunch years, consistent with the argument that examinations during the credit crunch period tended to cover a higher-quality cut of the industry than did examinations during the precrunch period, which may explain the slightly improved supervisory assessments. Similar results hold for

Table 9.5 **Sample Selection—Examined Banks versus the Industry over Time**

	Number of Banks			Total Capital Ratio			Nonperforming Loan Ratio		
	Examined	Industry	Fraction Examined	Examined	Industry	Difference	Examined	Industry	Difference
				Panel A					
1986	6,042	14,197	0.426	0.154	0.178	−0.024	0.061	0.057	0.004
1987	6,763	13,956	0.485	0.157	0.177	−0.019	0.057	0.057	0.001
1988	7,729	13,443	0.575	0.170	0.185	−0.015	0.050	0.049	0.000
1989	8,352	12,863	0.649	0.173	0.185	−0.012	0.044	0.044	0.001
1990	8,316	12,447	0.668	0.178	0.186	−0.008	0.043	0.042	0.000
1991	8,377	12,088	0.693	0.169	0.177	−0.008	0.043	0.043	0.001
1992	9,040	11,677	0.774	0.169	0.178	−0.009	0.042	0.042	0.000
1993	9,594	11,232	0.854	0.179	0.186	−0.007	0.033	0.034	−0.001
1994	8,867	10,778	0.823	0.183	0.191	−0.008	0.029	0.029	0.000
1995	7,821	10,266	0.762	0.184	0.191	−0.007	0.026	0.025	0.000
1996	7,273	9,760	0.745	0.182	0.193	−0.011	0.027	0.027	0.000
1997	6,381	9,346	0.683	0.131	0.137	−0.005	0.028	0.028	0.000
1998	5,578	8,954	0.623	0.173	0.192	−0.018	0.026	0.026	0.001
				Panel B					
Precrunch period	20,534	41,596	0.494	0.161	0.180	−0.019	0.055	0.054	0.001
Credit crunch period	34,085	49,075	0.695	0.172	0.181	−0.009	0.043	0.043	−0.000
Boom period	45,514	60,336	0.754	0.174	0.182	−0.008	0.028	0.028	0.000

other capital ratios (not shown in the table).[3] Perhaps surprisingly, there is much less support for this argument from the nonperforming loan data; examined banks had only slightly higher nonperforming loan ratios than the industry as a whole during the precrunch period, and the difference disappeared during the credit crunch period.[4] Thus, the examination pool seems to have improved substantially relative to the industry in terms of capital, but much less so in terms of nonperforming loans.

Table 9.6 rearranges the raw data in a way that should at least partially offset the changes in sample selection over time. For each examination, we show the changes in composite CAMEL ratings, total classified asset ratio, and weighted classified asset ratio since the previous examination. If a bank did not have an examination in the year or if there are no prior examinations available, the data are excluded from this table (this exclusion is not made in our empirical analysis below). This procedure should partially offset the sample selection problem because each examination is paired with exactly one prior examination of the same bank. As is shown, there are very few observations at the start of the sample because we have data on only a very small number of examinations prior to the start of the precrunch period in 1986. The data are roughly consistent with the expectations that supervisory assessments deteriorated during the credit crunch period and improved during the boom period. As is shown in Panel A, CAMEL downgrades exceed upgrades in the first three years of the credit crunch period from 1989 through 1991, and CAMEL upgrades exceed downgrades in every year from 1992 through 1997 (upgrades, downgrades, and constant CAMEL ratings fractions sum to 1 by construction). Similarly, the percentage of examinations with increases in classified assets is relatively high in 1989 through 1991 and then falls off sharply in the immediately following years (classified asset ratio decreases and increases fractions sum to 1 by construction). The summary data in Panel B confirm this. During the credit crunch period, composite CAMEL downgrades slightly exceed upgrades, whereas upgrades slightly exceed downgrades during the precrunch years and upgrades greatly exceed downgrades during the boom years. Similarly, the fractions of examinations with increases

3. The mean Tier 1 and leverage capital ratios for examined banks improved from 0.149 and 0.082, respectively, during the precrunch years to 0.160 and 0.087 during the credit crunch years. For the industry, the corresponding ratios increased from 0.168 and 0.086, respectively, to 0.170 and 0.089. Again, the percentage point difference in capital ratios between examined banks and the industry as a whole dropped by about one-half in the credit crunch period.

4. A potential problem with the nonperforming loan data is that the definition may have changed slightly over time due to changes in supervisory policy in which loans for which no repayments had been missed were recorded as nonperforming. Similarly, there may have been a change in the reported data for C&I and real estate loans, as supervisors became more vigilant in requiring that commercial loans secured by real estate be reported as real estate loans.

Table 9.6 **Changes between Examinations in CAMEL Ratings and Classified Asset Ratios**

	Number of Banks	CAMEL			Total Classified Asset Ratio		Weighted Classified Asset Ratio	
		Upgrades	Downgrades	Constant	Decreases	Increases	Decreases	Increases
				Panel A				
1986	472	0.131	0.119	0.750	0.523	0.477	0.511	0.489
1987	3,816	0.187	0.155	0.658	0.583	0.417	0.591	0.409
1988	5,426	0.161	0.168	0.672	0.576	0.424	0.586	0.414
1989	7,258	0.157	0.158	0.685	0.554	0.446	0.563	0.437
1990	7,905	0.127	0.175	0.698	0.526	0.474	0.533	0.467
1991	8,072	0.135	0.171	0.694	0.513	0.487	0.522	0.478
1992	8,729	0.182	0.113	0.706	0.557	0.443	0.564	0.436
1993	9,364	0.230	0.060	0.710	0.675	0.325	0.678	0.322
1994	8,777	0.182	0.063	0.755	0.701	0.299	0.691	0.309
1995	7,754	0.164	0.067	0.769	0.645	0.355	0.643	0.357
1996	7,194	0.149	0.066	0.784	0.589	0.411	0.575	0.425
1997	6,277	0.127	0.079	0.794	0.576	0.424	0.568	0.432
1998	5,422	0.095	0.100	0.805	0.557	0.443	0.553	0.447
				Panel B				
Precrunch period	9,714	0.170	0.160	0.670	0.576	0.424	0.584	0.416
Credit crunch period	31,964	0.151	0.153	0.696	0.538	0.462	0.545	0.455
Boom period	44,788	0.165	0.070	0.764	0.633	0.367	0.627	0.373

in the classified asset ratios are greatest during the credit crunch years, whereas the fractions with decreases in these ratios are highest during the boom years. The data in table 9.6 suggest that supervisory assessments began to be somewhat harsher just before the onset of the credit crunch and began to be somewhat less harsh just before the onset of the banking boom. These data are also consistent with our arguments about sample selection. It may be that on average banks of a given quality received worse supervisory assessments in the credit crunch period than in the precrunch period, but that the average assessments improved because the increased examination frequency resulted in a better-quality cut of the industry being examined.

There are several other sample selection issues as well. There may be some missing observations—examinations that took place but were not on the electronic files—particularly at the beginning of our data set. Prior to 1986, the files are very incomplete, making lagged examination data an issue. Some of the data may also be missing for 1986 or other early years. We also may be missing some examinations from 1998 that were not finalized at the time we extracted the data set in the latter part of 1999. In addition, some banks drop out of the sample due to mergers and failures, and others enter the sample through the creation of new charters.

We deal with these sample selection issues in the empirical analysis in several ways. First, we include a large number of controls for bank quality, which may help compensate for changes over time in the quality of the cut of the industry that is examined. Second, we include observations in the regressions even when data for lagged supervisory assessments are missing, and include a dummy variable flagging these observations to account for the average difference of these banks from other banks. This increases representation for new entrants and for banks near the beginning of the data set when examination data are sparse. Third, we try a Heckman correction for sample selection bias, although we acknowledge identification problems with this procedure in our case.

9.4 Literature Review

In this section, we first briefly review the literature on the causes for the decline in bank lending during the credit crunch period. Very little of this research has used supervisory data, despite the widespread belief that an increase in supervisory toughness may be responsible for the reduced lending. We then review prior research that has used the supervisory data to test the timeliness and accuracy of supervisory assessments. To our knowledge there have been no prior tests of whether a decline in supervisory toughness may have contributed to changes in bank lending behavior during the banking boom.

9.4.1 Prior Research on the Causes of the Credit Crunch

A number of hypotheses of the decline in bank credit to business during the credit crunch period have been tested. A few studies have explicitly investigated forms of hypotheses 1 and 3 (i.e., that supervisors got tougher and that this toughness reduced business lending). In the study closest in approach to the current paper, Bizer (1993) ran ordered logit equations for composite CAMEL ratings on a limited number of Call Report items, regional dummies, and primary supervisor dummies. He found that the model predicted tougher CAMEL ratings during the quarters of the credit crunch period than in a single-quarter control period of 1988:4. He also regressed lending on lagged CAMEL ratings and a few control variables and found that worse CAMEL ratings were associated with reduced lending.

Although this was an excellent early attempt, in our opinion a more comprehensive approach is needed. As we discussed earlier, it is important to control for as much of the information used in the supervisory process at the time of the ratings assignment as possible, including the levels, trends, and peer group percentile ranks of the key balance sheet and income variables explicitly used to form the CAMEL ratings. Bizer's CAMEL equations include very few of the specified levels, and none of the trends or peer group percentile ranks. For example, he excluded the risk-based capital ratios, so the effects of enforcing these regulatory requirements through the supervisory process may not be captured. Similar criticisms also apply to the lending regressions, which do not control for problem loan categories. As is indicated later, our strongest results for the lending equations are generated by changes in classified assets, which are excluded from Bizer's analysis. We also include much more information about the condition of banks in the same state and use a three-year pre-crunch base period in place of a single quarter.

Another study that used supervisory assessments was Peek and Rosengren (1995a). These authors tested a form of hypothesis 3 by evaluating the effects of supervisory enforcement actions in New England during the credit crunch period. They found that banks under enforcement actions reduced lending more than other banks in the same region with the same capital-to-asset ratios, supporting the hypothesis that supervisory actions contributed to the reduction in lending. Again, the conclusions may be somewhat limited because there were very few control variables specified for bank condition, making it difficult to disentangle supervisory actions from the effects of the condition of the banks' portfolios.

A number of studies tested whether implementation of tougher capital standards contributed to the decline in U.S. bank lending to business during the credit crunch period. Some tested the effects of implementation of the Basel Accord risk-based capital standards (e.g., Haubrich and Wachtel 1993; Berger and Udell 1994; Hancock and Wilcox 1994a; Wagster 1999).

Others tested whether supervisors or regulators implemented higher explicit or implicit regulatory capital standards based on leverage ratios (e.g., Berger and Udell 1994; Peek and Rosengren 1994, 1995b; Hancock and Wilcox 1994a; Hancock, Laing, and Wilcox 1995; Shrieves and Dahl 1995). Although there is not full consensus, the empirical results generally do not support risk-based capital as a major contributor to the lending slowdown, but do provide some support for the effects of tougher explicit or implicit leverage capital requirements.

As noted previously, to the extent that capital requirements or other regulatory changes are enforced through the supervisory process by assigning worse CAMEL ratings for the same capital ratio and other balance sheet and income ratios, they may be captured in our tests of supervisory toughness below. That is, if supervisors enforce higher capital ratios, then there should be a worse CAMEL rating assigned for the same capital ratio, all else equal. In our empirical analysis, we include the Tier 1 and total risk-based capital ratios as well as the leverage ratio to capture these effects, although identifying these individual capital effects is quite difficult and is not a goal of this paper.

A notable advantage of our tests is that by including actual supervisory assessments, we can better distinguish between supervisory-induced changes in bank behavior and voluntary changes in bank behavior. It is possible that a reduction in lending during the credit crunch period by banks with capital below the regulatory minimums represents a voluntary retrenchment of risks by banks, rather than the effects of changes in regulation or supervision. Similarly, some studies found that during the credit crunch period, banks facing greater portfolio risks—such as those with more nonperforming loans or those in nations with more banking system risk—also tended to cut back their lending more than other banks (e.g., Berger and Udell 1994; Wagster 1999). Without supervisory information, it is not possible to distinguish whether this represents supervisory or voluntary reactions to risk. Our tests, which control for measures of portfolio risks, may help distinguish among these alternatives.

Other studies tested whether demand or supply factors other than regulatory/supervisory changes contributed significantly to the change in lending during the credit crunch period. Tests have been performed of the effects of the depletion of bank capital from loan loss experiences of the late 1980s (e.g., Peek and Rosengren 1994, 1995b; Hancock and Wilcox 1994a, 1997, 1998), potential choices of lower risk profiles by bank managers (e.g., Hancock and Wilcox 1993, 1994b), reduced loan demand because of macroeconomic or regional recessions (e.g., Bernanke and Lown 1991; Hancock and Wilcox 1993, 1997), or a secular decline in the demand for bank loans because of the growth of alternative sources of credit (e.g., Berger and Udell 1994). All of these hypotheses were supported to at least some degree.

9.4.2 Prior Research on Supervisory Timeliness and Accuracy

Previous research on bank examinations or bank holding company (BHC) inspections has usually focused on either the timeliness or accuracy of supervisory assessments of banking organization condition measured relative to market assessments. Studies of timeliness generally tested whether changes in supervisory assessments (changes in CAMEL; changes in BOPEC, the corresponding rating for bank holding companies; or identification of problem banks) occurred before or after changes in market assessments of banking problems (equity or debt price changes, changes in bond ratings, or changes in share ownership by institutions or insiders).

Most of the early studies of timeliness found that supervisors did not have information in a more timely fashion than market participants. Pettway (1980) performed even studies for six large banks that were placed on the problem bank list during 1972–76 and found significantly negative cumulative abnormal stock returns before the examination that first recognized the banks' problems, suggesting a timeliness advantage for investors over supervisors. Hirschhorn (1987) investigated whether CAMEL rating changes predate stock price changes, using data on examination ratings of the lead banks of the fifteen largest BHCs during 1978–87. He found that CAMEL ratings were approximately contemporaneously correlated with abnormal returns, suggesting that supervisors generally had little if any economically significant informational advantage over equity market participants. Cargill (1989) examined cross-sectional variation in the rates on large certificates of deposit for fifty-eight large banks during 1984–86. He found that CAMEL ratings added no significant explanatory power beyond Call Report financial ratios, again implying that supervisors did not have substantial information prior to market participants.

In contrast, more recent studies generally found that supervisors did have some valuable information on a more timely basis than market participants. Simons and Cross (1991) identified twenty-two BHCs whose lead banks had their composite CAMEL rating lowered to the problem ratings of 4 or 5 during 1981–87. They found that the company's weekly abnormal stock returns for the year preceding the downgrade were equally likely to be positive or negative, and that few news stories chronicled the firms' problems, suggesting that supervisors may have known about problems before market participants. Berger and Davies (1998) used event study methodology to identify abnormal BHC stock returns after 390 lead bank examinations during 1985–89. They separated out the three types of information that may be generated by the examination: private information about bank condition, certification information about the quality of audited financial statements, and supervisory discipline information about whether the bank may have greater or fewer restrictions placed on it. They

found that the only type of private information that was transferred to the market was unfavorable private information about bank condition, suggesting that supervisors force the release of unfavorable information. Jordan (1999) found results consistent with these when investigating the effects of examinations of banks in thirty-five BHCs in New England over the period 1988:1–1990:3. He found statistically significant negative abnormal stock returns (below the mean returns of these thirty-five BHCs) in the quarter after CAMEL downgrades involving at least one-third of the BHCs banking assets, but no significant change in market prices for examinations overall. DeYoung et al. (forthcoming) investigated whether national bank examiners' private information significantly predicted changes in the risk premiums on large BHCs subordinated debentures during 1989–95. They found that debenture yield spreads changed after the examination information, suggesting that examiners uncover relevant information before the market. Consistent with Berger and Davies (1998), this predictive effect occurred only for negative supervisory assessments. Flannery and Houston (1999) evaluated the correspondence between market and book valuations for a sample of BHCs in the fourth quarters of 1988 and 1990 and found that investors evaluated financial information differently when the BHC had recently received an on-site inspection, particularly in the relatively normal 1988 period. Inspected BHCs showed a closer correspondence between market and book values, consistent with the hypothesis that investors view examiners as credibly certifying of the financial statements' accuracy. Finally, Berger, Davies, and Flannery (2000) used quarterly data from inspections of 184 large BHCs over the period 1989:4–1992:2 and found that BHC supervisors and bond rating agencies both have some timely prior information that is useful to the other. However, supervisory assessments and equity market indicators were not strongly related to each other, presumably because of differences in incentives regarding risks and expected returns.[5,6]

Studies of supervisory accuracy generally tested whether changes in supervisory assessments added to the predictions of changes in bank condition (e.g., bank failure, book-value insolvency, changes in nonperforming

5. Consistent with this conclusion, Hall, Meyer, and Vaughan (1997) found that supervisors and shareholders responded differently to balance sheet measures of BHC condition.

6. Studies of bank "early warning" systems (e.g., Sinkey 1978; Whalen and Thompson 1988; O'Keefe and Dahl 1997) tested how well supervisory ratings can be predicted from publicly available information, generally Call Report data. These may be viewed as tests of whether supervisors have information not already in the publicly available data, although this was not the main purpose. These studies generally found that the supervisory ratings were far from perfectly predictable from Call Report information, consistent with the supervisors adding timely information. However, these studies are less useful for evaluating timeliness than are studies using stock and bond market data, because market data presumably incorporate much more information than the Call Report.

loans or equity capital) or macroeconomic performance beyond other public or private sources of information (e.g., market assessments, Call Report information, or Federal Reserve staff forecasts). This literature found mixed results. Davies (1993) tested whether CAMEL or BOPEC ratings versus market/book ratios better helped predict future book-value insolvency (bank's capital ratio below either 2 percent or 3 percent of assets) during 1986–91 and found that unsatisfactory bank CAMEL ratings helped predict a higher probability of book-value insolvency, but that unsatisfactory holding company BOPEC ratings had little or no additional predictive power. Cole and Gunther (1998) compared supervisory ratings with Call Report information in predicting future bank failures during 1988:2–1992:1 and found that CAMEL ratings improved forecast accuracy, but only if the examination was in the most recent two quarters. Berger, Davies, and Flannery (2000) similarly found that supervisory assessments are much less accurate overall than both bond and equity market assessments in predicting future changes in performance, but that supervisors may be more accurate when inspections are recent. Finally, Peek, Rosengren, and Tootell (1999a,b) used quarterly data from 1978:1–1996:2 and 1978:1–1994:4, respectively, and found that the proportion of the nation's banking assets in banks with composite CAMEL ratings of 5 (the worst rating) added information in predicting macroeconomic performance beyond what was incorporated in the predictions of private-sector forecasting firms and Federal Reserve staff.

A fundamental problem with tests of supervisory accuracy is that accuracy in predicting future performance may not be the primary goal of supervisors. Supervisors may be more concerned with accurately describing the *current* condition of a BHC in order to exert pressure on institutions to resolve problems, and be less concerned with predicting future condition. Supervisors may be very accurate in assessing current condition while appearing to be very inaccurate at predicting future condition, particularly if supervisors are successful at pressuring institutions to resolve problems. For example, a CAMEL downgrade or an increase in classified assets may encourage an institution to stop making risky loans, eventually reducing its nonperforming loan ratio. The finding in Cole and Gunther (1998) and Berger, Davies, and Flannery (2000) that supervisors may be more accurate than market participants in predicting short-run future performance and less accurate than market participants in predicting long-run future performance is consistent with this argument, because any change in problem loans caused by supervisory pressure is likely to take several quarters to appear in full in the data. Because of these difficulties, we do not try to determine whether any increase or decrease in supervisory toughness in the data represents a change in accuracy.

9.5 Methodology and Data

9.5.1 Tests of Changes in Supervisory Harshness (Hypotheses 1 and 2)

To test for changes in supervisory toughness, we model two types of supervisory assessments—classified assets and composite CAMEL ratings—as functions of measures of bank financial condition and other factors representing the economic environment of the bank. The econometric models mimic as closely as possible the information used in the supervisory process at the time of the supervisory assessments. Of course, it is not possible to include all of the information available to supervisors at the time they set the classified assets and CAMEL ratings, but we address this issue as well as we can by (a) including the key balance sheet and income variables specified in the supervisory procedures in their level, trend, and peer group percentile ranks, as discussed earlier; (b) including a large number of other control variables for bank condition and economic environment; (c) bracketing the information set used by supervisors by running the models with and without information on the future performance of the bank, which is more information than the supervisors could have access to at the time of the supervisory assessments; and (d) running large numbers of robustness checks on the models.

The classified assets model takes the form

$$\ln[\text{class}/(1-\text{class})] = f[\text{time dummies, lagged supervisory assessments, supervisory agency dummies, bank size, bank balance sheet and income items, state averages of balance sheet and income items, other economic environment indicators, (future performance)}].$$

These variables are shown in table 9.7. There are between 190 and 199 coefficients estimated in each classified assets equations, depending on whether the future performance variables (described later) are included.

The dependent variable is in log-odds form, the natural log of the proportion of loans that are classified divided by one minus this proportion. The equation may be interpreted as a log-odds grouped logit model for the probability that a dollar of loans will be classified. It is estimated by weighted least squares in order to avoid heteroscedasticity problems and the adjusted R^2s are corrected.[7] As is shown in table 9.7, we specify models for both total classified assets and weighted classified assets.

The time dummies are also specified in different ways to ensure robustness of the results. In some equations, we include dummies for each

7. Each observation is divided by a number proportional to the estimated standard error of its error term $[\{(1/\text{class}) + [1/(1-\text{class})]\}/\text{total loans}]^{1/2}$.

Table 9.7 **Variable Definitions and Sample Statistics for Supervisory Assessment Regressions**

Name	Definition	Mean	Std. Dev.
Supervisory Assessments of Bank Condition			
Total classified assets	Proportion of loans classified as substandard, doubtful, or loss.	.060	.065
Weighted classified assets	Weighted proportion of loans classified, weights of .2 on substandard, .5 on doubtful, and 1 on loss.	.015	.020
CAMEL 1	Dummy variable equal to 1 if CAMEL rating is 1.	.275	.447
CAMEL 2	Dummy variable equal to 1 if CAMEL rating is 2.	.521	.500
CAMEL 3	Dummy variable equal to 1 if CAMEL rating is 3.	.128	.334
CAMEL 4 or 5	Dummy variable equal to 1 if CAMEL rating is 4 or 5 (combined because there were so few 5s).	.075	.264
CAMEL satisfactory	Dummy variable equal to 1 if CAMEL rating is 1 or 2.	.797	.403
CAMEL unsatisfactory	Dummy variable equal to 1 if CAMEL rating is 3, 4, or 5.	.203	.143
Time dummies			
1986–88	Precrunch period. This is excluded as the base period in the main regressions.	.216	.412
1989–92	Credit crunch period.	.370	.483
1993–98	Banking boom period.	.414	.493
Individual year dummies	Included in some regressions.		
Lagged Supervisory Assessments			
Lagged total classified assets, weighted classified assets, CAMEL 1, CAMEL 2, CAMEL 3	Lagged values of supervisory assessments for banks with prior examination data, set to zero otherwise (see no lagged examination data variable).		
Time since last recorded examination	Years since last recorded examination, set to zero if no prior data (see no lagged examination data variable).	.994	.701
No lagged examination data	Dummy variable equal to 1 if no lagged examination data are available.	.106	.308
Supervisory Agency			
OCC	Dummy variable equal to 1 if the OCC was the lead agency in the exam.	.248	.432
FDIC	Dummy variable equal to 1 if the FDIC was the lead agency in the exam.	.366	.482
FRB	Dummy variable equal to 1 if the FRB was the lead agency in the exam.	.078	.268

Table 9.7 (continued)

Name	Definition	Mean	Std. Dev.
STATE	Dummy variable equal to 1 if state agency or other federal agency. This is excluded as the base case.	.308	.461
Bank Size variables			
ln(GTA)	Natural log of gross total assets.	11.039	1.221
SIZE1	Dummy variable equal to 1 if GTA $\leq$ \$100 million (excluded from regressions as base case).	.723	.448
SIZE 2	Dummy variable equal to 1 if \$100 million $<$ GTA $\leq$ \$1 billion.	.245	.430
SIZE 3	Dummy variable equal to 1 if \$1 billion $<$ GTA $\leq$ \$10 billion.	.028	.164
SIZE 4	Dummy variable equal to 1 if \$10 billion $<$ GTA.	.004	.065
Bank Balance Sheet and Income Items			
	Total capital ratio, Tier 1 capital ratio, leverage capital ratio, real estate loans/total loans, nonperforming loans/total loans, off-balance sheet items/total loans, other real estate owned/ total loans, return on assets, and volatile liability dependence. All are lagged and all are included as level, trend, and peer group percentile rank.		
State Averages of Balance Sheet and Income Items			
	State averages of the same variables as the bank balance sheet and income items. These variables are also lagged and all are included as level, trend, and peer group percentile rank.		
Other Economic Environment Indicators			
	Regional dummies, state income growth, and state unemployment rate.		
Future Performance			
Future nonperforming loans	Leads of 1, 2, and 3 years included in regressions. Mean for lead 1 shown.	.038	.036
Future charge-offs	Leads of 1, 2, and 3 years included in regressions. Mean for lead 1 shown.	.005	.035
Future total capital ratio	Leads of 1, 2, and 3 years included in regressions. Mean for lead 1 shown.	.169	.078

of our three main time periods: precrunch (1986–88), credit crunch (1989–92), and boom (1993–98). In other equations, we specify dummies for each individual year to allow the data more freedom to "choose for themselves" when changes in supervisory toughness occurred. We use the coefficients of the time dummies to establish the changes in supervisory toughness. That is, after controlling as well as we can for the supervisors' information in the rest of the equation, we test the coefficients of these dummies to see if classified assets tend to be higher in the credit crunch period as predicted by hypothesis 1, and lower during the boom period, as predicted by hypothesis 2.

We also include lagged supervisory assessments to account for stickiness in assessments or additional information inherent in past assessments. We include the lagged total classified assets ratio in the total classified assets regressions and the lagged weighted classified assets ratio in the weighted classified assets equation. In both models we include lagged dummy variables for the last previously recorded composite CAMEL rating (lagged CAMEL 4 or 5 is excluded as the base case). The time since last recorded examination may help predict supervisory outcomes because problem banks are typically examined more frequently, although a shorter lag may also predict less change in condition, because there is less time for changes in condition to occur. Importantly, we also include data for banks without previous examination records to avoid sample selection problems as discussed earlier. For these observations, we set the dummy for "No lagged examination data" to 1 and set the values of the other lagged supervisory assessment variables to zero. In effect, we account for the average difference of these banks from other banks.

We also include supervisory agency dummies to account for the possibility of systematic differences in supervisory standards across government agencies. They may also reflect systematic differences in the quality of banks with different charter types or Federal Reserve membership for which we do not otherwise adequately control.

The bank size variables include a continuous measure of bank assets, as well as dummies for different size classes. These control for many differences between large and small banks that may not be otherwise controlled for in the model, including the degree of industrial and geographic diversification in the loan portfolio, risks from off-balance sheet or international exposures, and any systematic differences in supervisory treatment.

The bank balance sheet and income items are the levels, trends, and peer group percentile ranks of the nine key balance sheet and income variables specified in the UBPR and taken from the appropriate Call Report quarter. These are the total capital ratio, Tier 1 capital ratio, leverage capital ratio, real estate loans/total loans, nonperforming loans/total loans, off-balance sheet items/total loans, other real estate owned/total loans, return

on assets, and volatile liability dependence. All of these variables are specified in both first- and second-order terms and interactions, so that each actually appears nine times in the regressor list to allow for a very flexible functional form. That is, for $i = 1, \ldots, 9$, we specify x_{it}, $(x_{it} - x_{it-1})$, $x\text{rank}_{it}$, $(x_{it})^2$, $(x_{it} - x_{it-1})^2$, $(x\text{rank}_{it})^2$, $x_{it} \times (x_{it} - x_{it-1})$, $x_{it} \times x\text{rank}_{it}$, and $(x_{it} - x_{it-1}) \times x\text{rank}_{it}$, where x_{it} represents the current value of the variable computed from the Call Report; $(x_{it} - x_{it-1})$ is the trend; and $x\text{rank}_{it}$ is the current peer group percentile rank, for a total of eighty-one variables specified (means, standard deviations, and coefficients not shown in tables).

We also include a number of controls for the economic environment of the bank. The state averages of balance sheet and income items are the same eighty-one variables as are specified for the bank itself, except that they are state averages to help control for the economic environment of the bank (data not shown in tables). Other economic environment indicators include regional dummies for the Federal Reserve District (which may capture systematic differences in regional economic conditions or supervisory treatment) as well as state income growth and unemployment rate. Although the local economic environment is not explicitly specified in the examination procedures, it is nonetheless important to control for the environment to account for exogenous changes in bank condition that may be reflected in supervisory assessments. For example, supervisors may be more likely to find problems in the loan portfolio and assign more classified assets and a worse CAMEL rating for a bank in a state with low income growth, a high unemployment rate, and poor state-average bank balance sheet and income items, even after taking into account the bank's own balance sheet and income items. To the extent that there are changes in the macroeconomic or regional environment that affect all banks in the nation or region, these effects may be mostly captured by these state-level variables, because banks were generally legally restricted to have full-service banking offices only in their home state for almost all of our sample.[8] That is, conditions outside the home state are likely to be much less important than those in the state.

Finally, we alternately exclude and include the future performance variables, which are leads of one, two, and three years of nonperforming loans, charge-offs, and the total risk-based capital ratio. As noted earlier, it is not possible to include all of the information available to supervisors at the time of the supervisory assessments, although the variables reviewed thus

8. Interstate bank branching was essentially prohibited prior to the implementation of the Riegle-Neal Banking and Branching Efficiency Act in 1997. BHCs were permitted to own banks in different states prior to this time, but our data are on the individual banks, not their holding companies.

far represent our best attempt. One of the ways we attack this problem is to include these future values of nonperforming loans, charge-offs, and capital, which capture more information than the supervisors could have had access to at the time of the assessments and represent fairly well the future condition of the bank that supervisors are interested in predicting or altering. In effect, we try to bracket the information set used by supervisors by running the models alternately with less information and with more information than supervisors have. If the same qualitative result for changes in supervisory toughness holds when we specify both less and more information than supervisors have, then we will feel more confident in drawing conclusions about what occurred with their actual (unobserved) information set. We recognize that the future performance variables are endogenous, that their coefficients are unreliable, and that the model is underidentified with their inclusion; but our purpose is to check the robustness of the main model, which excludes these variables, rather than to rely on equations with the endogenous variables. Fortunately, the results are robust to the inclusion or exclusion of the future performance variables, supporting our interpretation of the time dummies as reflecting changes in supervisory toughness, rather than important excluded variables.

We also run the classified asset model (as well as the CAMEL model below) using a Heckman correction to deal with potential sample selection problems. We first run a probit equation for the probability that a bank has an exam in a given year, and then include the resulting inverse Mills ratio as a regressor in the equations for the classified asset ratios and CAMEL ratings. We specify a separate probit model for each year to take account of the apparent significant changes over time in the probability of an examination. The variables in these models include the same past values of key balance sheet and income variables, past supervisory ratings, and so on, which should affect the decision to examine a bank, just as they affect the supervisory rating on a bank. This creates a problem of identification for the Heckman correction, because we have no variables in the first stage for the probability of an examination that are not also in the second stage for the supervisory assessments at the examinations. Because we do not have any "true" exclusion restrictions, our sample selection correction is identified by (a) the fact that we run separate probit equations for each year, letting all the coefficients vary to take account of changes over time in the probability of an examination, and (b) the nonlinearity inherent in the inverse Mills ratio. The use of the same underlying variables cannot be helped, because all of the variables that supervisors use in offsite monitoring in selecting banks to be examined are also used in their determination of the supervisory assessments at the end of the examination. Fortunately, our main results regarding hypotheses 1 and 2 are robust to including or excluding the Heckman correction.

The model for the composite CAMEL ratings is very similar and takes the form

$$\begin{aligned}\text{Probability(CAMEL)} = g[&\text{time dummies, lagged supervisory}\\ &\text{assessments, supervisory agency dummies,}\\ &\text{bank size, bank balance sheet and income items,}\\ &\text{state averages of balance sheet and income items,}\\ &\text{economic environment indicators,}\\ &\text{(classified assets), (future performance)}].\end{aligned}$$

This equation is specified as an ordered logit of the choice among composite CAMEL 1, 2, 3, and (4 or 5). As is indicated in table 9.7, CAMEL 5 is grouped with CAMEL 4 because CAMEL 5 is so rare.[9]

The regressors specified are identical to those in the classified assets model with one exception. We run the CAMEL model three ways: with current total classified assets included as a regressor, with current weighted classified assets included, and with no current classified assets included. The purposes are to allow the data to describe different types of changes in supervisory toughness and to check robustness of the results. One way that changes in supervisory toughness may affect CAMEL ratings is that supervisors may simply assign a higher or lower composite CAMEL grade after an on-site examination for a given evaluation of the loan portfolio, which may be described by the model with current classified assets specified in total or weighted form. That is, supervisors may take as given the set of classifications for the loan portfolio and assign a harsher or laxer rating. Alternatively, supervisors may assign a harsher or laxer CAMEL rating as part of the same process in which loans are classified more or less harshly. In this case, the specification with no current classified assets specified is correct. Fortunately, the results are robust to the inclusion or exclusion of the current classified assets variables as regressors.

9.5.2 Tests of Changes in Supervisory Toughness on Bank Lending Behavior (Hypothesis 3)

To test for the effects of changes in supervisory toughness on bank lending behavior, we model changes in bank lending and other measures of performance as functions of three years of past changes in supervisory assessments and include control variables for three years of other past changes in bank condition and economic environment. Three years of

9. As a robustness check, we try running the model with the management (M) component of the CAMEL rating in place of the composite rating, because the supervisors have a significant amount of discretion in assigning a management rating, with results very similar to those for the composite CAMEL. We also rerun the composite CAMEL model as a binomial logit for the probability of a satisfactory rating (1 or 2) versus an unsatisfactory rating (3, 4, or 5).

lagged changes are included because it may take a considerable amount of time for a bank to change the composition of its loan portfolio.

Our model for change in performance takes the form:

$$\Delta\text{performance} = h[\text{time dummies}, \Delta\text{supervisory assessments (3 years of lags)}, \Delta\text{bank balance sheet and income items (3 years of lags)}, \Delta\text{state averages of balance sheet and income items (3 years of lags)}, \Delta\text{state averages of supervisory assessments (3 years of lags)}, \Delta\text{other economic environment indicators (3 years of lags)}].$$

The Δperformance variables include two types of variables: (a) direct measures of the changes in lending behavior and (b) measures of changes in bank risk. The direct measures of changes in lending behavior are the one-year changes in the ratios of C&I loans, real estate loans, installment loans, and U.S. Treasuries to gross total assets (e.g., $C\&I_t/GTA_t - C\&I_{t-1}/GTA_{t-1}$) as well as the proportional change in gross total assets ($[GTA_t - GTA_{t-1}]/GTA_{t-1}$). We test whether CAMEL downgrades and increases in classified assets predict reductions in lending and assets and increases in Treasuries, and vice versa for CAMEL upgrades and decreases in classified assets.

The measures of changes in bank risk included as Δperformance dependent variables are the ratios of nonperforming loans and charge-offs to gross total assets and the total capital ratio (essentially, changes in the same variables alternately included and excluded in the supervisory assessment regressions above). The predicted signs on supervisory toughness in these regressions could go either way, depending on the extent to which a supervisory downgrade encourages banks to reduce risks versus the extent to which it accurately predicts declining future performance. This tension between supervisory assessments as intended to change behavior versus to predict outcomes is difficult to disentangle, as was indicated in the literature review. The results of these regressions should yield some interesting information on the net effect of these opposing forces, but we do not view the results of the changes in bank risk regressions as clean tests of hypothesis 3, that supervisory changes alter bank lending behavior.

The regressors included in the Δperformance model differ in a number of ways from those in the supervisory assessment equations. For the time dummies, we include the year dummies, rather than the period dummies, to allow maximum flexibility, because these variables are not the main focus of attention here. Data for the year 1986 are dropped, and the dummy for 1987 is the base case, because the data did not go back far enough to cover the lags needed for 1986. The remaining variables are measured as three years of lagged changes to allow time for the bank to adjust its portfolio in reaction to the changes in supervisory assessments and other

changes in bank condition and environment. As additional variables, we include state averages of changes in classified assets and CAMEL ratings. We exclude peer group percentile ranks of the balance sheet and income items because these variables should primarily influence supervisors, rather than bank managers.

In the specification of the Δsupervisory assessments variables, we specify three lags of dummies for CAMEL upgrades and downgrades, leaving "no change" as the base case. This allows for an asymmetric response of banks to upgrades and downgrades. We show the results with three lags of changes in total classified assets, but the results were robust to alternately using weighted classified assets. Classified assets are measured here as proportions of assets, rather than as proportions of loans as in the supervisory regressions, in order to form a better indicator of the supervisory pressure on banks to change their behavior.

9.6 Empirical Results

9.6.1 Results of Tests of Changes in Supervisory Harshness (Hypotheses 1 and 2)

Table 9.8 presents the weighted least squares regression equations for classified asset ratios and ordered logit regressions for the composite CAMEL rating. These models include dummies for the main time periods, the credit crunch (1989–92), and boom (1993–98) periods, with the precrunch (1986–88) period excluded as the base case. Other models that include dummies for each individual year yield similar results but are not shown in the tables. We also do not show the coefficients for most of the control variables to save space. As indicated previously, there are nearly 200 coefficients estimated in each supervisory equation. The two asterisks indicate statistical significance at the 5 percent level, two-sided.

To test hypothesis 1, that supervisors got tougher on banks during the credit crunch period, we test the coefficients of the time dummies to see if classified assets tend to be higher and composite CAMEL ratings tend to be worse in the credit crunch period than in the precrunch period after controlling as well as we can for the supervisors' information in the equations. The coefficients of the credit crunch dummy (1989–92) in the total classified assets equations in table 9.8 are positive, but small and statistically insignificant. For the weighted classified assets equations, the coefficients of the credit crunch dummy are larger and statistically significant. These findings hold whether or not the future performance variables (leads of one, two, and three years of nonperforming loans, charge-offs, and total capital) are included in the estimation (observations from the final three years of the sample are dropped when the future performance variables are included).

Table 9.8 **Regressions of Supervisory Assessments with Period Dummies**

	Total Classified Assets				Weighted Classified Assets				CAMEL			
	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
1989–92	0.005211	0.017926	0.01003	0.018817	0.046267**	0.018059	0.057193**	0.018726	−0.3355**	0.0418	−0.1979**	0.0489
1993–98	−0.16131**	0.030755	−0.13853**	0.033097	−0.15451**	0.030464	−0.11518**	0.032515	−0.1695**	0.0719	−0.1268	0.0863
Lagged classified assets	10.29125**	0.112903	8.977898**	0.12419	25.51462**	0.400763	21.73203**	0.435849	10.9414**	0.3002	10.4541**	0.3654
Lag CAMEL 1	0.47908**	0.028467	0.42174**	0.03119	0.103299**	0.029719	0.084658**	0.032084	6.2138**	0.0674	6.1182**	0.0823
Lag CAMEL 2	0.699025**	0.026069	0.60777**	0.02823	0.405948**	0.027581	0.339049**	0.029372	3.6971**	0.0609	3.6969**	0.0731
Lag CAMEL 3	0.543288**	0.023706	0.464806**	0.025212	0.385124**	0.025478	0.334712**	0.026676	1.9102**	0.052	1.9106**	0.0618
Years since last exam	−0.16398**	0.005336	−0.09785**	0.007547	−0.1304**	0.00555	−0.06696**	0.007341	0.018	0.0143	−0.00672	0.0192
No prior exam	0.744434**	0.031395	0.806143**	0.034212	0.283331**	0.032533	0.359236**	0.034756	4.4846**	0.0766	4.5068**	0.0919
OCC	0.159995**	0.010574	0.168187**	0.013095	0.151008**	0.010116	0.154065**	0.012467	−0.2793**	0.0242	−0.3743**	0.0318
FDIC	0.11576**	0.007679	0.14295**	0.008797	0.115969**	0.007836	0.15533**	0.008961	−0.3258**	0.0208	−0.3874**	0.0259
FRB	−0.00341	0.014849	0.008097	0.016897	0.024116	0.01436	0.024877	0.016248	−0.1479**	0.0347	−0.1559**	0.0431
Total classified assets									−82.938**	0.6564	−85.358**	0.8218
NPF, $t + 1$			2.797067**	0.194073			3.352305**	0.214042			−0.00768	0.9653
NPF, $t + 2$			0.559802**	0.201674			0.965655**	0.217772			−1.4128	0.9934
NPF, $t + 3$			0.549363**	0.173385			−0.27295	0.188366			−4.2268**	0.8816

Charge-offs, $t+1$		1.293406**	0.192597		1.68188**	0.224471		−20.087**	1.9758	
Charge-offs, $t+2$		2.142689**	0.335742		2.430947**	0.397049		−0.4434	2.0324	
Charge-offs, $t+3$		0.611406**	0.21981		−0.00928	0.184508		3.9199	2.1816	
Total capital, $t+1$		0.454978**	0.116291		0.126771	0.148643		2.1243**	0.4814	
Total capital, $t+2$		0.576912**	0.123038		0.917427**	0.157945		−1.2946**	0.4949	
Total capital, $t+3$		−0.04714	0.095274		−0.36475	0.118142		−0.2707	0.3772	
Adjusted R^2	0.5202	0.5312		0.5027	0.5182					
No. of observations	107,395	67,425		107,395	67,425		107,396	67,426		
−2 log-likelihood							101,354.96	64,756.72		

Notes: All of these regressions also include the following variables from the bank's Call Report: total capital ratio, Tier 1 capital ratio, leverage capital ratio, real estate loans/total loans, nonperforming loans/total loans, off-balance sheet items/total loans, other real estate owned/total loans, return on assets, and volatile liability dependence. All are lagged and all are included as level, trend, and peer group percentile rank. State averages of all of these items (lagged levels, trends, and peer group percentile ranks). State income growth and the state unemployment rate are also included in all regressions.

**Significant at the 5 percent level, two-sided.

To evaluate whether these results are *economically* significant, we evaluate the contributions of the credit crunch dummy to the probability that a dollar of loans is classified. The dependent variable is in log-odds logistic form [ln(class/(1 − class))], and may be interpreted as a probability model, as discussed earlier. Because the equation is nonlinear, the measured effect will depend on the point of evaluation. We choose the means of total and weighted classified asset proportions during the credit crunch as the most relevant points of evaluation, .072 and .018, respectively (see table 9.4, Panel B). Increasing the dependent variable of the total classified assets equation by .005211 (the coefficient on the credit crunch dummy) increases the predicted proportion of classified loans from 7.2 percent to 7.235 percent, an economically small effect.[10] Similarly, increasing the dependent variable of the weighted classified assets equation by .046267 increases the predicted weighted classified proportion from 1.8 percent to 1.884 percent, which is larger, but would still appear to be a small economic influence. Thus, the data suggest at most a relatively modest effect of examiners getting tougher during the credit crunch period in terms of requiring that banks of a given condition classify more loans or shift loans into more serious classifications. The economic significance results are consistent with on the order of magnitude of about 1 percent or less of the loan portfolio being additionally classified or classified more seriously.

We turn next to the measured effects on the composite CAMEL rating. The negative, statistically significant coefficients on the dummy for the period of 1989–92 indicate that the probability of receiving a favorable CAMEL rating is lower than during the precrunch period, all else held equal. Again, the effects are comparable, whether or not the future performance variables are included. The models shown in table 9.8 control for the current level of total classified assets, but the results are robust with respect to using current weighted classified assets or to excluding current classified assets altogether.

To evaluate the economic significance of the CAMEL results, we compare the predicted values of CAMEL 1, CAMEL 2, CAMEL 3, and CAMEL 4 or 5 with and without the coefficient of the credit crunch dummy variable. That is, we evaluate the predicted CAMEL ratings as if the coefficients reflect the precrunch supervisory regime versus the credit crunch supervisory regime. The point of evaluation is the median of all the variables for the credit crunch period except that the dummy variables are set to one or zero. We assume that the lagged CAMEL rating is a 2 (the modal rating), the region is 1 (New England), the size class is 1 (assets below $100 million), and that the bank was examined by a state supervisory agency. The predicted percentages of CAMEL 1, CAMEL 2,

10. Letting P_1 be the new probability of a dollar of loans being classified, the formula for the figure in the text is given by $\ln[P_1/(1 - P_1)] = \ln[.072/(1 - .072)] + .005211$.

CAMEL 3, and CAMEL 4 or 5 are 9.37 percent, 88.91 percent, 1.70 percent, and 0.001 percent, respectively, without the credit crunch dummy coefficient, and 6.89 percent, 90.74 percent, 2.36 percent, and 0.002 percent, respectively, with the credit crunch dummy coefficient. These results suggest that CAMEL ratings are relatively "sticky": Banks rated as CAMEL 2 in the prior examination are about 90 percent likely to receive a 2 during the next examination. These results are consistent with only a modest increase in supervisory harshness during the credit crunch period, worsening the CAMEL ratings for about 3 percent of banks.[11]

To test hypothesis 2, that supervisors got easier on banks during the boom period, we use the same models and test the coefficients of the time dummies to see if classified assets tend to be lower and CAMEL ratings tend to be more favorable in the boom period for a given bank condition and economic environment. The coefficients of the boom period dummy (1993–98) in the classified assets equations in table 9.8 are negative, larger in absolute value than the credit crunch period dummies, and statistically significant in all four cases, consistent with a reduction in supervisory toughness during the boom period. These results are robust to the specification of total or weighted classified assets and to whether or not the future performance variables are included.

To assess the economic significance of the classified asset results for the boom period, we evaluate the contribution to the probability that dollar of loans is classified of the boom period dummy minus the credit crunch dummy, which measures the change between these two periods. We evaluate at the mean proportions of total and weighted classified assets during the boom period, .039 and .009, respectively (see table 9.4). Changing the dependent variable of the total classified assets equation by (−.16131 − .005211; the boom period dummy coefficient minus the credit crunch dummy coefficient) reduces the predicted proportion of classified loans from 3.9 percent to 3.322 percent. Similarly, the predicted weighted classified proportion is reduced from 0.9 percent to 0.737 percent. These figures are not economically significant in terms of the reduction in the proportion of loans that are predicted to be classified or receive less serious classifications, on the order of magnitude of 1 percent of loans in both cases. Thus, the data are consistent with very modest reductions in supervisory toughness during the boom period in terms of classified assets.

11. We also rerun the CAMEL model as a binomial logit for the probability of a satisfactory rating (1 or 2) versus an unsatisfactory rating (3, 4, or 5; not shown in tables). The results again show a statistically significant effect of the credit crunch dummy variable. The results were also more economically significant than the full model; the data suggest that for a given bank condition at the mean of the data set, the probability of a satisfactory rating decreased about 9 percentage points (from 74.2 to 65.0 percent). The difference from our main result may be due in part to the sparser specification of the satisfactory versus unsatisfactory rating, and in part to the different point of evaluation.

Turning to the potential effects of changes in supervisory toughness on CAMEL ratings during the boom period, we note that the coefficients of the boom period dummy (1993–98) in the CAMEL models are both negative, and the coefficient for the main equation (without the future performance variables) is statistically significant. This suggests that the CAMEL ratings were harsher for a given bank condition in the boom period than in the precrunch period, contrary to the classified assets results. More important for investigating hypothesis 2, however, is that the boom period dummies are less in absolute value than the coefficients of the credit crunch period dummies, so they represent easier ratings for a given condition than during the credit crunch period.

To evaluate economic significance, we again compare the predicted values of the CAMEL probabilities. We evaluate the predicted probabilities with the coefficient of the boom period dummy in place of the credit crunch period dummy, evaluated at the median of the variables for the boom period (as well as lagged CAMEL rating 2, region 1, size class 1, and state agency examination). The predicted percentages of CAMEL 1, CAMEL 2, CAMEL 3, and CAMEL 4 or 5 are 21.98 percent, 77.39 percent, 0.63 percent, and 0.004 percent, respectively, with the credit crunch dummy coefficient specified, and 24.96 percent, 74.50 percent, 0.54 percent, and 0.004 percent, respectively, with the boom period dummy coefficient. These data suggest that bank conditions and economic environments were so strong during the boom period that even banks with lagged CAMEL 2 ratings were predicted to have over a 20 percent probability of rising to a CAMEL 1 rating without any change in supervisory toughness. The effects of any change in supervisory toughness are again rather mild, consistent with supervisory easing resulting in improved CAMEL ratings of about an additional 3 percent of banks receiving better CAMEL ratings. The use of the binomial logit model for the probability of a satisfactory versus unsatisfactory rating also showed very little effect in this case, moving the predicted probability of a satisfactory CAMEL rating during the boom period up by less than 1 percentage point (from 92.1 percent to 93.0 percent).

Overall, the classified assets and CAMEL models are modestly consistent with hypotheses 1 and 2. They generally show statistically significant results in the predicted directions but usually show only fairly small results from an economic viewpoint. In most cases, the findings are consistent with no more than about 1 percent of additional loans becoming classified or put into more serious classifications during the credit crunch period and similarly for the reduction in classifications during the boom period, for a given bank condition and economic environment. Similarly, the data are consistent with movements of CAMEL ratings for about 3 percent of banks in the predicted directions as a result of any changes in supervisory toughness, which is small compared with the effects of stickiness in ratings during the credit crunch period and the trend toward improved ratings

from economic conditions during the boom period. These findings are generally confirmed by a number of robustness checks not shown in the tables, including our Heckman correction for sample selection problems.[12]

We briefly discuss the other coefficients shown in table 9.8, but note again that many of the coefficients are not shown. In the classified assets equations, the coefficients of lagged classified assets are positive and statistically significant, consistent with the expectation that a prior problem loan portfolio would predict a current problem loan portfolio, because it takes a considerable amount of time to dispose of problem assets. The coefficients of the lagged CAMEL 1, CAMEL 2, and CAMEL 3 are positive and statistically significant in the classified assets equations. This suggests that a past rating of CAMEL 4 or 5—the base case in the regressions—has a positive effect in encouraging banks to improve their loan portfolios and reduce classified assets relative to their lagged levels. In the CAMEL equations, the positive and statistically significant lagged CAMEL coefficients are consistent with CAMEL stickiness—the higher the past rating, the higher the predicted current rating. As expected, the level of current classified assets has statistically significant negative coefficients in the CAMEL equations, consistent with banks with poor loan portfolios receiving poor CAMEL ratings. However, the lagged classified assets variable has a positive coefficient. Given that the current level of classified assets is in the same equation, this may be interpreted as reward (punishment) for improvement (deterioration) in classified assets since the prior examination. The variable for years since a prior examination has negative coefficients in the classified assets equations, consistent with banks that have problem portfolios being examined more often, although this does not appear to affect the CAMEL rating. The coefficients of the supervisory agency dummies—OCC, FDIC, and FRB—suggest that banks examined by the OCC and FDIC received worse supervisory assessments (higher classified assets, worse CAMEL ratings) than those examined by the Federal Reserve and state agencies (the base case), all else equal. This may reflect differences in supervisory standards or differences in the quality distributions of banks with different supervisors. Finally, the coefficients of the future performance variables generally suggest that banks that are assigned worse supervisory ratings (high classified assets or poor CAMEL ratings) will have higher nonperforming loans and charge-offs in the future, but may also raise their capital ratios. As noted pre-

12. We also tried evaluating economic significance by dropping the time dummies and running the model separately for the precrunch, credit crunch, and boom periods, allowing the coefficients of all the regressors to vary. Although this procedure yielded mostly the same qualitative results—consistent with toughening during the credit crunch period and easing during the boom period—the quantitative results were often too large to be believable. For example, at the boom period medians, the CAMEL models predicted a drop from 73.4 to 2.6 percent in the probability of a CAMEL 3 rating from the credit crunch supervisory regime to the boom period regime. Presumably, these models simply did not work very well out of sample.

viously, these variables are endogenous, so we reserve further judgment until we treat them as endogenous variables later.

9.6.2 Results of Tests of Changes in Supervisory Toughness on Bank Lending Behavior (Hypothesis 3)

Table 9.9 presents results from regressions aimed at addressing hypothesis 3, the effect of changes in supervisory toughness on direct measures of bank lending behavior. We regress changes in bank lending on three years of past changes in supervisory assessments and changes in bank condition and economic environment. The main predictions of the hypothesis are that a supervisory downgrade (worsened CAMEL rank, higher classified assets) should result in smaller proportions of assets being devoted to loans, a reduction in asset growth, and a larger proportion of assets being devoted to government securities, and vice versa for supervisory upgrades.

Our regressions appear to explain very little of what drives changes in lending behavior. The adjusted R^2s for the equations in table 9.9 are generally less than 5 percent. Nonetheless, a number of the changes in supervisory assessments are statistically significant. The changes in classified assets all have signs that are consistent with the hypothesis for all lag lengths, and all but one of these coefficients are statistically significant at the 5 percent level. That is, an increase in classified assets is associated with decreases in the future C&I loan ratio, real estate loan ratio, installment loan ratio, and asset growth ratio, and with an increase in the future Treasury holdings ratio. These results are also replicated when changes in weighted classified assets are specified in place of total classified assets (not shown). In addition, we tried rerunning the loan and Treasury ratios with different denominators to ensure that the results were not just driven by changes in asset denominator. We specified $(C\&I_t - C\&I_{t-1})/GTA_{t-1}$ and $(C\&I_t - C\&I_{t-1})/C\&I_{t-1}$ in place of $C\&I_t/GTA_t - C\&I_{t-1}/GTA_{t-1}$, and so forth for the other lending and Treasury ratios, and the results were robust.

To determine if the classified assets results are economically significant, we simply sum the coefficients on the three lags of the change in classified assets. Because the equations are linear, this gives the long-run effect of a change in classified assets (i.e., the sum of the effects of changes one, two, and three years hence). The results suggest that the economic impact of changes in classified assets appears to be rather small. An increase in classified assets of 1 percent of assets is predicted to reduce the C&I loan ratio, real estate loan ratio, installment loan ratio, and asset growth ratio by 0.08 percent, 0.14 percent, 0.11 percent, and 0.72 percent, respectively, and to increase the Treasury ratio by 0.08 percent.

The effects of CAMEL upgrades and downgrades on lending are not very consistent. They sometimes predict changes in lending in the opposite direction of what is expected, and the upgrades and downgrades

Table 9.9 Regressions of Changes in Lending and Assets on Lagged Changes in Supervisory Assessments and Other Variables

	ΔC&I Loans		ΔReal Estate Loans		ΔInstallment Loans		ΔU.S. Treasuries		ΔGross Total Assets	
	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
1988	−0.0015	0.00114	0.002607	0.001653	0.002231**	0.001008	0.012822**	0.001729	−0.09668**	0.014974
1989	−0.00293**	0.000906	0.003247**	0.001313	0.002629**	0.000801	0.01308**	0.001374	−0.08817**	0.011897
1990	−0.00249**	0.000978	0.001078	0.001418	0.002106**	0.000865	0.021528**	0.001484	−0.07921**	0.012847
1991	−0.00547**	0.000868	0.002569**	0.001257	−0.00152**	0.000767	0.023579**	0.001316	−0.08796**	0.011391
1992	−0.00351**	0.000899	0.00462**	0.001302	−0.00242**	0.000795	0.027741**	0.001363	−0.06352**	0.011802
1993	−0.00224**	0.000932	0.004634**	0.001351	0.000208	0.000824	0.023088**	0.001413	−0.071**	0.012238
1994	−0.00119	0.000897	0.003448**	0.0013	0.00389**	0.000793	0.026555**	0.00136	−0.0726**	0.011779
1995	0.002087**	0.000916	0.002035	0.001327	0.004961**	0.00081	0.011197**	0.001389	−0.06194**	0.012027
1996	0.001892**	0.000878	0.002887**	0.001273	0.003276**	0.000777	0.01199**	0.001332	−0.05113**	0.011532
1997	0.002663**	0.000926	0.011934**	0.001342	0.00199**	0.000819	0.000216	0.001404	0.017994	0.012157
1998	0.002332**	0.000816	0.01318**	0.001182	0.00018	0.000721	−0.00477**	0.001237	0.070603**	0.010709
CAMEL upgrade, $t-1$	−0.00437**	0.000354	−0.00178**	0.000514	−0.00347**	0.000313	0.002534**	0.000537	−0.00173	0.004653
CAMEL upgrade, $t-2$	−0.00057	0.000363	−0.00346**	0.000526	−0.00023	0.000321	0.000831	0.00055	−0.01895**	0.004763
CAMEL upgrade, $t-3$	0.000158	0.000357	−0.00091**	0.000518	0.000357	0.000316	−0.00016	0.000542	−0.00329	0.004692
CAMEL downgrade, $t-1$	−0.00088**	0.000432	0.010906**	0.000625	0.001593**	0.000382	−0.0027**	0.000654	0.060737**	0.005666
CAMEL downgrade, $t-2$	−0.00137**	0.000447	−0.00258**	0.000647	0.000706	0.000395	0.003478**	0.000678	−0.03283**	0.005867
CAMEL downgrade, $t-3$	−0.00137**	0.000444	−0.00147**	0.000644	−0.00046	0.000393	0.002855**	0.000674	−0.0222**	0.005835
Change in total classified assets, $t-1$	−0.02704**	0.003844	−0.08794**	0.005569	−0.05641**	0.003398	0.037958**	0.005828	−0.39303**	0.00464
Change in total classified assets, $t-2$	−0.0421**	0.003973	−0.03533**	0.005757	−0.03303**	0.003513	0.028004**	0.006024	−0.14216**	0.052161
Change in total classified assets, $t-3$	−0.01597**	0.003834	−0.01775**	0.005555	−0.01677**	0.00339	0.009414	0.005813	−0.18002**	0.050334
Adjusted R^2	0.0309		0.0366		0.0202		0.0449		0.0194	0.0309
No. of observations	79,960		79,960		79,960		79,960		79,960	79,960

Notes: All of these regressions also include the following balance sheet variables: total capital ratio, Tier 1 capital ratio, leverage capital ratio, real estate loans/total loans, nonperforming loans/total loans, off-balance sheet items/total loans, other real estate owned/total loans, return on assets, and volatile liability dependence. Three years of lagged changes of the state averages of all of these items as well as three years of lagged changes of state averages of CAMEL and total classified assets, state income growth and the state unemployment rate are also included in all regressions.

**Significant at the 5 percent level, two-sided.

sometimes work in the same direction (i.e., differing in the same way from the excluded case of no change in CAMEL). In most cases, the effects are very small, moving the ratios less than 1 percentage point in the long run for a CAMEL upgrade or downgrade.[13] Thus, the support for hypothesis 3 is mixed and weak. The changes in classified assets are consistent with the hypothesis but are small economically, and the changes in composite CAMEL ratings yield small, inconsistent effects.

Table 9.10 presents the regressions for the effects of changes in supervisory assessments on measures of changes in bank risk—changes in the nonperforming loan, charge-off, and total capital ratios. As discussed earlier, these results combine the effects of supervisory assessments on bank behavior with predictions of how banks choose to adjust their risks. The lagged changes in both classified assets and composite CAMEL ratings generally have statistically significant coefficients that are consistent with each other. A supervisory downgrade of either type is followed by increases in future problem loans, and vice versa for supervisory upgrades. These results suggest a dominance of the predictive ability of the ratings over their effects in persuading banks to change the risk of their loan portfolios. That is, a supervisory downgrade predicts an increase in nonperforming loans and charge-offs that is not fully offset by any changes in bank behavior to reduce their risky lending, likely in part because it takes time to resolve existing problem loans. However, the results are not economically significant; a 1 percent change in classified assets or a CAMEL upgrade or downgrade is predicted to change the nonperforming loan and charge-off ratios by less than 1 percentage point.

The results differ for the change in total capital ratio. The coefficients of the lagged changes in classified assets are statistically significant and predict an increase in future capital, consistent with the possibility that an increase in classified assets encourages banks to increase their capital ratios, more than offsetting the erosion of capital from the change in classification. However, changes in CAMEL ratings appear to have the opposite effect, with downgrades predicting a reduction in capital and upgrades predicting an increase in capital. Once again, all of these changes are economically small.

9.7 Conclusions

We investigate the possibility that overall changes in supervisory toughness may significantly influence bank lending behavior and potentially affect macroeconomic or regional economic health. Specifically, we test three hypotheses about whether U.S. bank supervisors changed their policies

13. The one exception of a larger predicted change is that a CAMEL upgrade predicts a decrease of 2.4 percent in the growth rate of assets, which is inconsistent with expectations.

Table 9.10 **Regressions of Changes in Performance on Lagged Changes in Supervisory Assessments and Other Variables**

	ΔNonperforming Loans		ΔCharge-offs		ΔTotal Capital	
	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
1988	−0.0008	0.000505	−0.00086**	0.000391	0.011116**	0.001117
1989	−0.00066	0.000401	3.41E-05	0.00031	0.012442**	0.000888
1990	−0.00039	0.000433	−0.00019	0.000335	0.00857**	0.000959
1991	−0.00031	0.000384	0.000207	0.000297	0.013028**	0.00085
1992	−0.0009**	0.000398	0.000461	0.000308	0.016657**	0.000881
1993	−0.00048	0.000412	−4.9E-06	0.000319	0.014444**	0.000913
1994	−0.0004	0.000397	6.26E-05	0.000307	0.010648**	0.000879
1995	4.54E-05	0.000405	0.000406	0.000314	0.009896**	0.000898
1996	−0.00024	0.000389	0.000339	0.000301	0.00954**	0.000861
1997	−0.00027	0.00041	0.000221	0.000317	−0.02143**	0.000907
1998	−0.00072**	0.000361	0.000211	0.000279	0.014723**	0.000799
CAMEL upgrade, $t - 1$	−0.00108**	0.000157	−0.00044**	0.000121	0.006821**	0.000347
CAMEL upgrade, $t - 2$	−0.00062**	0.00016	−0.00036	0.000124	0.001418	0.000355
CAMEL upgrade, $t - 3$	−0.00066**	0.000158	−0.00042	0.000122	4.66E-05	0.00035
CAMEL downgrade, $t - 1$	0.001639**	0.000191	0.001638**	0.000148	−0.00736**	0.000423
CAMEL downgrade, $t - 2$	0.000592**	0.000198	0.000402**	0.000153	−0.00022	0.000438
CAMEL downgrade, $t - 3$	−0.00051**	0.000197	−0.00068**	0.000152	0.001562**	0.000435
Change in total classified assets, $t - 1$	0.083329**	0.0017	0.026872**	0.001317	0.03454**	0.003766
Change in total classified assets, $t - 2$	0.019455**	0.001757	0.011038**	0.001361	0.016247**	0.003892
Change in total classified assets, $t - 3$	−0.00539**	0.001696	−0.00696**	0.001313	0.013343**	0.003756
Adjusted R^2	0.0882		0.0226		0.4184	
No. of observations	79,959		79,960		79,960	

Notes: See table 9.9.

and whether these policy changes affected bank lending behavior during the credit crunch period of 1989–92 and the banking boom period of 1993–98. We test these hypotheses using information on the supervisory process, confidential data on CAMEL ratings and classified assets from bank examinations, and bank balance sheet and income data over the period 1986–98. The data provide some support for all three hypotheses. However, the data also suggest that the economic effects of any policy changes are likely to have been quite small, and likely do not explain a substantial portion of the wide swings in aggregate bank lending to business during the 1990s.

The data provide modest support for hypothesis 1, that there was an increase in toughness during the credit crunch period. During 1989–92, banks of a given measured financial condition and economic environment had statistically significantly worse CAMEL ratings than in the precrunch period of 1986–88, and in some cases also had statistically significantly higher classified assets. Similarly, the data give some support for hypothesis 2, that there was a decline in toughness during the boom period relative to the credit crunch period. During 1993–98, both CAMEL ratings and classified assets are found to be better for a given bank condition than during the credit crunch period.

Despite the statistically significant support for these hypotheses, the data suggest fairly small results in terms of economic significance. The findings are generally consistent with no more than about 1 percent of additional loans becoming classified or put into more serious classifications during the credit crunch period and similarly for the reduction in classifications during the boom period, after controlling for bank condition and economic environment. Similarly, the data are consistent with movements of CAMEL ratings for about 3 percent of banks in the predicted directions as a result of any changes in supervisory toughness. The statistical and economic significance findings are generally confirmed by a number of robustness checks, although some of the checks suggested larger economic significance.

The data provide mixed support for hypothesis 3, that any changes in supervisory toughness affected bank lending in the predicted directions. Increases in classified assets are statistically significantly associated with decreases in the future C&I loan ratio, real estate loan ratio, installment loan ratio, and asset growth ratio, and with an increase in the future Treasury holdings ratio, all consistent with the hypothesis. However, our analysis of economic significance suggests that these effects are rather small, with an increase in classified assets of 1 percent of assets predicted to change these portfolio ratios by less than 1 percentage point each. The changes in CAMEL ratings did not appear to have consistent effects on future lending behavior, although these effects also appeared to be small.

We also tested for the effects of changes in supervisory assessments on

other measures of changes in bank risk—changes in the nonperforming loan, charge-off, and total capital ratios. These tests combine the effects of supervisory assessments on bank behavior with predictions of how banks choose to adjust their risks. The findings are statistically significant and suggest that supervisory downgrades in terms of either increases in classified assets or worsened composite CAMEL ranks tend to predict more future nonperforming loans and charge-offs, and vice versa for supervisory upgrades. These findings are consistent with a dominance of the predictive ability of the ratings over their effects in encouraging banks to change the riskiness of their loan portfolios, likely in part because it takes time to resolve existing problem loans. The results differ for the change in total capital ratio: lagged changes in classified assets are statistically significant and predict an increase in future capital, consistent with supervisory discipline that encourages banks to increase their capital ratios, more than offsetting any direct reduction in capital that may occur from classification. However, changes in CAMEL ratings appear to have the opposite effect. As with our tests of the main hypotheses, all of the measured effects of changes in supervisory assessments on bank risk appear to be small, with a 1 percent change in classified assets or a CAMEL upgrade or downgrade predicted to change the risk ratios by less than 1 percentage point.

The findings also suggest that to the extent that regulatory changes like modifications of capital standards are enforced through the supervisory process by assigning worse CAMEL ratings, these regulatory changes may not have much effect on bank lending or portfolio risk, because lending and loan risk do not appear to be influenced substantially through changes in CAMEL ratings. However, these regulatory changes could have strong effects through other channels.

These findings are subject to a number of caveats. First, our results of testing changes in supervisory toughness are subject to bias because we cannot exactly replicate the information set used by supervisors. Part of what we measure as changes in supervisory toughness may be systematic changes in bank conditions or economic environments that supervisors use, but that are not specified in our econometric models. We address this issue in a number of ways, by (a) including the level, trend, and peer percentile rank of the key financial ratios specified in the supervisory procedures, (b) including a large number of other control variables for bank condition and economic environment, (c) bracketing the supervisory information set using data on future performance, and (d) running many other robustness checks. The main findings results are robust to these procedures. We acknowledge that we cannot rule out that omitted-variable bias exists, and we recognize the endogeneity of the measures of future performance to the examination ratings. Ideally, we would include all the information that supervisors have or use a measure of predicted future performance in the absence of the effects of supervisory changes. Nonetheless,

we believe that we have gone well beyond prior studies of the credit crunch and other prior studies that used supervisory data in controlling for the information used by supervisors.

Our discussant, Steve Cecchetti, correctly points out that the estimated coefficients of our time dummies—which we interpret as reflecting changes in supervisory toughness in our tests of hypotheses 1 and 2—are highly correlated with macroeconomic series, such as industrial production. This is not surprising, given that the credit crunch period essentially corresponds to a macroeconomic recession and the boom period for bank lending essentially corresponds to a strong macroeconomic expansion. That is, the time dummies virtually *must* be strongly correlated with macroeconomic series if our hypotheses about changes in supervisory toughness are true, because these hypotheses predict a supervisory toughening during the recession and a supervisory easing during the expansion. These hypotheses do not specify reasons behind the changes in supervisory toughness, so if such changes are caused by supervisory reactions to macroeconomic conditions, this is still consistent with the hypotheses. However, a bias may occur if the macroeconomic changes are strongly correlated with significant changes in bank conditions that supervisors consider in making supervisory assessments that are left out of our econometric models. Although such a bias may exist, we do not believe it to be substantial because we control for state income growth, unemployment rate, and state-average bank balance sheet and income items. We expect that these state economic environment variables capture most of the effects of macroeconomic changes on banks, because banks mostly operated within their home states during the sample. That is, we do not expect a strong separate and independent effect from conditions outside the home state, which are represented by the macroeconomic variables, given that we have controlled for state conditions.

Second, part of our measured effects of changes in supervisory toughness on lending and bank risk taking may reflect the reactions of market participants to changes in bank condition or economic environment that are not captured by our control variables, rather than changes in supervisory discipline (hypothesis 3). The fact that these models explain only a small percentage of the variance in the changes in bank lending and the changes in problem loan ratios tends to make this scenario more likely.

Third, our results are subject to sample selection problems. The proportion of banks examined each year changes quite dramatically over time, and the data suggest that a change in the sample selected for examination may alter the quality pool of the banks examined relative to the industry as a whole. Also, some banks drop out of the sample due to mergers and failures, and others enter the sample through the creation of new charters. We deal with these sample selection issues by including a large number of

controls for bank quality, by including observations even when data for lagged supervisory assessments are missing, and by using a Heckman correction for sample selection bias.

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Comment

Stephen G. Cecchetti

In their ambitious and thought-provoking paper, Allen N. Berger, Margaret K. Kyle, and Joseph M. Scalise ask the following three questions: (a) Did U.S. bank supervisors get tougher during the credit crunch?; (b) did they get easier during the banking boom?; and (c) did it matter to bank lending? Their answers are yes, yes, and maybe.

These questions are of interest both to students of banking and to researchers interested in macroeconomic phenomena more generally. In the latter case, the hope is that this work will shed additional light on the monetary transmission mechanism. Specifically, proponents of the lending view of the transmission mechanism posit that loan supply shifts are an important channel for the transmission of monetary policy changes to the real economy. Unfortunately, there are virtually no studies that have been able to distinguish loan supply from loan demand shifts in a convincing fashion—all we know for sure is that contractionary monetary policy precedes a reduction in the overall quantity of loans made by banks. The hope is that a change in supervisory toughness that is unrelated to any other macroeconomic variable will provide an instrument, in the econometric sense, that shifts loan supply but not loan demand. In these comments, I will begin with a brief overview of the methods the authors use to reach their conclusions, and then move on to evaluate what I believe can be learned from the paper.

Berger, Kyle, and Scalise examine a panel data set composed of 5,500 to 9,500 banks from 1986 to 1998. Employing the data both from examinations directly and from the call reports, they look for changes in supervisory toughness and bank lending behavior over three periods: 1986–88, their base period; 1989–92, the period generally thought to include a credit crunch; and 1993–98, a boom period for banks and nearly everyone else.

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To address the first two hypotheses, that regulators first became more harsh (hypothesis 1) and then more lax (hypothesis 2), Berger, Kyle, and Scalise study classified assets and CAMEL ratings. As they discuss in detail, the first of these is a supervisory measure of bank asset health, whereas the second is an overall measure of bank soundness. In an attempt to uncover changes in the stance of examiners, the authors estimate two models. The first is a linear regression in which they estimate determinants of (scaled) classified assets, and the second is a probability model in which they try to measure the odds of a shift in a bank's CAMEL rating. Each of their hypotheses is tested by examining dummy variables for the 1989–92 and 1993–98 subperiods. Included in their estimation as controls are numerous bank balance sheet variables as well as measures of regional economic conditions.

The results, reported in table 9.8 of the paper, are encouraging. Berger, Kyle, and Scalise find that total classified assets fell in the 1993–98 period. They also find that the CAMEL rating for a bank with a given balance sheet in a given region of the country was on average worse in the crunch period 1989–92. Unfortunately, there is no real evidence that classified asset levels went up during the crunch period or that CAMEL ratings went down during the period of ease. Nevertheless, things do look pretty good.

But, as the authors point out, when we look further, the results suggest that the change in supervisory stance is statistically, but not economically, significant. That is, the effects can be measured precisely, but are small. To show this, they compute that the change from the precrunch to the crunch period increases the percentage of classified assets by about 0.04 percent. Since the mean in the data set as a whole is about 6 percent, however, this is not a big number. For the CAMEL ratings, again the probability of a shift is also small.

It is worth pausing for a moment and considering two important issues that bear on their results: sample selection problems, and the question of what else was going on during this period. With respect to sample selection, Berger, Kyle, and Scalise provide us with a very thorough description of their data set and make clear a number of things that are going on. They also spend substantial time in section 9.3 addressing sample selection issues and are aware of the difficulties. It is still worth spending a bit of time discussing one of the issues.

As shown in table 9.5, the number of banks examined (and, consequently, in the authors' data set) increased by about 50 percent from 1986 to 1993 and then declined by a similar amount. Furthermore, the fraction of banks examined increased dramatically during the crunch period, from 43 percent in 1986 to 85 percent in 1993. Even more importantly, as is reported in Panel B of table 9.5, the total capital ratio of the banks examined went up during the capital crunch, but the capital ratio for the industry as a whole did not.

What does this all mean for the authors' results? The answer, I think, is that it biases the case against them. It does this for two reasons. First, banks that incurred the most serious wrath of the supervisors—those that were truly bad—will either merge with good banks or cease operation altogether, and so they will drop out of the sample during the crunch period. Second, the change in regulatory strategy meant that more banks were examined, and so more good banks entered the data set. Overall, then, the loss of the bad banks and the addition of the good ones will make it more difficult to find an increase in supervisory toughness because the average bank is getting better and the worst banks are dropping out. The fact that the mean CAMEL rating (table 9.4, Panel A) rises during this period is additional evidence of what was happening.

The second important issue to consider here is what was going on around this time. There were several important events, but they were at the end of the authors' crunch period. First, there was the passage of FIDICIA in 1991, which Krozner and Strahan in this volume refer to as "the most important revision of U.S. supervision and regulations during the past two decades." Associated with this was the implementation of prompt corrective action and the risk-based capital requirements based on the Basel Accord. All of these came essentially in 1992 and would lead one to expect that the most significant regulatory changes should appear in the later part of the sample, not the middle.

Turning to the third hypothesis, Berger, Kyle, and Scalise look at bank balance sheet variables to see if bank behavior was influenced by the changes in supervisory toughness. Here they examine the changes in the proportion of assets attributed to various types of loans and securities and see if changes either in a banks CAMEL rating or in its level of classified assets affect balance sheet composition. I will focus my attention on the changes in commercial and industrial loans (columns 2 and 3 of table 9.9) and the change in U.S. Treasuries (columns 8 and 9 of table 9.9), both measured as a percentage of total bank assets. The results are intriguing. Looking at the CAMEL rating, we find that any change, regardless of whether it is an upgrade or a downgrade, results in a decrease in the percentage of assets held as C&I loans, and increases the percentage of U.S. Treasuries. That is, simply having an examiner change the bank's rating results in a reduction in lending. Although one would expect this for downgrades, surely it is not the expected outcome for upgrades.

As was the case earlier, however, the results indicate that the impact is not quantitatively important. Changes in classified assets of the order we actually see result in bank portfolio movements that are on the order of 0.1 percent of their assets, at most. Again, Berger, Kyle, and Scalise are aware of this and discuss it in the paper.

The overall message of my comment thus far is that the authors' results do not seem to be quantitatively important. But I have left one question

Table 9C.1 Correlation of Year Dummy Coefficients with Macroeconomic Variables

	Lag			Lead	
Correlation with:	−2	−1	0	+1	+2
	A. Classified Assets				
Risk spread	0.66	0.59	0.03	−0.26	−0.59
Term premium	−0.79	−0.25	−0.07	0.25	0.75
Core inflation	0.54	0.65	0.50	0.25	0.04
M2 growth	0.35	0.34	0.12	−0.16	−0.54
Industrial production growth	−0.16	−0.32	−0.61	−0.68	−0.27
Trade weighted $	−0.20	−0.07	0.09	0.19	−0.42
Unemployment rate	−0.66	−0.37	0.11	0.46	0.67
	B. CAMEL				
Risk spread	−0.51	−0.12	0.28	0.55	0.89
Term premium	0.61	0.39	0.06	−0.43	−0.85
Core inflation	−0.32	−0.42	−0.30	0.13	0.32
M2 growth	0.03	−0.02	−0.01	0.26	0.66
Industrial production growth	−0.05	0.31	0.72	0.43	−0.07
Trade weighted $	0.42	0.18	−0.01	0.19	0.48
Unemployment rate	0.66	0.42	−0.13	−0.51	−0.73

Source: Dummy variable coefficients were provided by Berger, Kyle and Scalise.

Notes: Core inflation is measured by the median CPI; the term spread is the difference between the 10 year and the 3 month Treasury (constant maturity); and the risk spread is the difference between the 3 month commercial paper rate and the 3 month treasury bill rate.

unanswered. Is the authors' finding really about supervisory toughness and shifts in loan supply, or could it be about something else? In all of their work, Berger, Kyle, and Scalise do control for economic conditions in a bank's state, but they are unable to remove economy-wide activity. How important might this be? To address this concern, I have taken the annual time dummy variables estimates that come from an extended form of the regressions reported in table 9.8, and I have computed their correlation with a number of macroeconomic variables. That is, I examine the relationship between annual measures of what Berger, Kyle, and Scalise interpret as supervisory stance with measures of the state of the aggregate economy. The results of this exercise for both the total classified assets and the CAMEL regressions are reported in table 9C.1.

Looking at the table, we see that these dummy variables are highly correlated with both growth in industrial production and core inflation. For example, the contemporaneous correlation of the dummy variables with growth in industrial production is −0.61 for classified assets and 0.72 for the CAMEL rating. All of this suggests that what Berger, Kyle, and Scalise are doing is picking up the supervisory reaction to the current general economic environment. As a result, I doubt very much that what they are finding are independent measures of toughness per se.

Discussion Summary

Patricia Jackson began by noting that the CAMEL ratings reflect many things and asked whether these ratings could be disaggregated.

Mark Carey wondered if the findings were possibly a sign of the times. He noted that the press reported dire economic conditions at the time and that these might be the true macroeconomic environment in which the supervisors were operating. He also noted that the Basel Accord went into effect at year-end of 1990 and that FDICIA in 1992 increased the de facto capital requirements. He observed that these changes might have improved bank capitalization over the sample period.

Ed Ettin noted that the backlog of closures at the time might have forced supervisors to delay writing down loans, which would have reduced capital (and forced additional closures). He noted that this might have resulted in the apparent anomaly of seemingly well-capitalized poorly rated (CAMEL 4 or 5) banks. He argued that macroeconomic conditions may not have been fully captured by the included variables.

Eric Rosengren raised the idea of performing nonperforming loans such as collateral impaired loans or loans with no required payments, such as construction loans. He noted that in practice these loans may have been captured as special mention loans, reserved against by the banks, and reflected in bank capital. He observed that these loans would be reflected in the CAMEL ratings, but not captured by the regression analysis that was used in the paper and focused on classified loans.

Joe Peek suggested that the authors should focus on the thresholds for different ratings rather than the level. He argued that the average quality of a given rating might not be of as much interest as the marginal cutoffs between ratings. He suggested that the key question is whether the thresholds between adjacent ratings changed, or possibly changed differently depending on the rating? He raised a second question about the use of loans as a share of assets. Although it will be important to scale the volume and changes of lending, he observed that if the balance sheet is shrinking faster than a bank's loans, the ratio may in fact be increasing. He suggested that the authors might look at the changes in loans scaled by lagged total assets as opposed to the change in the ratio.

Michael Dooley wondered if the forecast of the macroeconomy by supervisors was biased. He also wondered whether supervisors think the economy was in fact worse than the true prediction or the actual economic condition. He noted that past-due loans might not be the best measure of future conditions.

James Barth also suggested looking at the components of the CAMEL ratings, noting that classified loans are most directly linked to the C (capital) rating. He also suggested looking at the examiners' comments because they may reflect more information than the CAMEL ratings. He pointed

out that the authors could also look at supervisory actions with respect to specific banks. Finally, he followed up on a comment from the discussant (Stephen Cecchetti) on sample selection bias, noting that bad assets do not drop out of the banking system as a particular institution is resolved.

Randy Kroszner commented on the incentives facing the regulators, suggesting a further analysis of the asymmetric loss and resource constraints faced by the supervisors. James Wilcox noted that the regulatory agencies with more asset downgrades were not the same agencies with the most CAMEL rating downgrades. He noted further that these findings suggest that standards differed across agencies during this time period.

Charles Calomiris raised an issue that is addressed in chapter 8: Is it desirable to combine central banking and bank supervision? He noted that recently most industrialized countries have been removing the bank regulatory authority from the central bank on the theory that there is a conflict of interest between bank regulatory policy and monetary policy.

Doug Diamond asked if the use of the ratings changed over time, and if the outcomes change. He also wondered if there were a change in the persistence of the ratings.

Finally, following on a point made by the discussant about the importance of managing systemic risk, *Marc Saidenberg* suggested looking at CAMEL ratings by the size of the institution. He noted that if supervisors were more concerned about systemic risk, they might have approached larger institutions differently.

In response, *Allen Berger* agreed with many of the suggestions. He noted that he and his colleagues were working on a number of the suggestions already, including the size interactions. In response to Ettin and others, he agreed with the challenge associated with classified assets and the constraints that the supervisors may have faced.

He agreed that the 'performing nonperforming' loans were a potential problem and that the authors will be looking at thresholds between ratings. He also said that the authors would look at lending and asset behavior separately. He noted that they also would be addressing sample-selection bias.

Berger also agreed with comments by Wilcox and Calomiris. He noted that although differences between agencies are controlled for in the paper, it will be difficult to address this issue because banks are not randomly assigned charter types. He noted that he liked Diamond's suggestion to look at these as a function of capital requirements. Berger also noted that generally it is interesting that many of the new capital requirements were in place by 1992, the same time that supervisors appear to be getting easier. He argued that one explanation could be that by 1992 the banks were getting their houses in order so that possibly there is a missing variable, or supervisors felt that they could relax. Berger also responded to the point by Cecchetti and others that the estimated changes in supervisory tough-

ness are highly correlated with macroeconomic changes. He pointed out that this is not inconsistent with the hypotheses. The measured effects virtually have to be strongly correlated with macroeconomic series if the hypotheses are true, because the hypotheses predict a supervisory toughening during the recession and a supervisory easing during the expansion. If the changes in supervisory toughness are caused by reactions to macroeconomic conditions, this is still consistent with the hypotheses. A bias might occur if the macroeconomic changes are strongly correlated with significant changes in bank conditions that supervisors consider in making supervisory assessments that are left out of our econometric models. He argued that although such a bias may exist, it is not believed to be substantial in part because they control for home state economic conditions, and in part because the information on future nonperforming loans and charge-offs are better proxies for the bank conditions that supervisors consider than are general economic conditions outside the home state. Also in response, *Margaret Kyle* noted that they will attempt to disentangle types of regulatory actions, recognizing that the movement from a 1 to a 2 may not be the same as that from a 2 to a 3. She noted that the use of future performance measures is in practice both difficult and endogenous. She also observed that the authors will look further at the components of ratings, but noted that the aggregate CAMEL rating is restricted to be close to the C (capital) and A (asset quality) components. Finally, she agreed that the charter switches would be an interesting topic for future research.