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Federal Reserve Bank of Boston

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Abstract

This study investigates the direct link between regulatory enforcement actions and the shrinkage of bank loans to sectors likely to be bank dependent. We focus on New England because that region has experienced both the widespread application of formal regulatory actions and substantial reductions in new lending by banks. Controlling for weakness in loan demand, previous studies have been able to attribute part of this bank shrinkage to loan supply, with the degree of a bank's shrinkage related to its capital-to-asset ratio. In this study, we further partition the shrinkage due to loan supply into the component due to explicit regulatory enforcement actions and that due to a voluntary response by bank management to low capital-to-asset ratios. We find that banks with formal actions shrink at a significantly faster rate than those without, even after controlling for differences in capital-to-asset ratios. Furthermore, much of the reduced lending has been in loan categories containing primarily bank-dependent borrowers, indicating that the capital crunch has resulted in a credit crunch.

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Bank Regulation and the Credit Crunch

Recent sluggish growth, both in bank credit and in the economy, has revived interest in potential problems with the availability of credit. Several studies (Bernanke and Lown 1991; Peek and Rosengren 1992, 1993; Hancock and Wilcox 1992) have shown that loan supply as well as loan demand contributed to the observed slow loan growth, with poorly capitalized banks expanding loans less rapidly (decreasing loans more rapidly) than their better capitalized competitors. However, three important issues are still left unresolved. First, to what extent does this situation reflect a response forced by bank regulators, rather than the voluntary behavior of a bank's management choosing to improve its capital position? Second, to what extent does the loan shrinkage occur in those categories important for bank-dependent borrowers? Third, to what extent does the shrinkage in bank loans outstanding reflect reduced bank lending?

This paper investigates the direct link between activities of bank regulators and bank lending behavior. The presence or absence of formal regulatory actions provides a measure that can be used to identify two distinct regimes: those banks constrained by regulatory enforcement actions and those not so constrained. Thus, bank shrinkage due to the enforcement of capital-to-asset ratio requirements can be separated from voluntary actions by banks to improve their capital ratios. We document that bank regulators are constraining poorly capitalized banks to achieve capital ratios well above statutory minimums, resulting in substantial shrinkage of bank assets in addition to that associated with weak loan demand. For regions of the country such as New England, where a large proportion of bank assets is in institutions under formal regulatory actions, these regulatory restrictions seriously limit the credit available from local lenders.

However, a shrinkage of bank assets does not necessarily affect bank customers. First, selling securities and loans (perhaps through securitization) will shrink a bank's assets without necessarily altering credit available to that bank's customers. Second, much of the loan shrinkage could occur in loan categories not associated with bank-dependent borrowers. While most previous studies of bank lending (for example, King 1986; Bernanke and Lown 1991) have focused on changes in gross loans held in a bank's portfolio, we also examine net new lending, correcting the change in loans held in a bank's portfolio for loan charge-offs, foreclosures of real estate loans, and net loan sales. Other things equal (including the pattern of new lending), each of these factors reduces a bank's gross loans outstanding. We also examine subcategories of assets, including one deemed to be composed primarily of loans to bank-dependent borrowers. Even after correcting for these factors, we find that the institution of a formal regulatory action causes a significant drop in a bank's lending to sectors likely to be most dependent on local bank financing.

The first section of the paper describes the conditions required for a capital crunch, the evidence to date of its effect on bank behavior, and its connection to a credit crunch.[1] The second section describes bank capital regulation, with particular emphasis on formal enforcement actions implemented for banks with inadequate capital. The third section focuses on New England banks, which have been the target of many of the formal regulatory actions following the adoption of new capital standards. It shows that formal actions require banks to quickly reach capital ratios substantially greater than

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[1]The linkage between the banking sector and reduced credit availability emanating from a capital crunch differs from earlier episodes typically characterized as credit crunches. Previous credit crunches have been associated with financial disintermediation rather than a shortage of bank capital. See, for example, Wojnilower 1980, 1985.

statutory minimums, that such actions have been applied to banks that account for a substantial proportion of bank assets in New England, and that formal regulatory actions have been associated with significant shrinkage of bank assets. The fourth section describes the data, a pooled time series and cross-section panel of large FDIC-insured banks in New England, as well as the empirical test. The fifth section presents the results, which show that formal regulatory actions applied to New England banks have resulted in a significant drop in lending to sectors likely to be bank dependent. The final section summarizes the implications of our findings.

I. The Capital Crunch

Previous research has documented the link between bank capital regulation, the loss of bank capital, and bank shrinkage, commonly referred to as a capital crunch (Peek and Rosengren 1993; Bernanke and Lown 1991; Hancock and Wilcox 1992; Baer and McElravey 1992). A reduction in bank capital lowers a bank's capital-to-asset ratio. If the reduction is large enough to push the capital-to-asset ratio below that required by capital regulations, and those regulations are enforced, the bank must increase its capital-to-asset ratio. Banks with low or no earnings have only two options: raise new capital, or reduce assets and liabilities.

Accurate assessments of troubled banks are virtually impossible without an in-depth appraisal of the loan portfolio. Thus, banks that have recently lost capital have difficulty convincing investors that prospects for the future, rather than problems of the past, motivate their attempts to raise new equity. When such incentive problems make it impossible for viable banks to raise new equity quickly and at a "fair" price in order to replenish their capital, they are forced to shrink.

Previous research has verified that poorly capitalized banks are shrinking (Peek and Rosengren 1992, for New England; Bernanke and Lown 1991, for New Jersey; and Hancock and Wilcox 1992, and Baer and McElravey 1992, for the United States). Still, three important questions have been left unanswered. The first is how much of the bank shrinkage is directly linked to bank regulation. The second concerns whether the diminished lending is in categories containing primarily bank-dependent borrowers. The third concerns whether the shrinkage in loans held by banks also entails diminished lending.

Most studies have attributed the capital crunch to the large losses in bank capital in combination with the adoption of new capital standards. However, the direct linkage to the enforcement of capital requirements has been asserted rather than proven. Banks may maintain a desired level of capital which they would quickly replenish after a large decrease in their capital, even in the absence of capital regulation.[2] And, even with capital regulation, banks may not respond to a loss of capital by quickly rebuilding their capital to the required minimum in the absence of enforcement actions. This paper addresses this issue by examining the extent to which bank shrinkage is directly tied to the enforcement actions of federal regulators.

Banks can shrink by selling securities, selling other assets, charging off loans, or reducing new lending. Because of potential liquidity problems, many troubled banks prefer to increase, or at least not reduce, their securities holdings. Banks frequently can sell assets, although it may require shedding their most profitable lines of business. Furthermore, many

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[2]Hancock and Wilcox (1992) incorporate an adjustment process whereby banks adjust actual capital to its desired level, even though that level may differ from the required minimum. In fact, some banks consistently maintain capital-to-asset ratios well above the regulatory minimum. Baer and McElravey (1992) point out that in the presence of deposit insurance, banks should not have an incentive to quickly restore capital, since their cost of liabilities is unaffected by their financial position.

types of loans, such as one- to four-family mortgages and revolving credit on credit cards, are available from banks outside the local region or nonbank sources. Thus, bank shrinkage of such asset categories should not be particularly disruptive to local credit markets.

However, certain types of loans, such as lines of credit to small businesses, may not be provided by institutions outside of the local lending market (Elliehausen and Wolken 1990; Gertler and Gilchrist 1991). If the reduction in bank assets is accomplished by reducing lending to such bank-dependent borrowers, this may seriously impair not only the long-run viability of the bank but also the operations of local business community members dependent on the lending relationship. While reducing loans at one bank can disrupt historical lending relationships, the problems should be short-lived if other well-capitalized local lenders can extend additional credit. However, if all (or most) banks in a region experience large losses of capital simultaneously (as was the case in New England), no immediate alternative source of funds may be available. Thus, the linkage from a capital crunch to a credit crunch concerns the extent to which bank asset shrinkage is concentrated in lending categories important to bank-dependent borrowers.

II. Enforcement of Capital Requirements

In response to the international agreement reached in Basle on standardizing capital regulation, as well as large losses resulting from the savings and loan debacle (see, for example, Barth 1991), bank regulators in the United States increasingly have scrutinized the adequacy of bank capital. The Basle Accord requires banks to maintain minimum capital-to-asset ratios,

with the assets weighted using broad risk classifications.[3] The minimum capital for "strong banking organizations" is 4 percent of risk-weighted assets for tier 1 capital and 8 percent for total capital. Institutions with identifiable weaknesses are expected to maintain ratios above the minimum, although it is left to each country's regulators to decide how much additional capital is necessary.

The United States supplemented the risk-based standards with a leverage ratio that requires a minimum ratio of tier 1 capital to unweighted assets. The purpose of the leverage ratio is to control for risks not captured in the Basle Accord risk weighting, such as interest rate risk. The minimum leverage ratio for the strongest banking institutions is 3 percent, with regulators requiring higher levels of capital for weaker institutions.

The regulations provide substantial leeway for regulators to determine appropriate minimum capital ratios for all but the strongest institutions. The required ratios for weaker institutions are not stated precisely in any regulations. Instead, they can be deduced only from capital targets set in various regulatory actions, the primary mechanism for forcing banks to improve their capital position before they become severely undercapitalized.[4]

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[3]For both the tier 1 and the total risk-based capital standards, government securities are assigned a zero weight, government-sponsored agency securities a 20 percent weight, residential mortgages a 50 percent weight, and loans not elsewhere included (for example, commercial real estate loans, commercial and industrial loans, loans to individuals) a 100 percent weight. Both ratios also weight off-balance-sheet assets. The ratios differ in their definitions of capital. Tier 1 capital includes equity capital, while total risk-based capital includes tier 1 capital plus subordinated debt and a portion of loan loss reserves. The details of the calculation of Tier 1 and total capital differ somewhat by regulatory agency. See, for example, 12 C.F.R § 325.

[4]Regulators also have indirect methods of forcing banks to improve their capital position. Banks that are low on capital, but are not so impaired as to require legal sanctions, may be denied authorization to acquire new

As an institution experiences financial difficulties, regulators usually undertake formal or informal action requiring the bank to take steps to improve its financial condition. In rating banks according to their financial condition, regulators consider the capital adequacy, asset quality, management quality, earnings potential, and liquidity of the institution (CAMEL). The composite CAMEL rating provides an assessment by examiners of the strength of a banking institution. Institutions with a composite rating of 4 (potential of failure, performance could impair viability) or 5 (high probability of failure, critically deficient performance), and some institutions with a CAMEL rating of 3 (remote probability of failure, flawed performance), will undergo some enforcement action.

The least serious action taken by regulators is the memorandum of understanding (MOU). This informal action, frequently taken after an examination, represents an understanding between the bank's board of directors and the regulator about deficiencies in the bank's operations and the proposed remedial action. While the agreement is not legally enforceable, failure to satisfy the MOU would likely result in a formal action being undertaken by the regulator. The MOU is generally not disclosed publicly.

For more troubled or recalcitrant banks, the regulator will normally enter a formal action, either a formal agreement or a cease and desist order. Both actions are legally enforceable and are publicly disclosed. Cease and desist orders and formal agreements are considered more severe actions compared to MOUs, and often involve less negotiation with the bank. Cease and

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institutions or to engage in new nonbank activities without first improving their capital position. In addition, the early intervention provision in the Federal Deposit Insurance Corporation Improvement Act (FDICIA) places constraints on the worst-capitalized institutions. However, most institutions would be subject to regulatory actions well before the capital provisions of FDICIA affect them.

desist orders and formal agreements both carry civil penalties. Because only the formal actions are in the public domain, we will focus on these regulatory actions, although a large number of institutions in New England have MOUs that include conditions similar to those of the formal actions.[5]

III. Enforcement Actions in New England

New England has become the laboratory for the new capital regulations, since it is the first region to experience the widespread loss of bank capital under the new regime. Since 1989, 106 New England banks have signed formal actions with the Federal Deposit Insurance Corporation (FDIC) and 41 New England banks have signed formal actions with the Office of the Comptroller of the Currency (OCC). The Federal Reserve is the primary regulator for only four state member banks in New England, none of which had formal actions as of the second quarter of 1992.[6]

Formal actions provide guidelines for improving the financial condition of the bank. Most formal actions include sections on management, strategic and capital plans to implement the bank's recovery, risk review, and a review of nonperforming assets and reserving procedures. Table 1 provides an overview of standard conditions related to capital ratios that are included in formal actions instituted during the 1989:I to 1992:II period for large FDIC-insured New England banks, with "large" defined as having more than $300 million in assets as of 1989:I.

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[5]Cease and desist orders are normally considered somewhat more punitive than formal agreements. In our sample, all formal actions by the FDIC were cease and desist orders and all OCC formal actions were formal agreements.

[6]The Federal Reserve did have formal actions with holding companies whose bank subsidiaries were under formal actions with either the FDIC or the OCC.

Table 1

Conditions Contained in Formal Regulatory Actions
FDIC-Insured Large Banks,[a] First District,[b] 1989:I to 1992:II

Total Banks	Banks with Formal Actions[c]	Based on Leverage Capital Definition (Percent of Assets)				Based on Primary Capital Definition (Percent of Assets)		Capital Plan Only	No Mention of Capital	Increase in Loan Loss Reserves (Percent of Assets)		
		8	6	5	4	8	<8			>1	<1	Increase Not Quantified
150	50	2	21	9	1	11	1	4	1	13	11	26

[a]Large banks are those with assets greater than $300 million as of 1989:I call report.
[b]New England is defined here as the First District of the Federal Reserve System.
[c]Includes formal actions with institutions that eventually failed.

One-third of these banks had formal actions. If the confidential MOUs were included, this share would be significantly larger. While many of the 1989 and 1990 formal actions required banks to maintain a capital ratio of at least 8 percent under the old capital definitions, all the specific targets in more recent formal actions were tied to the leverage ratio.[7] In addition, although no specific target was specified, four of the banks were required to provide a capital plan, and only one action required no capital plan. The most common capital target in these actions was a 6 percent leverage ratio.[8] Thus, formal regulatory actions are requiring leverage ratios that are twice the minimum required for the strongest institutions.

Requiring substantially higher leverage ratios for capital-impaired institutions has several undesirable features. First, such a policy is procyclical: as a bank's capital deteriorates, its required leverage ratio rises. Second, the higher capital requirement is applied on average assets. Thus, as a bank's capital deteriorates, all assets must be supported by the higher level of capital. This includes new loans as well as existing loans and relatively safe loans as well as more risky loans.[9] Third, the leverage ratio becomes the most binding ratio, making the risk-based ratios irrelevant for now. Table 1 also illustrates that many banks are required to substantially increase their loan loss provisions, which, in the absence of current earnings, substantially decreases their capital. Half of the formal actions in Table 1 required specific increases to the loan loss reserve. This suggests that many of the banks had previously been underreserved. At

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[7]The old definition of capital, referred to as primary capital, was principally composed of equity capital, goodwill, and allowance for loan and lease losses, divided by the sum of the quarterly average of assets and the allowance for loan and lease losses minus goodwill. (See Regulation Y, appendix B, pages 58-59 for more details.)

[8]An examination of 11 confidential capital plans (the four included in Table 1 plus seven from smaller New England banks) also found the 6 percent leverage ratio to be the most common target.

[9]Thus, banks are given the perverse incentive to originate risky rather than safe loans in an effort to generate a high enough expected return to justify the bank capital tied up by the loan.

many of the institutions, the increases were substantial, with 13 of the formal actions requiring an increase in reserves in excess of 1 percent of total assets. Raising the required capital-to-asset ratio while simultaneously requiring loan loss provisions that decrease a bank's capital amplifies the procyclical nature of the implementation of capital regulation.

Table 2 provides information on the number and assets of large New England institutions that have failed or are under formal regulatory actions. Of the FDIC-insured large banks operating in the first quarter of 1989, 25 percent have failed and 19 percent were solvent but under formal actions as of the second quarter of 1992. Because the formal actions were primarily in the largest institutions, 35 percent of 1989:I assets were in banks that were still solvent as of the second quarter of 1992 but under formal actions, while 25 percent were in banks that failed. These formal regulatory actions (which do not include the milder MOUs) affected 40 percent of the assets in large banks in New England as of 1992:II.

Table 3 orders large New England banks with formal actions by the size of the leverage ratio at the time of the exam that resulted in the formal action. The largest number of banks with formal actions had capital under 4 percent. However, the largest volume of assets was held by banks in the 4.5 to 5.0 percent and 5.0 to 5.5 percent leverage ratio ranges, together accounting for more than one-half of bank assets in large institutions with formal actions.

Table 2

Number and Asset Value of Large[a] New England Banks by 1992:II Status

	1989:I Number	1989:I ($) Assets	1992:II ($) Assets[c]
Failed[b,d]	38	52,175,871	
Solvent	96	143,677,243	174,908,742
with Formal Action	28	73,154,930	70,656,244
with No Formal Action	68	70,522,313	104,252,498
Mergers	16	12,897,259	
Totals	150	208,750,373	174,908,742

[a]Large banks are those FDIC-insured banks with assets greater than $300 million as of the 1989:I call report.
[b]Assisted mergers were counted as failures.
[c]Asset values in 1992:II include assets acquired through unassisted mergers and acquisitions of failed bank assets. Thus, comparisons with the corresponding 1989:I asset levels would overstate (understate) growth (shrinkage) on a same-institution basis.
[d]Seventeen failed banks had no formal action.

Table 3

Distribution of Banks and Assets by Leverage Ratio for Large[a] New England Banks with Formal Regulatory Actions

Leverage Ratio[b] (Percent)	Banks (Number)	Asset Value ($Millions)
<4.0	14	17,354
4.0-4.5	8	12,053
4.5-5.0	6	28,720
5.0-5.5	4	30,586
5.5-6.0	6	12,303
6.0-6.5	5	3,321
6.5-7.0	4	5,351
7.0-7.5	0	0
7.5-8.0	1	1,046
>8.0	2	1,328
Total	50	112,062

[a]Large banks are those FDIC-insured institutions with assets greater than $300 million as of 1989:I call reports.
[b]Leverage ratios and asset values computed from call report data for the quarter containing the end of the bank examination preceding formal action.

Surprisingly, even banks with leverage ratios exceeding 6 percent had formal actions. This occurred for at least two reasons. First, as a consequence of their examinations, several of these banks saw their leverage ratio drop well below 6 percent after they had fully reserved for their problem loans, suggesting that their reported leverage ratios at the time of the examination were misleading. Second, some banks with leverage ratios exceeding 6 percent were subjected to a formal action at the same time poorly capitalized banks within the same holding company were, in order to limit transfers of assets from poorly to better capitalized affiliates.

Table 4 shows how large banks responded during the year following a bank examination that resulted in a formal action. The leverage ratio improved in only slightly more than one-third of the banks, even though all but one bank shrank its assets. Less than 60 percent of the banks shrank their holdings of securities, yet every bank shrank its total loans. In addition, the bank-dependent loan category, which includes commercial and industrial loans, construction loans, multifamily residential mortgages, and commercial real estate loans, shrank at every bank with a leverage ratio below 6 percent.[10]

These tables indicate that the regulatory capital standards applied in the formal actions have been roughly twice the minimum leverage capital standard, and they have been applied to banks accounting for a significant percentage of bank assets in New England. Of course, factors other than formal regulatory actions also are likely to be important contributors to the observed bank shrinkage. In particular, the weakness of the New England economy, by slowing loan demand, likely accounts for at least some of the observed weakness (shrinkage) in loan growth. The next section provides more

[10]We use multifamily residential to refer to buildings with five or more units, that is, total residential mortgages less those on one- to four-family residences. Thus, the bank-dependent category includes commercial and industrial loans plus total real estate loans less one- to four-family residential mortgages.

Table 4

Behavior During Year Following Formal Action
Large FDIC-Insured Banks with Formal Actions, New England[a]

Banks with Formal Action = 23
Banks with Formal Action within 1 year of 1992:II call report = 7
Banks in Current Sample = 16

Leverage Ratio[b]	Number of Banks	Increase Leverage Ratio	Decrease Total Assets	Decrease Total Securities	Decrease Total Loans	Decrease C&I Loans	Decrease Real Estate Loans	Decrease Individual Loans	Decrease Bank-Dependent Loans[c]
<4.0	1	1	1	1	1	1	1	1	1
4.0-4.5	4	2	4	2	4	4	4	4	4
4.5-5.0	2	1	2	1	2	2	2	2	2
5.0-5.5	2	0	1	0	2	2	1	2	2
5.5-6.0	3	1	3	2	3	3	3	2	3
6.0-6.5	1	0	1	1	1	1	1	1	1
6.5-7.0	2	1	2	1	2	1	1	2	1
7.0-7.5	0	-	-	-	-	-	-	-	-
7.5-8.0	0	-	-	-	-	-	-	-	-
>8.0	1	0	1	1	1	1	1	1	0
Total	16	6	15	9	16	15	14	15	14
% of Total	100	37.5	93.8	56.3	100	93.8	87.5	93.8	87.5

[a]The sample of banks includes only those New England banks with assets greater than $300 million as of 1989:I that had neither failed nor acquired a nonaffiliate depository institution during the 1989:I to 1992:II period.
[b]Leverage ratios and the change in assets are measured with the call report data as of the quarter containing the end of the bank examination preceeding the formal action.
[c]Bank-dependent loans include commercial and industrial loans (C&I), construction loans, multifamily residential mortgages, and commercial real estate loans.

rigorous evidence that formal regulatory actions have significantly altered bank behavior and play an important, independent role in the shrinkage in bank assets.

IV. Data and the Empirical Test

To establish whether regulatory enforcement actions have contributed to a credit crunch, we constructed a pooled time series and cross-section panel of balance sheet and income statement data from the call reports. The sample includes all large FDIC-insured institutions in New England (defined here as the First District of the Federal Reserve System) over the 1989:I to 1992:II period, with "large" defined as those institutions with assets exceeding $300 million as of the first quarter of 1989.[11] The focus is on New England banks because this is the region where many of the formal regulatory actions have been issued under the new capital guidelines, the bank structure and regulatory guidelines were readily available, and the complaints of a credit crunch have been widespread. Furthermore, limiting the sample to one region of the country reduces the differences across banks in demand shocks compared to what would be found in a national sample. However, even though these banks did experience similar regional economic conditions, this is not equivalent to being subjected to identical demand shocks. As a result, our empirical work will also control for banking activities that may have been disproportionately affected by the recession.

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[11]Large banks account for 75 percent of all bank assets in New England. We concentrated on large institutions because the bank structure information and the formal actions were often not available for small banks, and frequently these institutions are too small to provide significant business credit. For example, a $300 million institution with 5 percent capital that did not exceed the concentration guidelines of 15 percent of its capital could not issue a loan to one borrower in excess of $2.25 million.

The panel begins in the first quarter of 1989 because the new capital guidelines that increased the emphasis regulators were placing on capital ratios were just being issued at that time. In addition, formal regulatory actions and bank structure information were not readily available for earlier periods. Finally, because of the need to control for bank structure changes, extending the sample to earlier periods would have substantially reduced the number of institutions that could be included in the sample.[12] The last available quarter was the second quarter of 1992, providing 14 quarters for the panel.

We base our estimation on a "clean" sample that includes all FDIC-insured New England banks with assets of at least $300 million in 1989:I that neither failed nor consummated an acquisition or merger with a nonaffiliated bank during the 1989:I to 1992:II period. Of the 150 large New England institutions as of the first quarter of 1989, 37 failed, 37 engaged in nonaffiliate mergers, and 8 merged with affiliates also in the sample, leaving 68 banks in our "clean" sample.

While including banks that failed or were involved in nonaffiliate mergers would provide a larger sample, doing so would introduce a number of problems. Some of the merger activity includes non-FDIC-insured institutions for which consistent data are not available. Furthermore, since the empirical

[12]Because the empirical estimation attempts to explain the change over time in a bank's asset holdings, it is important that the data series be consistent across time. For example, if bank A acquires bank B during our sample period, we would need to force merge the two banks' data for the periods preceding the acquisition so that the data series would consistently reflect the activities of the consolidated bank (A+B). Otherwise, the differenced asset series would show a jump for the quarter of the acquisition that reflected bank A becoming bank (A+B) rather than an increase in lending activity.

test focuses on the role of regulatory actions on the shrinkage of new lending, inclusion of failed banks would bias our results towards finding a relationship. A failed bank generally shrinks before being closed, as its borrowers seek new lenders and its management downsizes the balance sheet, under regulatory guidance, to facilitate the transfer of failed bank assets.

Nonaffiliate mergers pose a problem because most such acquisitions have been assisted acquisitions of failing institutions, with only partial transfers of assets (with the FDIC retaining the problem assets rather than the acquiring bank). This makes it difficult to force merge the bank data (combine the balance sheets of the merged banks for the premerger period as well) in a meaningful way. Although this has been done by a number of investigators (for example, Hancock and Wilcox 1992; Bernanke and Lown 1991) in an effort to construct a consistent data series, the consolidated data for the acquiring banks could show drops in certain asset categories at the time of the merger due to the elimination of those assets retained by the FDIC in a partial transfer. Similarly, the consolidated data could show assets to be declining during the period immediately preceding the merger when, in fact, only the acquired institution shrank as the FDIC prepared for the transfer of bank assets. This premerger shrinkage of the force-merged consolidated institution would not reflect a conscious decision by the surviving bank to shrink, and thus not accurately reflect its behavior.

Most previous studies of credit crunches have focused on gross changes in bank assets and bank loans (for example, Bernanke and Lown 1991; King 1986). However, the change in outstanding loans reflects more than just new loan originations (lending). Charge-offs (CO), transfers of real estate loans to other real estate owned (OREO) due to foreclosures, and net loan sales (LS)

can each reduce the quantity of loans outstanding without a corresponding reduction in new lending. The relationship between new lending (NL) relevant for credit availability and the change in outstanding loans (ΔL) is summarized in equation 1:[13]

$$NL = \Delta L + CO + \Delta OREO + LS. \quad (1)$$

When a loan is charged off, outstanding loans decrease by the amount of the charge-off. This alters gross loans on the balance sheet but does not represent a change in current lending, since it reflects only losses from past loans. When a real estate loan is foreclosed, the difference between the current market value of the loan and the face value of the loan is charged off and the collateral is transferred to the OREO account at its current market value. This reduces outstanding real estate loans, but reflects a shift between asset categories rather than a decline in funds made available to the real estate sector. Loan sales (or loan securitization) reduces the volume of loans on the bank's balance sheet, but again does not represent reduced lending to its customers.[14] On the other hand, loans purchased by a bank increase loans on the balance sheet without a corresponding increase in funds

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[13]Ideally, we would want the inflow of assets into the OREO category rather than the change in OREO assets. However, sales from the OREO category are not included in the call report data.

[14]The important point here is that the need to raise its capital-to-asset ratio places pressure on a bank's balance sheet, not necessarily on its flow of new lending. The bank could shrink its portfolio of loans while continuing to meet the borrowing needs of its current loan customers by selling loans (or participations in loans). Thus, both loans held and loans originated are of interest. For regulatory purposes, the emphasis is on the bank's balance sheet, and for credit crunch issues, the emphasis is on new lending. In practice, when a bank comes under a formal action, new lending as well as loans held in the bank's portfolio decline, although not necessarily with the same timing or to the same degree.

made available to the bank's local bank-dependent loan customers. Failure to make these adjustments could cause one to conclude that lending has decreased when, in fact, the decline in outstanding loans at a troubled bank was due to large charge-offs, foreclosures, and/or net loan sales.

Reduced credit availability from banks to a firm is important if the credit is not easily replaced from other sources. Many categories of a bank's loans are also available from other sources, both from nonbanks and from banks outside that bank's immediate lending market. For example, owner-occupied one- to four-family mortgages are actively traded in a national secondary mortgage market so that the financial impairment of local banks is unlikely to prevent homeowners from obtaining mortgage credit. Similarly, credit cards and car loans are frequently provided by institutions outside the immediate banking market of the borrower, limiting the impact on credit availability of localized problems in the banking sector. Thus, if local banks shrink by selling securities, originating fewer one- to four-family mortgages, or reducing credit card receivables, local bank-dependent borrowers are not likely to experience greater difficulties in obtaining financing.

Some areas of bank credit, however, have few alternative sources outside of local banking markets. Small to medium-sized commercial and industrial (C&I) loans, construction loans, multifamily residential mortgages and commercial real estate loans are all loans typically made by local banks and

are generally not easily securitized.[15] Thus, we combine these loan classifications into our bank-dependent loan category.

This combination also allows us to avoid several data problems. Because the call reports classify as a real estate loan any loan with real estate as collateral, many loans to small and medium-sized firms with some real estate collateral are categorized as real estate loans. In addition, as a result of their collateral becoming impaired and criticism of their classification system by examiners, many banks have made large classification changes among the commercial and industrial, construction, and commercial real estate loan categories that can distort the data if the categories are analyzed separately (Peek and Rosengren 1993).

In its simplest form, the equation estimated is:

$$(2)\quad \frac{\Delta A_{j,i,t}}{A_{i,t-1}} = \alpha_1+(\alpha_2+\alpha_3\frac{K_{i,t}}{A_{i,t}})FA_{i,t}+\alpha_4\frac{K_{i,t}}{A_{i,t}}(1-FA_{i,t})+\alpha_5 LogA_i+\alpha_6 FEE_i+\alpha_7 DSB_i+\epsilon_{i,t}$$

The dependent variable is the change in asset category j of bank i scaled by total assets of bank i. The equation includes a dummy variable for formal actions (FA) with a value of one for any quarter the bank is under a formal

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[15]Large companies can generally borrow directly from the credit markets by issuing commercial paper or corporate bonds, or by taking out large loans from banks outside the local area or nonbanks, such as pension funds or life insurance companies. Thus, because the largest borrowers in each of these categories are likely to have access to national credit markets, only a portion of loans in these categories are made to truly bank-dependent borrowers. However, because a disproportionate share of borrowers at banks are likely to be bank dependent, significant shrinkage by banks is likely to include bank-dependent borrowers. Unfortunately, lending data by size of borrower are not available.

regulatory action and zero otherwise. Equations estimated in the existing literature include a special case of this more general formulation with the capital-to-asset ratio as an argument but FA omitted, that is, with $\alpha_2=0$ and $\alpha_3=\alpha_4>0$. However, if it is the imposition of formal regulatory actions rather than low capital-to-asset ratios alone that causes banks to shrink (or at least grow more slowly), we would expect to find $\alpha_2<0$ and both α_3 and α_4 not significantly different from zero.

However, such a specification may be too restrictive. Formal actions may not affect the change in assets (and its components) by the same percentage of total assets for each quarter a formal action is in effect. Because formal actions specify a leverage ratio, usually 6 percent, that the bank is legally required to achieve, the most poorly capitalized banks have the greatest incentive to shrink. Thus, the magnitude of the effect of formal actions on the change in assets may differ across banks, in particular, being related to a bank's leverage ratio. This hypothesis can be tested by specifying the coefficient on FA to be a function of the leverage ratio as in equation 2, with α_3 predicted to be positive. We also include the leverage ratio for banks not under a formal action as an argument in the equation to enable us to test for an effect of formal regulatory actions over and above any voluntary bank response to stated capital requirements. That is, being below minimum capital requirements may not in itself generate a bank response to restore its capital position in the absence of formal regulatory actions.

While many of the differences in the demand for loans across banks will be ameliorated by concentrating on banks in one region, we also include a series of classification variables intended to control for any differences arising from a bank's specialization in particular types of activities that

may have experienced different demand shocks. The logarithm of bank asset size (LogA) is included because large banks may support different loan markets than smaller institutions. National banks, for example, are constrained to lend not more than 15 percent of their capital to any one borrower (see footnote 11). This prevents smaller institutions from making large loans. If loan demand varies by size of borrower, loan growth may vary by size of institution.

Many banks in New England derive substantial non-interest income. Banks concentrated in off-balance-sheet activities may be better insulated from loan demand changes. To control for this difference across banks, we include the ratio of fee income to the sum of total interest and fee income (FEE) for the first quarter of 1989 for each bank.[16] We anticipate a positive estimated coefficient.

Until the mid-1980s, New England savings banks were prevented from lending to businesses and tended to focus on home mortgages. Because the shocks to commercial loan demand may be different from those to residential loan demand, we include a dummy variable (DSB) that has a value of one for those institutions with a savings bank charter and zero for those with a commercial bank charter.

V. Empirical Results

All of the regression results presented in the tables are estimated with a variance components model. This model is economically appealing because it

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[16]The first quarter is very highly correlated with the total for the calendar year 1989. To use the 1988 value, we would be required to incorporate bank structure changes for 1988 as well, further reducing the number of banks that could be included in our "clean" sample.

allows for bank-specific effects, such as bank management, that are not easily quantified. In this case, α_1 in equation (2) would become $\alpha_{1,i}$, with each bank having its own constant term. While a fixed-effects specification would treat the $\alpha_{1,i}$'s as constants, the variance components model treats them as mutually independent random variables that are independent of the equation's error term. It is assumed that the $\alpha_{1,i}$'s are drawn from a common distribution with a finite variance.

The fixed-effects specification that includes a dummy variable for each institution was tried but did not materially change the results. In addition, the Hausman test could not reject the variance components specification relative to the fixed-effects specification. Thus, the statistical tests indicated that the variance components model was more appropriate for this application.

Table 5 presents the results of estimating equation (2) for total assets and for five asset categories. All estimated equations included a set of dummy variables to control for differences in the constant term for each time period (not reported in the tables). The gross change in both assets and loans is included for comparison with previous studies. The change in total securities is included to investigate the extent to which banks react to regulatory actions by shrinking securities, which would have no direct impact on credit availability to bank-dependent borrowers. We also include as dependent variables three alternative proxies for bank-dependent loans. The first is the gross change in bank-dependent loans (BD, the sum of construction, multifamily residential, commercial real estate, and commercial

Table 5

The Effects of Formal Actions and Leverage Ratios on Asset Categories

Estimation Method: Variance Components

Independent Variable[a]	Δ Assets / Assets	Δ Securities / Assets	Δ Loans / Assets	Δ BD Loans / Assets	Δ BDN Loans / Assets	Δ BDNS Loans / Assets
Constant	-.218	.278	-.019	.467	.836	8.987**
	(3.567)	(2.408)	(2.748)	(2.348)	(2.159)	(3.473)
Formal Action	-3.800**	-1.074	-2.304**	-1.381*	-1.407*	-1.590*
	(1.046)	(.741)	(.844)	(.646)	(.596)	(.754)
Leverage Ratio* Formal Action	.517**	.138	.336*	.269**	.310**	.154
	(.170)	(.121)	(.138)	(.104)	(.096)	(.120)
Leverage Ratio*No Formal Action	.108	-.005	.118	.047	.036	-.017
	(.083)	(.057)	(.065)	(.053)	(.048)	(.067)
Log Assets	-.027	-.069	.012	-.036	-.067	-.552*
	(.251)	(.169)	(.193)	(.165)	(.152)	(.246)
Savings Bank Dummy	.658	.137	-.174	-.121	.022	.039
	(.455)	(.307)	(.350)	(.300)	(.276)	(.448)
FEE	14.383**	.968	4.027	1.852	1.694	.137
	(3.633)	(2.444)	(2.789)	(2.404)	(2.210)	(3.616)
Theta	.656	.770	.765	.535	.541	.275
R^2	.105	.037	.103	.048	.041	.056
SSR	13470	7154	9232	5094	4356	5612
SER	4.108	2.994	3.401	2.527	2.336	2.652

[a]Each estimated equation also includes a set of dummy variables (not reported in the table) to control for differences in the constant term for each time period.

Standard errors in parentheses

*: Significant at the 5% confidence level

**: Significant at the 1% confidence level

and industrial loans). The second adds charge-offs on bank-dependent loans and changes in OREO to obtain a measure of net loans for bank-dependent borrowers (BDN).[17] The final column (BDNS) adds net sales of commercial and industrial loans to BDN to convert the change-in-loans measure to a measure of net new lending to bank-dependent borrowers.[18]

The results in column 1 in table 5 show that formal actions do have a significant impact on bank shrinkage. The effect of formal actions on the change in assets is captured by two variables, a formal action intercept dummy variable and a formal action dummy variable that interacts with the leverage ratio. The estimated coefficient on the formal action intercept dummy variable measures the effect of the formal action controlling for the effects of the capital-to-asset ratio. The estimated coefficients on both the formal action variable and the formal action*leverage ratio interaction variable are of the predicted sign and significantly different from zero at the 1 percent confidence level. On the other hand, the estimated coefficient on the

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[17]Charge-offs on bank-dependent real estate loans were calculated as total real estate loan charge-offs less those on one- to four-family mortgages. Because charge-offs for the components of real estate loans are not available prior to 1991:I, they were constructed using the average ratio of charge-offs on one- to four-family mortgages to the level of one- to four-family mortgages for each individual bank based on the six quarters of available data. For observations prior to 1991:I, the ratio was multiplied by the level of one- to four-family mortgages to obtain charge-offs on one- to four-family mortgages. We included the portion of OREO not categorized as one- to four-family houses. However, the OREO category is not disaggregated prior to 1992:I. For observations prior to 1992:I, we applied the average proportion for each bank, based on the two available observations, to the observed level of total OREO.

[18]The call report data include loan sales of commercial and industrial loans with no recourse, but do not include recourse loans or sales of construction, multifamily residential, or commercial real estate loans. However, these latter three categories are not generally sources of large quantities of bank loan sales.

leverage ratio for banks not subject to formal actions is smaller in magnitude and not statistically significant.

The estimated coefficient on FA indicates that for each quarter that a formal action is in force, total bank assets shrink by an additional 3.8 percent, controlling for differences in the leverage ratio. However, because leverage ratios with and without formal actions have different estimated impacts, the effect of the leverage ratio must also be incorporated in order to calculate the net additional impact of formal actions on asset shrinkage. For example, for a bank with a 4 percent leverage ratio, the additional shrinkage due to the implementation of a formal action is 2.2 percent of assets per quarter.[19] Recognizing that a higher leverage ratio mitigates the degree of shrinkage associated with a formal action, an alternative measure of the relative effect of formal actions is the value of the leverage ratio at which formal actions cease to retard asset growth. Again, this can be calculated using the estimated coefficients on formal actions and the two leverage ratio interaction variables.[20] For total assets, this "break-even" value for the leverage ratio is 9.29 percent.

Since none of the formal actions placed on New England institutions in our sample have been removed and banks with formal actions tend to have leverage ratios well below the "break-even" leverage ratio, one would expect

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[19]Using the notation in equation 2, this is calculated as

$$\alpha_2 + (\alpha_3 - \alpha_4)*K/A.$$

In this case, the calculation would be -3.800 + (.517 - .108)*4 = -2.164.

[20]We solve for the value of the leverage ratio where the impact on asset growth on banks with formal actions is the same as on those without. That is, the value of the leverage ratio that is obtained from solving:

$$\alpha_2 + \alpha_3*K/A = \alpha_4*K/A,$$

where α_2, α_3, and α_4 correspond to the equation 2 notation, and their estimated values from column 1 in table 5 are used.

to find that formal actions have accounted for a significant decline in the gross assets of banks. Based on the estimates in table 5, the subset of New England banks included in our sample accounts for a $6 billion reduction in bank assets due to formal actions taken during the 1989:III to 1992:II period, with relatively more of the reduction occurring in the later quarters as more bank assets came under formal actions. This represents 6.7 percent of the assets of banks in our sample as of 1989:II, the quarter immediately prior to the first of the formal actions recorded in our sample.

Column 2 shows that the additional shrinkage in total assets has not been at the expense of securities holdings. This failure to sell securities in response to a formal action may reflect liquidity concerns. This may be particularly relevant today in the wake of the restrictions on discount window borrowing contained in the Federal Deposit Insurance Corporation Improvement Act (FDICIA), and the zero weight given government securities under the risk-based capital standards.[21]

Both total loans and bank-dependent loans also have a sizable response to formal actions (FA), with estimated coefficients on both FA and the interaction term that are of the predicted sign and statistically significant. Again, the leverage ratios for banks not under formal actions have estimated coefficients that are smaller in magnitude and not statistically significant. Repeating the calculations made for total assets, the "break-even" leverage ratios for total loans and for bank-dependent loans are 10.6 percent and 6.2

[21]Most institutions required to satisfy a 6 percent leverage ratio will find this much more binding than the risk-based standards. Substitution of securities for loans will relieve a binding risk-based capital ratio, but will do nothing to relieve a binding leverage ratio. Thus, faced with a binding leverage ratio, any increase in securities requires institutions to reduce loans even more.

percent, respectively. At a 4 percent leverage ratio, the implied shrinkages due to formal actions are 1.4 percent and 0.5 percent of total assets per quarter, respectively.

Because the asset categories are scaled by total assets, these percentages understate the percentage declines in the asset categories themselves. For example, because bank-dependent loans account for roughly one-third of total bank assets, the implied percentage decline would be in the range of 1.5 percent per quarter. In dollar terms, the reduction in loans attributable to formal actions is $4.2 billion, representing 6.7 percent of the 1989:II value of loans for the banks in our sample. For bank-dependent loans, the corresponding decline is $765 million, 2.5 percent of bank-dependent loans.

The adjustments to the bank-dependent loan category for charge-offs and the change in OREO leave the effect of formal actions statistically significant, but reduce (in absolute value) the magnitude of the effect somewhat. This is as expected, since the net bank-dependent loan (BDN) category adds back to bank-dependent loans (BD) charge-offs and the change in OREO to reflect the fact that the reclassification of bank-dependent loans does not, in and of itself, reduce the funds made available to these borrowers. That is, a part of the reduction in bank-dependent loans in bank portfolios is a consequence of charge-offs and foreclosures rather than reduced lending.

When net bank-dependent loans are adjusted for net loan sales, the effect of formal actions on loan growth triples (doubles compared to BD). That is, by adding back loan sales (and subtracting purchases) from the change in loans held in a bank's portfolio, the difference between the rates of loan

growth for banks with and those without a formal action widens. At a 4 percent leverage ratio, formal actions account for a reduction in bank-dependent lending of 0.91 percent of total assets per quarter, with a "break-even" leverage ratio of 9.3 percent. In dollar terms, the decline is $2.5 billion, representing 8.3 percent of 1989:II bank-dependent loans. Thus, our results indicate that the effect of formal actions on lending is even more pervasive than that on the change in loans held by banks.

One explanation for this result is that banks not under formal actions tend to sell more loans (raising ΔBDNS relative to ΔBDN). For bank-dependent loans, loan sales may reflect primarily participations in newly originated loans, that is, underwriting activity, rather than sales of seasoned loans from a bank's portfolio. In that case, better-capitalized banks likely account for the bulk of loan sales. Large borrowers may prefer to establish their primary borrowing relationship with a healthy rather than a troubled bank. And, to the extent sold loans have implicit recourse to the loan originator, loan purchasers may prefer to purchase loans from better-capitalized banks. Thus, we might expect underwriting activity to decline at a bank placed under a formal action. At the same time, a bank placed under a formal action might be expected to decrease loan purchases (narrowing the difference between the changes in loans and lending), given that this represents a relatively quick and painless way to slow its loan growth compared to breaking long-term lending relationships with its current customers.

In fact, in our sample, banks without formal actions are nearly twice as likely as those under formal actions to be net sellers. Only 42 of the 154 observations (27 percent) of banks with formal actions are net sellers of

these loans, compared with 46 percent of the non-formal-action observations. And, among those banks with formal actions, there is no obvious relationship between net loan sales and leverage ratios: net loan sellers are as likely to have high as low leverage ratios.

Only 26 of the 154 observations of banks with formal actions are net purchasers of these loans. Of those 26, 22 are accounted for by the better capitalized affiliates of two holding companies. Thus, it appears that troubled affiliates with formal actions are likely raising their leverage ratios by shifting assets to their better capitalized affiliates. Among banks with formal actions associated with their own capital situation (as opposed to that of their affiliates), there is essentially no net loan purchasing action. On the other hand, only 12 percent of the observations in our sample not under formal actions are net purchasers. Fifty-six percent of the observations with formal actions and 42 percent of those without formal actions have no net loan sales (or purchases).

While the coefficient on FEE is significant at the 1 percent confidence level in the total assets equation, it is not statistically significant in the disaggregated asset equations. This is in part due to the smaller percentage of loans made at banks whose main source of income is from fees rather than interest. The estimated coefficient on the log of assets is significant at the 5 percent confidence level in only the BDNS equation, and the savings bank dummy is not significant at the 5 percent confidence level in any of the equations.

Consistent with earlier studies, when the explicit effects of formal actions are ignored, the leverage ratio has a positive impact on asset and loan growth, being statistically significant in all but the securities and net

lending categories (not shown in tables). However, the Table 5 results show that once formal actions are taken into account, the statistical significance of the leverage ratio for banks not under a formal action disappears, suggesting that previous equations were misspecified. Now, the leverage ratio has a significant impact only for those banks under formal actions. Although the estimated coefficients for banks without a formal action always have magnitudes much smaller than those for banks with formal actions, the differences are statistically significant only for the total assets, bank-dependent loans, and net bank-dependent loans categories.[22] The failure to find a stronger effect on the leverage ratio for banks without formal actions would seem to indicate that until the threat of explicit penalties contained in formal actions is made, banks are much slower to shrink to satisfy capital requirements.

One notable characteristic of the equations in table 5 is their relatively low R^2. One explanation for this is that the data are panel rather than time series data and the dependent variables have been differenced. Furthermore, if our hypothesis that loan demand effects are spread relatively evenly across the banks in the New England region is correct, low R^2's would not be surprising since the fitted part of the equation would not reflect the impact of reduced loan demand. In fact, given that the fixed effects specification was rejected and the control variables tend not to be significant, individual bank effects, such as would be associated with

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[22]These differences occur even though many of the institutions without formal actions have MOUs, which also require (but not as forcefully) improvements in the leverage ratio. Thus, if anything, the differences between the estimated coefficients on the leverage ratio with and without a formal action would be larger if MOUs were explicitly taken into account.

differential loan demand shocks across banks in the region, do not appear to be present.

Table 6 relaxes the constraint that a formal action has the same effect in each quarter in which it applies. Now, the coefficient on formal actions is allowed to have a different value for each quarter the formal action is in effect. Formal Action (0) is a dummy variable with a value of one in the quarter of the bank exam that resulted in a formal action and zero otherwise. Similarly, Formal Action (1) has a value of one for the first quarter following the quarter containing the initial exam date and zero otherwise, and so on. Formal Action (8) denotes all observations 8 or more quarters after the initial exam. While this specification asks a lot from the data, it can provide some indication of the relative timing of banks' responses to formal actions.

The results indicate that the shrinkage is generally spread out over time. For the total assets equation, the estimated coefficients indicate a decline in excess of 3 percent per quarter and are significantly different from zero at the 5 percent (or better) confidence level through the seventh quarter after the initial exam. The equations for total, bank-dependent, and net bank-dependent loans show generally stable coefficients through the fifth quarter after the exam before falling off, with the most significant effects (economically and statistically) clustered two to five quarters after the exam. The estimated coefficient on leverage*formal action is significant at the 1 percent confidence level for all but the securities and BDNS equations. The relative patterns of the coefficients and their significance levels for the leverage ratios for banks with and without formal actions are similar to those presented in Table 5.

Table 6

Adjustment to Formal Actions

Estimation Method: Variance Components

Independent Variable[a]	Δ Assets / Assets	Δ Securities / Assets	Δ Loans / Assets	Δ BD Loans / Assets	Δ BDN Loans / Assets	Δ BDNS Loans / Assets
Constant	1.229 (3.589)	.394 (2.479)	1.710 (2.735)	1.054 (2.379)	1.192 (2.187)	7.122* (3.561)
Formal Action (0)	-4.171** (1.460)	-.158 (1.053)	-3.916** (1.183)	-1.903* (.879)	-1.428 (.812)	.710 (.971)
Formal Action (1)	-4.214** (1.430)	-1.642 (1.033)	-2.859* (1.160)	-.683 (.858)	-.682 (.792)	.238 (.937)
Formal Action (2)	-4.830** (1.399)	-1.205 (1.011)	-3.452** (1.136)	-1.767* (.839)	-1.765* (.775)	-.516 (.917)
Formal Action (3)	-4.934** (1.374)	-1.306 (.992)	-4.045** (1.114)	-1.989* (.827)	-1.912* (.764)	-.621 (.914)
Formal Action (4)	-6.163** (1.395)	-.483 (1.007)	-4.102** (1.132)	-1.940* (.838)	-1.498 (.775)	-1.386 (.927)
Formal Action (5)	-3.974** (1.416)	-.946 (1.023)	-4.006** (1.149)	-2.887** (.851)	-2.912** (.786)	-2.141* (.941)
Formal Action (6)	-3.764** (1.431)	-1.675 (1.034)	-1.789 (1.162)	-.616 (.859)	-.973 (.794)	-1.111 (.950)
Formal Action (7)	-3.073* (1.559)	-1.605 (1.127)	1.041 (1.267)	-.587 (.935)	-.556 (.864)	-3.222** (1.032)

Table 6 - continued

Adjustment to Formal Actions

Estimation Method: Variance Components

Independent Variable	Δ Assets / Assets	Δ Securities / Assets	Δ Loans / Assets	Δ BD Loans / Assets	Δ BDN Loans / Assets	Δ BDNS Loans / Assets
Formal Action (8)	-2.137	-.587	-1.255	-.650	-.763	-1.757
	(1.423)	(1.024)	(1.149)	(.862)	(.796)	(.970)
Leverage*Formal Action	.631**	.133	.504**	.303**	.317**	-.053
	(.188)	(.135)	(.151)	(.114)	(.105)	(.129)
Leverage Ratio*No Formal Action	.088	-.006	.100	.039	.031	.001
	(.083)	(.058)	(.064)	(.053)	(.049)	(.069)
Log Assets	-.124	-.076	-.112	-.074	-.088	-.418
	(.252)	(.174)	(.192)	(.167)	(.154)	(.252)
Savings Bank Dummy	.684	.136	-.118	-.119	.016	-.074
	(.447)	(.308)	(.339)	(.298)	(.274)	(.455)
FEE	14.906**	1.100	4.566	2.030	1.811	-.497
	(3.565)	(2.452)	(2.701)	(2.385)	(2.192)	(3.671)
Theta	.692	.776	.814	.540	.547	.262
R^2	.118	.043	.131	.063	.056	.079
SSR	13376	7114	9015	5014	4291	5454
SER	4.115	3.001	3.378	2.519	2.331	2.627

[a]Each estimated equation also includes a set of dummy variables (not reported in the table) to control for differences in the constant term for each time period.

Standard errors in parentheses

*: Significant at the 5% confidence level

**: Significant at the 1% confidence level

The timing of the effects of formal actions on bank-dependent loans is affected by the net loan sales adjustment.[23] Compared to the change in bank-dependent loans held in bank portfolios, the shrinkage in lending occurs later, with much less shrinkage during the year immediately following the examination that resulted in the formal action. The evidence suggests that initially banks do not react by reducing new lending to bank-dependent borrowers, but rather by decreasing purchases or, perhaps, increasing loan sales (although in our sample, banks without formal actions are almost twice as likely to be net sellers of these loans). Perhaps this reflects a reluctance by banks to harm existing lending relationships. It may also reflect the nature of the loans. If these are not demand loans (and are not sold), the lender would have to wait until the loan matured or violated covenants in order to remove the loans from its books. In fact, some of the bank-dependent loans (for example, construction loans) do have relatively short maturities. Thus, the reduction in loans, even in the absence of new lending, would occur only after a delay. However, when the shrinkage does finally occur, it is dramatic, with the additional loan shrinkage representing more than 3 percent of total assets (roughly 9 percent of bank-dependent loans) in a single quarter.

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[23]Net loan sales and purchases significantly increase the variance of the bank-dependent loan series. Many banks do not sell or purchase loans. For these institutions, BDN and BDNS are equivalent. For those that do it infrequently, the sales and purchases are lumpy, causing a large single-quarter change. In addition, many of the loan sales are between affiliates of the same holding company. Binding capital ratios would encourage institutions to sell loans from their weakly capitalized subsidiaries to their better-capitalized subsidiaries.

IV. Conclusion

Previous research has documented a significant correlation between capital ratios and bank shrinkage (Bernanke and Lown 1991; Peek and Rosengren 1992; Hancock and Wilcox 1992), but left untested whether this link was related to regulatory policy and whether it affected credit availability to bank-dependent borrowers. This paper fills that gap. The correlation between bank shrinkage and capital ratios could be the result of voluntary actions by undercapitalized banks seeking to improve their capital ratios. However, we find no independent role for leverage ratios causing bank shrinkage in the absence of formal actions, even though many of the banks not under formal actions have MOUs. Apparently a threat of civil and criminal penalties, rather than vague regulations on bank capital requirements, is necessary to induce banks to quickly increase their capital-to-asset ratios so as to meet minimum capital requirements. Thus, the capital crunch reported in previous work is shown to have an explicit regulatory link.

Most recent studies have looked at changes in the stock of loans (Bernanke and Lown 1991; Hancock and Wilcox 1992). However, a credit crunch concerns a reduction in the flow of loans (lending). A difference between the change in loans outstanding and new lending can occur because the stock of loans is affected by charge-offs, transfers of foreclosed real estate loans to OREO, and net loan sales. We correct for these factors to obtain a measure of the net flow of new funds made available to a bank's loan customers. We also focus on the categories of loans that are most likely to be given to bank-dependent borrowers, rather than total assets or total loans (where loan sales can be particularly important).

The findings indicate an explicit regulatory link to the shrinkage of

both bank loan portfolios and bank lending. The shrinkage that occurs as a result of formal actions is not only statistically, but also economically, significant. And, this shrinkage is in addition to any bank shrinkage due to weak loan demand associated with weakness in the overall economy.

The pattern of bank balance sheet shrinkage is also important. The shrinkage is not concentrated in securities holdings; loans are declining. More importantly, a large share of the shrinkage occurs in the bank-dependent loan category, and the shrinkage is in lending as well as loans already held in the bank's portfolio. Because formal actions have been particularly widespread in New England, including most of the largest lenders in the region, and these are the loans with few nonbank alternatives, bank-dependent borrowers who have traditional banking relationships severed may have great difficulty finding new financing. Because so many bank loans are generated locally, and because informational and regulatory impediments deter the transfer of bank capital and credit across regions, our evidence suggests that New England did suffer from a regulatory-induced credit crunch.

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