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Risk-based Capital Standards and the Credit Crunch

ONE OF THE MYSTERIES of the sluggish recovery from the 1990–91 recession was the failure of the economy to respond to the stimulus of lower interest rates, with one often-cited explanation for the slow recovery being the failure of the banking system to play its normal role in the transmission of the monetary policy stimulus to the economy. Some analysts put part of the blame both for the recession and the slowness of the recovery on a decline in bank lending.¹ It has become common to refer to this situation as a “credit crunch,” more because of the allure of alliteration than because of its contribution to analytic clarity. In the past the term was used to describe situations in which borrowing was restricted at lower than market-clearing interest rates, perhaps by such restrictions as usury ceilings. This time it seems to refer to an unwillingness of banks to lend, regardless of rates.

Several alternative explanations for a reduced willingness to lend have been advanced, including increased risk aversion and increased criticism from bank examiners.² We believe that if there is anything to the credit crunch or banker reluctance

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1. Conventional macroeconomic explanations are not completely satisfactory. Most analysts view monetary policy during the recovery period as appropriately stimulative, as indicated by the very dramatic decline in short-term interest rates and the smaller but still significant decline in long-term rates. However, some monetarists believe that the growth of the monetary aggregates was slower than conditions warranted. It is equally difficult to evaluate fiscal policy during this period. The federal deficit has been very large during the recession and recovery periods, both in absolute terms and as a percentage of GDP. The deficit did decline during the recovery period, and it appears that fiscal policy did not contribute to recovery to the extent that it has in past recoveries.

2. Increased risk aversion on the part of banks might result from large loan losses during the 1980s. But such a change in risk preference with respect to lending would simply shift the supply curve to the

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to lend hypothesis, it is to be found in the risk-based bank capital requirements that became fully effective in 1992.³ The effect of the risk-based standards has been much discussed, but with the exception of papers by Bernanke and Lown (1991) and Berger and Udell (1994), there has been little empirical investigation of the effect of these risk-based requirements on bank lending. Baer and McElravey (1993) find that the level of capital at which banks begin to shrink assets has increased as regulatory capital requirements increased, and that the proportion of banks whose growth was constrained by capital requirements reached an all time high between June 1989 and June 1991. Moore (1992), Baer and McElravey (1992), and Cantor and Johnson (1992) all establish a link between higher capital ratios in general and asset growth for bank holding companies in the 1989–91 period.

Furlong (1992) finds that during 1991 the difference between the equity capital/total asset ratio and estimated average target ratios for large and small banks was significantly associated with reduced lending. Peek and Rosengren (1993) find that for banks in New England, formal regulatory actions caused banks to shrink, although leverage ratios alone played no role in the reductions. Berger and Udell (1993) attempt to measure the importance of the various explanations for the slow growth of bank lending, and conclude that the risk-based capital requirements had little effect. The hypothesis that banks with high risk-based capital ratios would increase their lending at a greater rate than banks with low ratios was not supported by the data.

Of course, it is not easy to tell whether a decline in bank lending is the *cause* of the weakness in business activity, or the *result*. Bankers during this period, particularly in response to criticism from Administration officials and Congress, have argued that loan demand was very weak. Kliesen and Tatom (1992) share this view, saying that bank loans are historically used to finance inventories and that the decline in bank lending was commensurate with the decline in business inventories.

This paper takes a different approach to modeling the effect of the risk-based capital requirements. We view the 1988 Basel Agreement on risk-based capital standards as a shock to the credit supply system, along the lines of the model presented by Bernanke and Blinder (1988). We look for differences in bank lending between 1987 and 1991 based on how those banks were affected by the risk-based standards. Unlike the studies cited above (that is, Berger and Udell 1994) that focus on *levels* of capital, we look at the *change* in excess capital directly caused by the announcement of the risk-based requirements. We calculate the *difference* between the capital required in 1987 under the old guidelines and the amount required under the risk-

left. With an upward-sloping supply curve, this would result in higher interest rates, but would not explain an increase in complaints from disappointed borrowers willing to pay going market rates [although Stiglitz and Weiss (1981) do present a model in which the loan supply curve is not necessarily upward sloping, and this type of credit rationing could occur].

It is probable that examiner criticism of loans did increase in the late 1980s and 1990s. Many examiners believed that they would not be criticized for being overly tough with the banks they examined, but their jobs might be endangered if they overlooked something that later turned out to be significant.

3. It is for this reason that Richard Syron (1991) noted that this might be better referred to as a "capital crunch."

based guidelines. This allows for the possibility that banks maintain self-imposed capital ratios rather than simply react to explicit regulatory requirements. That is, some banks have high capital ratios because they have a preference for high capital ratios, and these banks will not leverage that capital to the full extent allowed by regulation. This paper also examines the link between lending and *exogenous* changes in excess capital (due to changes in regulation), while the studies previously cited look at the link between lending and equity ratios.⁴

Section 1 of the paper outlines the risk-based capital standards and their differential impact on U.S. banks. Section 2 describes the data and our approach to examining the impact of the capital standards on loan growth, and discusses the results. Conclusions are summarized in section 3.

1. RISK-BASED CAPITAL REQUIREMENTS

It has long been recognized that high capital requirements are an effective way to protect depositors (or the deposit insurance system) against bank failure. Regulators in the United States were moving banks in the direction of higher capital during the 1970s and 1980s, but faced complaints that higher U.S. capital requirements put American banks at a disadvantage in competition with foreign banks. The problem was resolved by the 1988 Basel agreement on risk-based capital that imposed new, but not necessarily higher, capital standards on banks.

Under the risk-based standards, banks holding risky assets, such as business loans, would be subject to higher capital requirements than banks with assets concentrated in holdings of government securities or single-family mortgage loans.⁵ The risk of off-balance-sheet transactions, such as issuance of letters of credit, or futures transactions, were taken into account, and banks were required to hold capital against such contingent obligations.

The components of bank capital were changed, as well as the required ratios. Whereas banks were previously required to meet primary and total capital ratios of 5.5 percent and 6 percent respectively, the new standards required banks to hold Tier 1 capital equal to 4 percent of risk-adjusted assets, and total capital of 8 percent of risk-adjusted assets. Tier 1 capital was defined, essentially, as common stock and undivided profits (and perpetual noncumulative preferred stock), less most intangible assets. Tier 2 capital includes subordinated debt, most preferred stock, and allowances for loan losses (up to a maximum of 1.25 percent of risk-adjusted assets).

It is important to note that for most American banks the new requirements were *lower* than the previous standards.⁶ This was particularly true for smaller banks

4. We are indebted to the referee for this formulation.

5. The regulations regarding the risk-based capital requirements can be found in the Code of Federal Regulations, 12 CFR 225. For a more general description, see Keeton (1989).

6. Table 2 shows that over 80 percent of all commercial banks in existence in 1987 and 1991 had larger capital surpluses under the risk-based standards than they had under the previously existing standards. However, these banks account for only one-third of bank assets.

(which did not have large amounts of off-balance-sheet transactions), and for banks that held relatively large amounts of securities. On an aggregate basis, the banking system had sufficient capital to meet the new requirements. The aggregate Tier 1 capital to risk asset ratio was 7.88 percent and the total capital to risk asset ratio was 10.0 percent.⁷ Thus the new capital standards would not appear to be a constraint on the expansion of bank lending on an aggregate basis.

However, the aggregate capital ratio numbers may be misleading. Excess capital cannot easily be traded among banks. A bank with a capital shortage, where capital is the binding constraint on the expansion of loans, cannot borrow capital from a bank with a surplus. Thus, individual bank capital shortages can result in an aggregate decline in lending, despite an overall surplus. This is more likely if capital surpluses are concentrated in smaller banks, which may not have loan limits of sufficient size to meet the loan needs of customers frozen out of larger banks. In addition, restrictions on branching and interstate banking may limit the ability of banks with capital surpluses to satisfy unmet loan demand in other regions. Samolyk (1992) presents a model under which high interregional monitoring costs can prevent banks with excess capital from making loans in a region inadequately served by a capital-poor bank.

2. DATA AND RESULTS

The data used are from the year-end FDIC call reports of condition and income reports for 1987 and 1991 for all domestically owned U.S. commercial banks. 1987 was the year immediately prior to the announcement of the risk-based requirements and establishment of the timetable for the implementation of those requirements. It is assumed that some banks would begin reacting to the new requirements upon their adoption in 1988, although the interim requirements did not go into effect until the end of 1990. Descriptive measures of the data are given in Table 1. In 1987, 13,513 banks held \$1.514 trillion in loans and in 1991, 11,747 banks held \$1.739 trillion in loans for a 14.9 percent increase. However, 2,445 banks which existed in 1987 did not exist in 1991, either due to failure or absorption in a merger. In addition, 677 de novo charters were granted between 1988 and 1991. Because the purpose of this paper is to analyze the impact of capital standards on bank growth, only those banks which existed in both 1987 and 1991 are included in the sample of "survivor" banks. Excluded from the sample are 267 banks that did not meet the capital requirements in effect in 1987, the assumption being that the growth of these banks was already constrained even in the absence of the risk-based requirements. Also excluded from this sample are 349 banks whose charters were granted in 1986 or 1987, and 7 for whom the data were incomplete, the rationale being that the de novo banks had large capital ratios associated with their initiation of operations as well as large percent-

7. The calculations are based on the regulatory guidelines and the authors' assumptions outlined in the Appendix.

TABLE 1
SAMPLE DESCRIPTIVE STATISTICS

	1987	1991
All Banks		
<i>N</i>	13,513	11,747
Loans (millions)	1,514,124	1,739,729
Assets (millions)	2,469,148	2,908,194
Aggregate Loan/Asset Ratio	.613	.598
Aggregate Loan Growth, %		14.9%
Aggregate Asset Growth, %		17.8%
Survivor Banks		
<i>N</i>	10,445	10,445
Loans (millions)	1,257,084	1,627,394
Assets (millions)	2,057,359	2,714,860
Aggregate Loan/Asset Ratio	.611	.599
Aggregate Loan Growth, %		29.5%
Aggregate Asset Growth, %		32.0%
No Mergers		
<i>N</i>	9,008	9,008
Loans (millions)	712,765	825,500
Assets (millions)	1,206,920	1,427,439
Aggregate Loan/Asset Ratio	.591	.578
Aggregate Loan Growth, %		15.8%
Aggregate Asset Growth, %		18.3%

The survivor bank sample includes only those banks in existence in both 1987 and 1991, and excludes banks with de novo charters in 1986 and 1987. The no-merger sample is a subset of the survivor sample and includes only those banks not involved in mergers between 1988 and 1991.

age increases in loans, both of which could skew the results. The “survivor sample” of 10,445 banks has a total growth in loans between 1987 and 1991 of 29.5 percent, much higher than for the sample of all banks. One reason loan growth is higher is that many of the assets of the banks lost through failure or mergers were taken over by the surviving banks. As this merger activity could also skew the results, a sample was created which eliminated all banks involved in a merger between 1988 and 1991, unless it could be determined that the increase in assets resulting from the merger was less than 1 percent of the assets the surviving bank. The loan growth for this “no mergers” sample is 15.8 percent, only slightly higher than the growth for the universe of banks.

The size of each bank’s excess capital is determined by calculating its 1987 Tier 1 and Tier 2 capital and risk-adjusted assets based on the 1992 guidelines. Because the information in the 1987 call reports was not sufficiently detailed to calculate exactly each bank’s risk-adjusted assets and capital, certain assumptions and adjustments had to be made, and these are described in the Appendix. The required Tier 1 and total ratios of 4 percent and 8 percent were applied to each bank’s risk-adjusted assets and the resulting amount was subtracted from actual Tier 1 and total capital to determine the dollar amount of the surplus or shortage. A similar procedure was used to calculate primary and total capital surpluses under the 1987 guidelines. The banks were then divided into three groups. The first consisted of those banks which had larger surpluses of Tier 1 and total capital as a result of the 1992 requirements.

The second group was those banks whose surplus Tier 1 capital was smaller than their surplus primary capital, or those whose surplus total capital under the 1992 requirements was less than their total capital surpluses under the requirements in effect in 1987. The third group consisted of those banks which failed the new standards because either their 1987 Tier 1 or total capital was below the 1992 requirements.

Table 2 gives, for each of the three capital categories, the number of banks, the total 1987 loans and assets, the 1987 to 1991 loan and asset growth, the aggregate loan to asset ratios in 1987 and 1991, and the aggregate percentage change in loans. The total sample is then broken down into four categories by size. When loan growth is aggregated according to capital surplus, the banks with larger capital surpluses grew at almost twice the rate of those banks which had smaller surpluses, while the growth of the banks which had smaller surpluses was much closer to that showed by the banks which failed the new standards. Banks with larger surpluses had a 46.2 percent increase in loans, while those with smaller surpluses increased by 24.1 percent and those which failed the new standards increased by 19.5 percent. This result implies that, to the extent the new capital requirement reduced the size of the capital cushion some banks previously enjoyed, those banks responded by limiting loan growth to a rate only slightly above the growth shown by those banks which failed the new standards.

Table 2 presents several other important results. First, while the banks which had smaller surpluses or failed the new standards respectively made up only 14.6 percent and 1.6 percent of the total number of banks, they accounted for a combined total of 71.3 percent of total loans in 1987, yet were responsible for only 55.0 percent of the loan growth between 1987 and 1991. Conversely, the 83.9 percent of banks with larger surpluses held only 28.7 percent of the loans in 1987 yet accounted for 45.0 percent of the loan growth. Another important result is that the banks with larger surpluses increased their loans at a faster rate than they increased their total assets, 46.2 percent versus 42.2 percent. This is not true for the other two groups. Banks with smaller surpluses increased total assets faster than loans, 27.3 percent versus 24.1 percent, as did those banks which failed the standards, 25.6 percent versus 19.5 percent. Thus, the loan to asset ratio increased for the larger surplus banks, but decreased for the others, though the banks with the larger capital surpluses had the lowest loan to asset ratios to begin with. These results are consistent with the notion of the risk-based standards being a binding constraint for some for the expansion of loans but not the expansion of other assets such as Treasury securities which carry no requirement for additional capital under the risk-based standards.

Table 2 also presents the aggregate results for the banks grouped by size. The results for the two largest groups, over \$1 billion and between \$1 billion and \$300 million, are consistent with the full sample. For the two smallest groups, the smaller surplus banks grew slightly faster than the larger surplus banks, although the loan to asset ratios increased only for the larger surplus banks.

While these results are interesting, the sample of banks included in the data may

TABLE 2

AGGREGATE LOAN AND ASSET GROWTH FOR BANKS IN EXISTENCE IN BOTH 1987 AND 1991, OTHER THAN DE NOVO CHARTERS IN 1986 AND 1987, AGGREGATED ACCORDING TO CAPITAL SURPLUS FOLLOWING THE ADOPTION OF THE RISK-BASED CAPITAL STANDARDS AND ASSET SIZE

(\$ amounts in millions)	Larger Capital Surplus under 1992 Standards	Smaller Capital Surplus under 1992 Standards	Failed 1992 Standards	Total
All Banks				
N	8,759	1,523	163	10,445
(% of total)	83.9%	14.6%	1.6%	
1987 Loans, \$	360,814	625,058	271,211	1,257,083
(% of total)	28.7%	49.7%	21.6%	
87-91 Loan Growth, \$	166,689	150,694	52,928	370,311
(% of total)	45.0%	40.7%	14.3%	
1987 Assets, \$	689,411	964,216	403,732	2,057,359
(% of total)	33.5%	46.9%	19.6%	
87-91 Asset Growth, \$	290,747	263,560	103,195	657,501
(% of total)	44.2%	40.1%	15.7%	
1987 Loan/Asset Ratio	.523	.648	.672	.611
1991 Loan/Asset Ratio	.538	.632	.639	.599
Loan Growth, %	46.2%	24.1%	19.5%	29.5%
Asset Growth, %	42.2%	27.3%	25.6%	32.0%
Banks with assets greater than \$1 billion				
N	68	140	51	259
1987 Loans, \$	80,414	514,586	258,933	853,932
Loan Growth, \$	50,087	107,868	50,701	208,656
1987 Assets, \$	146,117	802,612	387,192	1,335,921
Asset Growth, \$	93,504	186,472	97,553	377,529
1987 Loan/Asset Ratio	.550	.641	.669	.639
1991 Loan/Asset Ratio	.545	.629	.639	.620
Loan Growth, %	62.3%	21.0%	19.6%	24.4%
Asset Growth, %	64.0%	23.2%	25.2%	28.3%
Banks with assets between \$300 million and \$1 billion				
N	212	139	16	367
1987 Loans, \$	53,924	53,184	7,398	114,507
Loan Growth, \$	23,135	18,795	231	42,161
1987 Assets, \$	98,737	76,342	9,760	184,838
Asset Growth, \$	37,230	33,214	1,612	72,056
1987 Loan/Asset Ratio	.546	.697	.758	.620
1991 Loan/Asset Ratio	.567	.657	.671	.610
Loan Growth, %	42.9%	35.3%	3.1%	36.8%
Asset Growth, %	37.7%	43.5%	16.5%	39.0%
Banks with assets between \$50 million and \$300 million				
N	3,089	554	46	3,689
1987 Loans, \$	163,613	45,606	4,043	213,262
Loan Growth, \$	66,545	18,841	1,719	87,104
1987 Assets, \$	311,813	67,312	5,574	384,699
Asset Growth, \$	112,664	34,033	3,410	150,107
1987 Loan/Asset Ratio	.525	.678	.725	.554
1991 Loan/Asset Ratio	.542	.636	.641	.562
Loan Growth, %	40.7%	41.3%	42.5%	40.8%
Asset Growth, %	36.1%	50.6%	61.2%	39.0%
Banks with assets under \$50 million				
N	5,390	690	50	6,130
1987 Loans, \$	62,863	11,683	836	75,382
Loan Growth, \$	26,922	5,191	277	32,390
1987 Assets, \$	132,745	17,951	1,206	151,901
Asset Growth, \$	47,348	9,840	620	57,809
1987 Loan/Asset Ratio	.474	.651	.693	.496
1991 Loan/Asset Ratio	.499	.607	.610	.514
Loan Growth, %	42.8%	44.4%	33.2%	43.0%
Asset Growth, %	35.7%	54.8%	51.4%	38.1%

not be the most appropriate, because the sample includes a number of banks that grew through mergers. Since those banks with the healthiest capital ratios were the most likely to grow through acquisition, the results shown in Table 2 may reflect the effect of mergers rather than new lending. Therefore, banks involved in mergers were excluded from the sample and the analysis was repeated. The results, shown in Table 3, confirm the "survivor" sample results. Banks with larger surpluses increased loans by 28.6 percent, while loans of those with smaller surpluses grew only at a rate of 8.1 percent, somewhat smaller than the 10.4 percent rate at which the banks that failed the standards increased loans. The results are also consistent when the sample is broken down by size, with the exception of banks in the \$50 million to \$300 million category who failed the new standards. The loans growth for these banks actually exceeded the other two categories.

Although the aggregate data provides the most important information as to the possible impact of the new standards on the economy, they may mask patterns of individual bank behavior. Another way to examine the impact of the 1988 risk-based capital standards on bank lending and the recession is to look at how banks individually responded to the new standards. Banks with larger capital surpluses under the new standards had no reason to restrict their lending practices. On the other hand, absent any additions to their capital, banks that did not meet the new requirements would be expected to cut back on their lending and boost the percentage of securities on their balance sheets. Increasing the amount of securities they held would allow them to maintain earnings and build capital without lowering their risk-based capital ratios. The case of banks which met the new requirements but with smaller capital surpluses is less clear. To the extent that managers of these banks operated at a desired comfort level above the old regulatory minimums, they might reduce lending in order to return to their previous surplus positions. These banks may have continued to make loans at a pace higher than those banks that had a shortfall of capital under the new standards, but lower than those banks with increased capital surpluses. In addition, the question arises as to how whatever additional capital was raised by a bank was used. A bank may increase capital to support growth in loans, or it may issue capital to rebuild capital to required or desired levels or levels.

For the purpose of this analysis, the null hypothesis is that the change in capital standards had no effect on the lending practices of the three groups, and that newly issued capital was used to fund loan growth to the same extent by each group. However, if the null can be rejected, the new capital standards may have depressed aggregate lending in the economy. A significant difference among the groups would be consistent with the idea that the change in the capital standards contributed to the depressed state of the economy.

OLS regressions were run using the same two samples, with the exception that thirty-six banks with four-year loan or asset growth in excess of 1,000 percent were dropped. The regression specification is as follows:

$$L_i = \alpha + \beta_1 S + \beta_2 F + \beta_3 \Delta K + \beta_4 (\Delta K * S) + \beta_5 (\Delta K * F) + \beta \text{ SIZE} + \beta \text{ REGION} + \epsilon \quad (1)$$

TABLE 3

AGGREGATE LOAN AND ASSET GROWTH FOR BANKS NOT INVOLVED IN MERGERS BETWEEN 1988 AND 1991

(\$ Amounts in Millions)	Larger Capital Surplus under 1992 Standards	Smaller Capital Surplus under 1992 Standards	Failed 1992 Standards	Total
All Banks				
N	7,716	1,174	118	9,008
(% of total)	85.7%	13.0%	1.3%	
1987 Loans, \$	255,280	341,676	115,809	712,765
(% of total)	35.8%	47.9%	16.2%	
87-91 Loan Growth, \$	72,901	27,790	12,045	112,735
(% of total)	64.7%	24.7%	10.7%	
1987 Assets, \$	494,707	553,672	178,541	1,206,920
(% of total)	41.0%	44.2%	14.8%	
87-91 Asset Growth, \$	133,580	65,115	21,824	220,519
(% of total)	60.6%	29.5%	9.9%	
1987 Loan/Asset Ratio	.516	.640	.649	.591
1991 Loan/Asset Ratio	.522	.617	.638	.578
Loan Growth, %	28.6%	8.1%	10.4%	15.8%
Asset Growth, %	27.0%	12.2%	12.2%	18.3%
Banks with assets greater than \$1 billion				
N	33	66	25	124
1987 Loans, \$	34,127	272,375	107,058	413,571
Loan Growth, \$	8,140	12,151	10,678	30,970
1987 Assets, \$	64,224	433,183	166,945	664,352
Asset Growth, \$	25,681	35,261	18,553	79,496
1987 Loan/Asset Ratio	.532	.629	.641	.623
1991 Loan/Asset Ratio	.470	.607	.635	.598
Loan Growth, %	23.8%	4.5%	10.0%	7.5%
Asset Growth, %	40.0%	8.1%	11.1%	12.0%
Banks with assets between \$300 million and \$1 billion				
N	127	72	12	211
1987 Loans, \$	31,125	25,481	5,247	61,853
Loan Growth, \$	8,404	3,696	-110	11,990
1987 Assets, \$	56,124	35,231	6,680	98,035
Asset Growth, \$	12,411	7,782	595	20,788
1987 Loan/Asset Ratio	.555	.723	.785	.631
1991 Loan/Asset Ratio	.577	.678	.706	.621
Loan Growth, %	27.0%	14.5%	-2.1%	19.4%
Asset Growth, %	22.1%	22.1%	8.9%	21.2%
Banks with assets between \$50 million and \$300 million				
N	2,569	422	35	3026
1987 Loans, \$	132,639	33,589	2,767	168,995
Loan Growth, \$	37,324	9,288	1,371	47,982
1987 Assets, \$	253,084	49,527	3,835	306,446
Asset Growth, \$	63,895	16,935	2,407	83,237
1987 Loan/Asset Ratio	.524	.678	.722	.551
1991 Loan/Asset Ratio	.536	.645	.663	.557
Loan Growth, %	28.1%	27.7%	49.5%	28.4%
Asset Growth, %	25.2%	34.2%	62.8%	27.2%
Banks with assets under \$50 million				
N	4,987	614	46	5,647
1987 Loans \$	57,380	10,230	736	68,346
Loan Growth, \$	19,033	2,655	105	21,793
1987 Assets, \$	121,275	15,732	1,081	138,087
Asset Growth, \$	31,593	5,137	268	36,998
1987 Loan/Asset Ratio	.473	.650	.681	.495
1991 Loan/Asset Ratio	.500	.617	.624	.515
Loan Growth, %	33.2%	26.0%	14.3%	31.9%
Asset Growth, %	26.1%	32.7%	24.8%	26.8%

These banks were existence in both 1987 and 1991, de novo 1986 and 1987 charters are eliminated, and loan and asset growth is aggregated according to capital surplus following the adoption of the risk-based capital standards and asset size.

L_i is percentage change in loans between 1987 and 1991 for bank i , S is an indicator variable equal to 1 if the risk-based capital surplus is smaller than the total capital surplus under the 1987 guidelines, and F is an indicator variable equal to 1 if the 1987 risk-based capital was below the 1992 final requirements.⁸ All banks which failed the 1992 standards also had smaller surpluses, therefore $F = S * F$. By structuring the model this way, the significance of any difference between having a smaller surplus and actually failing the new requirements can be ascertained. ΔK is the amount of equity and subordinated debt issued between 1987 and 1991 as a percent of total 1987 risk-based capital, **SIZE** is a vector of three indicator variables representing four asset size categories, and **REGION** is a vector of indicator variables for the twelve Federal Reserve districts to account for any regional differences in loan growth.⁹ A similar model was run for changes in total assets.

The reason for including a variable for new capital issues is that banks faced with a capital constraint on their growth can also respond by issuing new capital and/or increasing retained earnings rather than restricting loan growth. It is also possible that banks with smaller surpluses or which failed the 1992 requirements used additions to capital to boost their surpluses rather than support loan growth. The differences, if any, in the correlations between capital increases and loan growth are captured by the significance of the slope coefficients of $\Delta K * S$ and $\Delta K * F$. While capital growth and loan growth are almost certainly endogenous, as Bernanke and Lown (1991) discuss, we structure the model to capture differences in the correlations between additions to capital and loan growth for banks with larger or smaller capital surpluses, or those that failed the requirements. Thus, while endogeneity might explain a significant coefficient on ΔK , it would not explain different coefficients on $\Delta K * S$ and $\Delta K * F$. However, since the possibility of endogeneity remains, the model was run with and without the capital change variables and both sets of results are reported.

The regression results are reported in Table 4 for loan and asset growth for both the "survivor" and "no merger" samples. Of importance is that, first, the coefficients on S and F are both significant and negative for the loan growth regressions when the capital change variables are included. Thus banks with smaller surpluses grew their loans at a slower rate than those with larger surpluses, and those that failed grew even slower. Second, the coefficient on ΔK is significant while the coefficient

8. Peek and Rosengren (1993) examine the possibility that the leverage ratio, Tier 1 capital divided by total assets, may have had an effect on bank lending in 1991. This is difficult to test given the imprecise nature of the leverage limit rule (see Baer and McElravey 1993) and the debate over whether the effective leverage requirement was 3 percent, 4 percent, 5 percent, or something higher. Using 1987 capital figures, no additional banks failed the leverage requirement at the 3 percent level that did not already fail either the Tier 1 or total capital requirements. At the 4 percent level, eleven additional banks failed, thirty-six at the 4.5 percent level and one hundred and the 5 percent level. Including these banks in the "failed" category had no significant impact on the regression results.

9. Some of the differences in loan growth across banks are associated with regional differences in economic expansion between 1987 and 1991. In general, banks in the middle of the country (those in the Dallas, Kansas City, and Minneapolis districts) and in the New York district showed the smallest increases in loans. The San Francisco, Atlanta, and Philadelphia district banks had the largest loan growth. The results for aggregate loan and asset growth when the banks were grouped by Federal Reserve District and capital surplus show the same pattern of loan growth for the three samples as already reported. The regional results are not included in this paper but are available from the authors.

TABLE 4
REGRESSION RESULTS FOR THE BANKS IN THE "SURVIVOR" SAMPLE (N = 10,409) AND THE "NO MERGER" SAMPLE (N = 9,004) FOR LOAN AND ASSET
GROWTH BETWEEN 1987 AND 1991

$$L_i = \alpha + \beta_1 S + \beta_2 F + \beta_3 \Delta K + \beta_4 (\Delta K * S) + \beta_5 (\Delta K * F) + \beta \text{ SIZE} + \beta \text{ REGION} + \epsilon$$

	Full Sample			No Mergers Sample		
	Loan Growth	Asset Growth	Asset Growth	Loan Growth	Loan Growth	Asset Growth
α	.3799 (26.62)**	.5754 (35.30)**	.1488 (14.67)**	.4070 (31.53)**	.4913 (38.08)**	.1843 (21.25)**
S	-.0474 (-2.61)**	-.0572 (-2.85)**	.0379 (2.93)**	-.0650 (-3.80)**	-.0820 (-4.94)**	.0034 (0.30)
F	-.1743 (-3.15)**	-.0616 (-1.08)	-.1389 (-3.53)**	-.1751 (-3.30)**	-.0351 (-0.71)	-.1281 (-3.59)**
ΔK	1.020 (57.56)**		.9611 (76.30)**	.5878 (24.20)**		.5375 (32.93)**
$\Delta K *$	-.4871 (-17.00)**		-.1984 (-9.74)**	-.3312 (-7.88)**		.0488 (1.73)
S	-.0620 (-1.20)		-.1832 (-4.99)**	.1337 (2.28)*		-.1052 (-2.67)**
$\Delta K *$	-.1122 (-2.86)**		-.0376 (-1.35)	-.2131 (-4.61)**		-.0929 (-2.99)**
SIZE1	-.0962 (-3.02)**		-.0541 (-2.39)**	-.1739 (-5.04)**		-.1182 (-5.09)**
SIZE2	-.0678 (-5.49)**		-.0064 (-0.73)	-.1003 (-8.93)**		-.0333 (-4.42)**
SIZE3	239.87 (3.04)		467.55 (.026)	80.50 (.144)		140.83 (.228)
F-Stat						
R^2_{adj}						

NOTES: *t*-statistics in parentheses; **significant at 1 percent level; *significant at 5 percent level.
 L_i = percentage change in loans (or assets) between 1987 and 1991 for bank *i*
 β_1 = 1 if the risk-based capital surplus is smaller than the total capital surplus under the 1987 guidelines, 0 otherwise.
 β_2 = 1 if the 1987 risk-based capital was below the 1992 final requirements, 0 otherwise. (Note that F = F * S.)
 ΔK = (1991 issued capital and debt - 1987 issued capital and debt) ÷ total risk-based capital.
 $\Delta K *$ = a vector of three dummy variables representing four asset size categories:
 SIZE1 = 1 if over \$1 billion, 0 otherwise.
 SIZE2 = 1 if \$300 million to \$1 billion, 0 otherwise.
 SIZE3 = 1 if \$50 million to \$300 million, 0 otherwise.
 REGION = a vector of dummy variables representing the twelve Federal Reserve districts to account for region differences in growth. (Results are not reported to conserve space.)

on $\Delta K * S$ is both significant and negative. The results show that banks with larger capital surpluses had a one-to-one correspondence between the percentage increase in issued capital and the percentage increase in loans, but for banks with smaller surpluses, the percentage increase in loans was only half that for the larger surplus banks for the same percentage increase in capital. The coefficient of $\Delta K * F$ is negative but not significant. Thus while there is a difference between the extent to which new capital injections were associated with increases in loans between the larger-surplus and smaller-surplus banks, no significant difference exists between the smaller-surplus banks and those that failed the new standards. Furthermore, while endogeneity cannot be ruled out when looking solely at the results for ΔK , the possibility of endogeneity cannot explain the magnitude and the significance of the coefficient on $\Delta K * S$.

When the loan growth regression was run on the "no mergers" sample, the results were almost identical. The smaller-surplus banks and those that failed the standards both had significantly lower loan growth than those banks with larger surpluses. Injections of new capital into smaller surplus banks were still associated with significantly smaller increases in loan growth than in the larger surplus banks, although the coefficient for $\Delta K * F$ was positive and significant. We interpret this as further evidence that there was little difference in the behavior of those banks that had smaller surpluses and those which failed the standards.

When contrasted with the loan growth regressions, the results for asset growth are somewhat surprising. First, for the full "survivor" sample, smaller-surplus banks increased total assets at a slightly faster rate than the larger-surplus banks. For the "no merger" sample, there is no difference between the two groups. One explanation is that the banks with capital constraints under the risk-based standards grew their total assets faster in areas such as securities, in order to generate sufficient earnings to boost their capital internally. As for the impact of new capital, the coefficient for capital increases in the smaller-surplus banks in the "survivor" sample is negative and significant, but the size of the difference between the larger- and smaller-surplus banks, as indicated by the coefficient on $\Delta K * S$, is much smaller for asset growth than for loan growth. For the "no mergers" sample, there is no significant difference. Thus, while there is a clear difference in the extent to which new capital was used to fund loan growth for the large- and smaller-surplus banks, this difference is either much smaller or does not exist for asset growth.

In the regressions without the capital change variables, the smaller capital surplus variable remains significant, but the variable for failing the 1992 standards is not. Thus, when one ignores the impact of new capital issues, there is no significant difference in loan growth between the banks that failed the 1992 standards and those that had smaller surpluses. For asset growth, we again see that banks with smaller surpluses grew their assets at faster rates.

3. CONCLUSION

After the announcement of the risk-based capital standards in 1988, many banks had capital that exceeded the new requirements by more than it exceeded the previ-

ously existing requirements. On the other hand, a fair number of (mostly) large banks failed the new standards, and a large number met the new standards, but with smaller surpluses than they had before. If the change in capital requirements did *not* affect bank lending, then loan growth at these three groups of banks should not have been significantly different. In fact, however, banks with larger surpluses under the new standards grew at a faster rate than those with smaller surpluses or which failed the new standards, even after size and location differences are accounted for. Second, new capital brought into the banking system was used to grow loans at different rates depending on the change in a bank's excess capital. Larger surplus banks used their new capital to grow loans at twice the rate that banks with smaller surpluses did. If the slow rate of loan growth in recent years was due solely to a decrease in demand, as some have argued (that is, Kliesen and Tatom 1992) one would expect little difference in the growth rates of larger surplus and smaller surplus banks. The important policy implications of these results is that the potential impact of any future changes in bank capital requirements must be estimated not only in terms of how many banks might fail a new standard, but also by how many would have their cushions of excess capital reduced.

Whether these differences in loan growth actually left loan demand unmet and created a "credit crunch" cannot be determined unequivocally without clear knowledge of the loan demand schedule. It is possible that loan demand was satisfied by the growth shown by the larger-surplus banks. However, because the capital shortages were greatest among the larger banks, it is highly unlikely that the smaller banks were able to meet fully the credit needs of the larger bank customers.

Finally, whether one believes that the shock to the supply of bank credit caused by the 1988 risk-based capital standards was sufficient to cause the recession, exacerbate it, or delay the recovery from it, depends on one's view of the importance of the credit channel for the transmission of monetary policy. It is important to note, however, that the differences among the three groups of banks are not only statistically significant, they also involve very large dollar amounts. For example, if *all* banks had loan increases at a rate equal to that of the banks with larger surpluses (46.2 percent), total bank loans would have grown by \$581 billion from 1987 to 1991 instead of \$370 billion.¹⁰ Despite the artificiality of this calculation, it does demonstrate that the impact of the changes in capital requirements was large enough to have had a substantial macroeconomic effect.

APPENDIX

In order to estimate the 1987 risk-based capital position of the banks in the sample, certain assumptions had to be made because some of the information required

10. The calculations are based on the numbers in Table 2. We recognize, of course, that if the slower growing banks had increased their loans by \$215 billion more than they actually did, the other banks would not have been able to grow as rapidly as they did. This calculation is simply designed to show the dollar magnitude of the differences in growth rates of the three groups of banks.

under the 1992 guidelines was not reported in 1987. A summary of the items used to calculate the components of capital and assets follows.

Capital

TIER 1 includes the par value of common stock, surplus, undivided profits, all noncumulative preferred (the regulations permit only perpetual noncumulative preferred), and minority interest in consolidated subsidiaries, less goodwill and other intangibles.

TIER 2 includes all subordinated debt and limited-life preferred stock, up to 50 percent of Tier 1 capital, mandatory convertible debt and allowable allowance for loan and lease losses. Subordinated debt and limited-life preferred stock with remaining maturities of less than five years are discounted on a sliding scale from 20 percent for one to two years remaining to 80 percent for four to five years remaining. Because information on remaining maturities was not provided in 1987, all subordinated debt and limited life preferred stock was included, up to the 50 percent of Tier 1 capital maximum. The maximum amount of the allowance which can be included is 1.25 percent of total risk-weighted assets less intangibles. For Form 34 reporting banks, banks with less than \$100 million in total assets, agricultural loss deferral is also included. Finally, total Tier 2 capital cannot exceed Tier 1 capital.

Total risk-based capital is defined as Tier 1 plus Tier 2 capital, minus reciprocal capital holdings. However, reciprocal capital holdings were not reported in 1987.

Balance Sheet Assets. Weight:

0% includes currency and coin, balances due from Federal Reserve banks, loans to OECD foreign governments and official institutions, U.S. Treasury securities, U.S. government agency obligations, and GNMA guaranteed securities (assumed to be 10 percent of government agency securities), U.S. Treasury securities held in trading accounts (if not reported, assumed to be 30 percent of total trading account securities), and Federal Reserve stock (calculated as 3 percent of common stock plus surplus) for Federal Reserve member banks.

20% includes loans to depository institutions, acceptances of other banks, cash items in the process of collection (estimated as 5 percent of non-interest-bearing balances for Form 34 banks), fed funds sold, securities purchased under agreements to resell, securities issued by FNMA and FHLMA (assumed to be 90 percent of total government agency securities), government agency securities in trading accounts (if not reported, assumed to be 15 percent of trading account securities), general obligations of any OECD public entity, including state and municipal general obligations (assumed to be 50 percent of total municipal securities) and foreign debt securities, general obligation municipal bonds held in trading accounts (assumed to be 50 percent of municipal bonds in trading accounts if reported or 15 percent of total trading account securities if not), and 5 percent of risk loans, calculated as total loans and leases plus unearned income less risk-less loans (loans to depository institutions, acceptances of other banks, 5 percent of revolving, open-end loans secured

by one–four-family residential properties, 95 percent of all other loans secured by one–four-family residences, obligations of state and political subdivisions in the United States and loans to OECD foreign governments and institutions.

50% includes revenue obligations of OECD public entities, including state and municipal securities (calculated as 50 percent of total municipal securities and 25 percent of loans to state and political subdivisions), revenue obligation municipal bonds held in trading accounts (assumed to be 50 percent of municipal bonds in trading accounts if reported or 40 percent of total trading account securities if not), 5 percent of revolving, open-end loans secured by one–four-family residential properties, 95 percent of all other loans secured by one–four-family residences, and 50 percent of all holdings of private certificates of participation in pools of residential mortgages.

100% calculated as total assets plus allowance for loan and lease losses and allocated transfer risk reserve, less the assets in the 0 percent, 20 percent, and 50 percent risk categories.

Off-Balance-Sheet Assets. Weight:

20% includes the amount of unused loan commitments, standby letter of credit, and acceptances participated to others.

50% includes mortgages transferred with recourse (not reported in 1987), greater than one-year commitment to sell and purchase securities when issued, greater than one-year interest rate swaps, greater than one-year future and forward contracts, and purchased option contracts (calculated as .125 percent of notional values), less than one year foreign exchange swaps, commitments to purchase and purchased options (calculated as .75 percent of notional value), greater than one-year foreign exchange swaps, commitments to purchase and purchased options (calculated as 1.25 percent of notional value), and 5 percent of the notional value of any other swap, futures, forward or option contracts on commodities or equities.

100% includes 50 percent of unused loan commitments with an original maturity exceeding one year, 50 percent of standby letters of credit, 20 percent of commercial and similar letters of credit, acceptances acquired, securities lent, and other significant commitments and contingent liabilities.

Total risk assets are calculated as the sum of the risk-weighted on- and off-balance-sheet items, less goodwill, other intangibles and the portion of allowance for loan loss not qualifying as Tier 2 capital.

Primary and Secondary Capital Calculations

Primary capital was calculated as the sum of common stock par and surplus, undivided profits, perpetual preferred stock, minority interest in consolidated subsidiaries, allowance for loan and lease losses, allocated transfer risk reserve, mandatory convertible debt, and mortgage servicing rights.

Secondary capital was calculated as the sum of subordinated debt and limited life preferred stock, up to a maximum of 50 percent of primary capital.



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