# Bank Capital Ratios, Asset Growth, and the Stock Market

*by Richard Cantor and Ronald Johnson*

In recent quarters, the U.S. banking system has rapidly improved its capital strength. Motivated by strategic business opportunities and regulatory pressures, bank holding companies now appear to be targeting capital ratios well above the minimums set by regulation. The current drive for capital is apparently being rewarded by private investors: those bank holding companies that have significantly increased their capital ratios, particularly those that began from initially low levels, have experienced large appreciations in their stock prices.

This article tracks three important capital-to-asset ratios for the banking system: 1) the leverage ratio (book value of tangible equity to total assets), 2) the tier 1 risk-based ratio (tangible equity to total risk-adjusted assets), and 3) the total—that is, tier 1 plus tier 2—risk-based ratio (tangible equity plus secondary capital instruments to total risk-adjusted assets). We identify the broad changes that have taken place in these ratios over an eighteen-month period and the reasons for the improvement in capital measures. Central to this effort is an examination of the various actions taken by bank holding companies to boost their capital ratios. We analyze the relationship between these "strategies"—all moves to raise capital or shrink assets—and the rewards assigned to them by the stock market.

The evidence suggests that, as a simple accounting matter, almost all of the aggregate improvement in the leverage ratio has been due to equity growth, mostly through stock issuance. The risk-based capital ratios have risen even more than the leverage ratio because risk-weighted assets have declined more sharply than total assets as banks have curtailed loan growth and purchased securities. These aggregate trends mask differences in the strategies adopted by individual bank holding companies to improve their capital ratios. For example, institutions with initially low capital ratios and weak public bond ratings have reduced their assets or slowed their acquisition of assets much more than other bank holding companies.

Our analysis of the stock market response to the various methods of improving capital ratios shows that different strategies have garnered different rewards. For bank holding companies that were well capitalized at the beginning of the sample period, stock price appreciation was more highly correlated with capital ratio improvements achieved through capital growth than with improvements through asset reduction. For weakly capitalized institutions, however, the stock market appears to have rewarded capital growth and asset shrinkage about equally. For all institutions, we find that stock prices responded in about the same proportion to a reduction in total assets as to a decline in risk-weighted assets. Of the various ways that companies increased capital, increases in earnings were, not surprisingly, associated with the largest stock price increases. Nevertheless, building capital by other methods, such as limiting dividends and issuing stock, also appears to have been rewarded by the stock market.

**Background on the current capital regulations**[1]

Banks and bank holding companies are required to meet minimum capital standards calculated on both a simple leverage basis and a risk-adjusted basis. The

[1]Further elaboration can be found in the testimonies of William Taylor, late Chairman of the Federal Deposit Insurance Corporation, and Jerome Powell, Under Secretary for Finance, Department of the Treasury, given at the hearings on "Capital Standards and Credit Availability," House Committee on Small Business, July 9, 1992.

leverage standard specifies that a certain minimum amount of tangible equity be held against total assets. The risk-based standard is more complex, incorporating both equity and other forms of capital and measuring both assets and off-balance sheet exposures on a risk-adjusted basis. The current capital guidelines for banks and bank holding companies were adopted in early 1989 (with certain interim rules effective at year-end 1990 and final rules effective as of year-end 1992).[2] The risk-based guidelines are based on an international agreement called the Basle Accord, negotiated by bank regulators from the major industrialized countries under the auspices of the Bank for International Settlements in Basle, Switzerland.

Under the risk-based standard, risk weights are assigned to different asset categories. Cash and U.S. government securities are given zero risk weight; municipal securities, federal agency securities, and interbank obligations, a 20 percent risk weight. Loans (first liens only) secured by residential real estate are assigned a 50 percent risk weight. Other assets, including most consumer and business loans, are given a risk weighting of 100 percent. In addition, credit equivalencies assigned to off-balance-sheet activities such as loan commitments, letters of credit, and swaps are risk weighted and added to the risk-adjusted assets on the balance sheet to arrive at total risk-weighted assets.

As of year-end 1992, all banks and bank holding companies will be required to maintain tier 1 capital, essentially tangible common equity and most preferred stock, in excess of 4 percent of risk-weighted assets. The risk-based standards also define a broader measure of capital, total capital, which combines tier 1 with tier 2 capital. The latter designation applies primarily to subordinated debt, mandatory convertible securities, and loan loss reserves (up to a maximum of 1.25 percent of risk-weighted assets). In addition to satisfying the tier 1 capital requirement, banks and bank holding companies must maintain total capital in excess of 8 percent of risk-weighted assets.

The leverage ratio requirement was designed to supplement the risk-based capital framework established under the Basle Accord. As originally formulated, the risk-based system principally addressed broad categories of credit risk associated with particular depository institution assets and off-balance-sheet activities rather than interest rate risks and other noncredit banking risks. The leverage ratio was intended to compensate for these gaps in the risk-based capital requirements. The leverage ratio is defined as the ratio of tier 1 capital to average tangible assets. The minimum leverage ratio requirement for individual banks and bank holding companies varies with their examination ratings and activities and with other factors. Under current regulations, a bank or bank holding company may maintain a leverage ratio as low as 3 percent if the institution is in very sound condition and not experiencing or anticipating significant growth. As a practical matter, minimum leverage ratios for most institutions are about 4 to 5 percent.[3]

The Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) requires that bank regulators publish interest rate risk regulations by June 1993.On July 31, 1992, the Federal Reserve Board, the Federal Deposit Insurance Corporation, and the Office of the Controller of the Currency jointly put forward for public comment a proposal incorporating interest risk in the risk-based capital standards. The agencies have stated that they may lower or eliminate the leverage capital requirement once interest rate risk is included in the risk-based capital framework.[4]

Banks and bank holding companies have strong regulatory incentives to maintain capital levels in excess of the required minimums. Regulators require that banks and bank holding companies experiencing or anticipating rapid growth maintain capital ratios well above the stated minimums. Moreover, to implement section 131 of FDICIA, regulators have recently refined the existing capital standards to recognize different degrees of capital strength. In particular, specific capital "zones" have been adopted by bank regulators for use in (1) determining eligibility for brokered deposits, (2) setting risk-based premiums for deposit insurance, and (3) prompting corrective regulatory actions. Under this scheme, banks are assigned to capital adequacy groups as follows:[5]

Well capitalized: The bank's tier 1 risk-based ratio is greater than 6 percent, total risk-based ratio is greater than 10 percent, and leverage ratio is greater than 5 percent.

[2]The guidelines for bank holding companies and state-chartered banks that are members of the Federal Reserve System are laid out in the "Capital Adequacy Guidelines," 12 CFR 208, appendix A, and 12 CFR 225, appendixes A and B.

[3]See the testimonies of William Taylor and Jerome Powell on "Capital Standards and Credit Availability." Regulations require a 3 percent minimum leverage ratio for banks with the highest examination ratings; however, the minimum capital ratio is 100 to 200 basis points higher for most other institutions. The appropriateness of a bank's leverage ratio is reviewed by its primary regulator.

[4]See the testimonies of William Taylor and Jerome Powell on "Capital Standards and Credit Availability."

[5]See, for example, "Proposals to Implement Prompt Corrective Actions for Undercapitalized State Member Banks," Federal Reserve Bank of New York, Circular no. 10552, July 13, 1992.

Undercapitalized:[6] The bank's tier 1 risk-based ratio is less than 4 percent, total risk-based ratio is less than 8 percent, or leverage ratio is less than 4 percent.[7]

Adequately capitalized: The bank is neither well capitalized nor undercapitalized.

In the discussion below, we sometimes combine the adequately capitalized and undercapitalized bank holding companies into a single "weakly capitalized" group.

**Recent changes in the aggregate capital ratios and balance sheets**

Our analysis focuses primarily on bank holding companies rather than banks, even though both are subject to the same minimum capital requirements.[8] We concentrate on the holding companies for three reasons. First, bank holding companies generally make and execute the key financing decisions for the banks, including decisions about dividend policy and capital market issuance. Second, because bank holding companies have some flexibility to transfer capital from one subsidiary to another, the consolidated strength of a bank holding company may be the best measure of the long-run capital strength of any individual subsidiary bank.[9] Third, bank holding companies issue most of the publicly traded stock of U.S. banking organizations.

Our basic sample consists of all bank holding companies with assets greater than $150 million that reported risk-based capital and assets in the FR Y-9C reports filed with the Federal Reserve for September 30, 1990. This is the first date that bank holding companies were required to report risk-weighted assets. (A few small institutions did not comply and had to be dropped from the sample.) The most recent data available to us are for the reporting period ending March 31, 1992. Altogether, the sample comprised 1082 bank holding companies in the beginning of the period and 983 at the end.

Consolidation within the industry has been very rapid. A total of ninety-nine bank holding companies (9.1 percent of sample) with $237 billion in assets (7.9 percent of the sample) "exited" by March 31, 1992 (that is, they did not file a FR Y-9C report for that date). Most exiting bank holding companies either merged with other bank holding companies or were closed by the Federal Deposit Insurance Corporation (FDIC). Bank holding companies that exited through merger are part of the sample at the start of the period and, in a sense, remain in the sample at the end because their assets and capital appear on the balance sheet of an acquirer. The consolidation process is continuing: numerous mergers have been effected since March 31, 1992, and others are being planned.[10]

In general, the holding companies in the sample substantially strengthened their capital ratios over the eighteen-month period (Table 1). Specific improvements included a 1.4 percentage point rise in the tier 1 risk-based capital ratio, a 1.8 percentage point rise in the total risk-based capital ratio, and a 0.7 percentage point rise in the tier 1 leverage ratio. Underlying the improvements in the capital ratios were strong tier 1 capital growth (12.1 percent), slightly negative asset growth (−1.2 percent), and shrinkage of risk-weighted assets (−7.8 percent). The composition of assets shifted toward those with low risk weights. Holdings of securi-

[6]This definition of undercapitalized includes the banks defined in the regulations as "significantly undercapitalized" and "critically undercapitalized."

[7]Banks that have the highest examination ratings and are not experiencing or anticipating significant growth are not undercapitalized if they maintain a leverage ratio in excess of 3 percent.

[8]To date, the various capital zones adopted in connection with FDICIA apply only to banks. We have chosen to apply these zones to bank holding companies only for the purposes of our analysis.

[9]Bank holding companies are discouraged by their regulators and the credit rating agencies from excessive "double leverage," that is, from downstreaming significantly more equity to their subsidiaries than they have in equity on a parent-only basis.

[10]We did not attempt to construct pro forma combinations as of September 30, 1990, for bank holding companies that merged before March 31, 1992, because such combinations obscure the fact that weak bank holding companies are being absorbed by the strong. In most cases, the acquirer must raise additional equity following a merger to maintain its initial capital ratios. In this sense, mergers are similar to other forms of asset growth in that they absorb capital. Moreover, each merger is different and pro forma combinations mask the differences. For example, in a merger of "equals," the bank holding company designated the acquirer may not need to raise any additional capital to maintain its earlier capital ratios after the merger, whereas in an FDIC-assisted merger, the bank holding company targeted for acquisition has no equity and the acquiring bank holding company will probably need to issue new equity.

Large mergers during the period analyzed include Chemical/Manufacturers (assets, $66 billion), Nationsbank (NCNB)/C&S-Sovran ($50 billion), Fleet/Bank of New England ($23 billion), First Union/Southeast ($15 billion), Society/Ameritrust ($11 billion), Wachovia/South Carolina National ($7 billion), Norwest/United Banks of Colorado. ($6 billion), and ABN Amro/European American ($5 billion). The mergers of Bank of America/Security Pacific ($73 billion), Comerica/Manufacturers.National ($14 billion), and Bank One/Valley National ($11 billion) were not completed as of March 31, 1992. The sample does not include the 160 bank holding companies with $46 billion in assets that filed FR Y-9C reports for March 31, 1992, but not for September 30, 1990. Many of these are newly formed bank holding companies. In general, the entrants have better than average capital ratios. (One entrant is a $6 billion credit card company, MBNA, which was spun off to private investors by MNC Financial during the sample period.)

ties rose sharply (16.9 percent), while loans fell (−7.0 percent).[11] On a risk-weighted basis, off-balance-sheet items shrank (−13.1 percent) more rapidly than on-balance-sheet items (−6.6 percent). Among the off-balance-sheet items, foreign exchange and interest rate contracts declined (−7.2 percent, on a risk-adjusted basis),[12] but less sharply than other off-balance-sheet items (−13.8 percent) such as unused loan commitments and letters of credit. Nonperforming assets rose 19.0 percent, a rate faster than the growth in loan loss reserves (3.4 percent). Although bank holding companies with low tier 1 capital ratios were probably not reserving aggressively, loan loss reserve growth may also have been weak because over half of all reserves do not qualify as tier 2 capital (qualifying reserves are limited to 1.25 percent of risk-weighted assets according to the final year-end 1992 rules).

The changes in equity and supplemental capital components for bank holding companies that filed FR Y-9C reports both at the beginning and end of the sample period are recorded in Table 2. Here we see the components of capital growth, including net income, dividends, capital market issuance, and equity acquired through mergers. Equity is acquired through a merger when a bank holding company assumes both the assets and liabilities of another financial institution.[13] To raise

[11]Board of Governors of the Federal Reserve System, "Senior Loan Officer Survey on Bank Lending Practices," August 1992, reports the explanations given by loan officers for their banks' decision to increase securities holdings over the last two and one-half years. Among the fifty-nine respondents, thirty-five indicated that securities offered greater profits, thirteen emphasized the uncertain economic outlook, eleven cited a need to fund anticipated increases in loan demand, nine stressed a desire to improve their risk-based capital ratios, and nine gave other reasons. (Banks were allowed more than one answer.)

[12]This decline was due to a decrease in the replacement value of outstanding foreign exchange contracts. The replacement values of interest rate contracts and the notional values of both interest rate and foreign exchange contracts continued to rise throughout the sample period. Moreover, the aggregate risk-weighted amount of swaps could be volatile: mostly flat over the sample, the amount of swaps spiked upwards on December 31, 1991.

[13]The different methods of accounting for equity acquired through mergers are discussed in William LeCates, "Accounting for Bank Mergers," Federal Reserve Bank of New York, memorandum, June

Table 1

**Assets and Capital of Bank Holding Companies Reporting for 1990-III**

| | September 30, 1990 | March 31, 1992 | Level Change |
|---|---|---|---|
| Capital ratios (percent) | | | |
| Tier 1 risk-based ratio | 6.5 | 7.9 | 1.4 |
| Total risk-based ratio | 9.5 | 11.3 | 1.8 |
| Leverage ratio | 5.5 | 6.2 | 0.7 |
| Number of bank holding companies | 1082 | 983 | −99 |
| | Billions of Dollars | Billions of Dollars | Percent Change |
| Assets | 3,003 | 2,965 | −1.2 |
| Loans | 1,923 | 1,787 | −7.0 |
| Securities | 490 | 573 | 16.9 |
| Other assets | 590 | 606 | 2.6 |
| Risk-weighted assets | 2,508 | 2,314 | −7.8 |
| On balance-sheet | 2,064 | 1,928 | −6.6 |
| Off balance-sheet | 445 | 386 | −13.1 |
| Interest rate and foreign exchange contracts† | 45 | 41 | −7.2 |
| Other items | 400 | 345 | −13.8 |
| Nonperforming assets‡ | 93 | 110 | 19.0 |
| Loan loss reserves | 50 | 52 | 3.4 |
| Tier 1 capital | 164 | 184 | 12.1 |
| Tier 2 capital | 74 | 77 | 4.5 |

Notes: The sample consists of all bank holding companies with assets greater than $150 million that filed FR Y-9C reports, including reports of risk-weighted assets, for 1990-III. The sample includes the ninety-nine bank holding companies with $237 billion in assets that "exited" before 1992-I, mostly through mergers or regulatory closures. The sample does not include the 160 bank holding companies with $46 billion in assets that filed Y-9C reports in 1992-I but not in 1990-III. Many of these are newly formed bank holding companies.

†The decline in swap-related risk-based assets is due to a drop in the replacement value of foreign exchange contracts. Notional values of both foreign exchange and interest rate contracts and replacement values of interest rate contracts continued to rise during the period.

‡Nonperforming assets consist of nonaccruing loans, accruing loans past due ninety days or more, restructured loans, and real estate acquired through foreclosure.

equity, bank holding companies relied chiefly on common stock issuance ($9.3 billion) and preferred stock issuance ($5.3 billion). Most net income during this period ($15.6 billion) was absorbed through dividends on common stock ($10.4 billion) and preferred stock ($1.7 billion). Retained earnings were more important for many bank holding companies than the aggregate statistics would suggest, however, because other companies experienced losses over this period.

Subordinated debt growth was also strong ($9.8 billion); yields on debt securities for many bank holding companies fell sharply after reaching junk bond heights in late 1990. Mandatory convertible securities were on net retired (−$3.6 billion), a predictable development given that these instruments count only as tier 2 capital under the risk-based capital guidelines but had been a core capital component under the "primary capital guidelines" in place before 1991. Loan loss reserves increased for this sample (which differs substantially from the sample analyzed in Table 1), largely owing to mergers; however, virtually none of the additional reserves qualified as tier 2 capital, because the shrinkage of risk-weighted assets reduced the amount of reserves allowable for regulatory capital.

*Footnote 13 continued*
9, 1992. Since bank holding companies in the sample maintain a ratio of assets to equity of about 16.5, the $10.3 billion in equity acquired through mergers could support up to about $170 billion in merger assets before the bank holding companies would have to raise additional capital.

Table 2
**Changes in Equity and Supplemental Capital Components between 1990-III and 1992-I**
In Billions of Dollars

| | |
|---|---|
| **Changes in equity** | |
| Equity acquired through business combinations (mergers) | 10.3 |
| Net income | 15.6 |
| Less dividends on common stock | 10.4 |
| Less dividends on preferred stock | 1.7 |
| Equals retained earnings | 3.4 |
| Net issuance of common stock | 9.3 |
| Net issuance of preferred stock | 5.3 |
| Other increases in equity[†] | 0.5 |
| Equals total increase in equity[‡] | 28.8 |
| **Changes in supplemental capital** | |
| Subordinated debt | 9.8 |
| Mandatory convertible securities | −3.6 |
| Loan loss reserves (total) | 7.5 |
| Loan loss reserves qualifying for tier 2 capital[§] | 0.1 |

Note: Sample is limited to those 983 bank holding companies that filed FR Y-9C reports for both 1990-III and 1992-I.

[†]Increases consist of a variety of accounting adjustments to equity, including foreign currency translation adjustments, cumulative effects of earlier changes in accounting principles, and corrections for past accounting errors.

[‡]Total increase differs from the change in tier 1 capital reported in Table 1 by roughly the equity acquired through mergers net of goodwill.

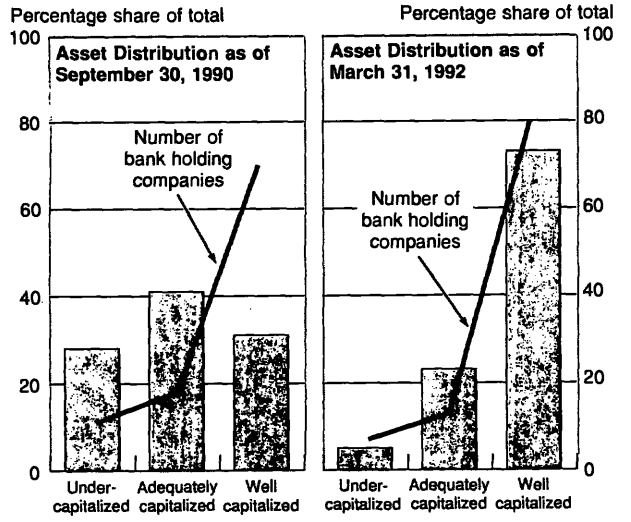
[§]As of year-end 1992, loan loss reserves up to a maximum of 1.25 percent of risk-weighted assets qualify as tier 2 capital.

### The distribution of bank holding companies across capital adequacy groups

Applying the capital adequacy definitions adopted for banks in connection with FDICIA, we find that both the number and the asset share of bank holding companies that would be deemed "well capitalized" have increased.[14] Chart 1 depicts the change in the distribution of bank holding companies and bank holding company assets across the three capital adequacy zones

[14]For simplicity, we have categorized all bank holding companies with leverage ratios below 4 percent as undercapitalized, although banks and bank holding companies with strong examination ratings may be permitted to operate with leverage ratios as low as 3 percent.

Chart 1
**Distribution of Bank Holding Companies across Capital Adequacy Groups**




Notes: Sample for 1990-III (1992-I) consists of 1082 (983) bank holding companies representing $3,003 ($2,965) billion in total assets. Bank holding companies are assigned to capital adequacy groups as follows: 1) well capitalized if tier 1 risk-based capital ratio is greater than 6 percent, total risk-based capital ratio is greater than 10 percent, and leverage ratio is greater than 5 percent; 2) undercapitalized if tier 1 risk-based capital ratio is less than 4 percent, total risk-based capital ratio is less than 8 percent, or leverage ratio is less than 4 percent; and 3) adequately capitalized if neither well capitalized nor undercapitalized.

between September 30, 1990, and March 31, 1992. The increasing shares of all bank holding companies and bank holding company assets in the stronger capitalization groups are quite impressive. In the beginning of the period, 70 percent of all bank holding companies, possessing only 30 percent of the assets, were classified as well capitalized, but at the end of the period, these percentages rose to 80 percent and 73 percent, respectively. Moreover, 11 percent of the bank holding companies, representing a 28 percent share of the assets, were undercapitalized at the start, and these percentages fell to 7 percent and 5 percent by the end of the period.

Capital ratios have shown strong improvement across the various capital adequacy groups, rising for those that were initially undercapitalized as well as for those that were already well capitalized. Table 3 details the movements of bank holding companies in and out of the three capital zones over the sample period. Here we see that the improved distribution of bank holding companies across capital adequacy groups is only partly explained by mergers and closings. Of the 111 undercapitalized bank holding companies observed at the beginning of the period, 33 left the sample by the end of the period. Another 66 of these institutions became adequately or well capitalized over the same period. The most striking statistic in this table, however, is that 93 of the adequately capitalized bank holding companies (with $881 billion in assets) moved into the well-capitalized group during this short sample period.

**Capital adequacy and asset growth**

Of the 983 bank holding companies included at both the beginning and the end of our sample, the institutions that were well-capitalized as of September 30, 1990, had asset growth of 15.5 percent, the adequately capitalized grew 9.9 percent, and the undercapitalized shrank 10.6 percent.[15] Much of this differential growth reflects merger activity. Previous studies have noted that well capitalized banks have grown faster than undercapitalized banks over the last few years.[16] These studies implicitly support the view that differences in capital ratios across institutions have more powerful effects on relative asset growth rates in banking than in unregulated financial industries.[17]

[15]Risk-weighted assets grew more slowly, at a rate about 6 percentage points less than asset growth for each capital adequacy group.

[16]See Ronald Johnson, "The Bank Credit 'Crumble,'" this *Quarterly Review*, Summer 1991, pp. 40-51; Cara Lown and Ben Bernanke, "The Credit Crunch," *Brookings Papers on Economic Activity*, 1992:2, pp. 205-39; Joe Peek and Eric Rosengren, "The Capital Crunch in New England," Federal Reserve Bank of Boston *New England Economic Review*, May-June 1992, pp. 21-31; and Herbert Baer and John McElravey, "Capital Adequacy and the Growth of U.S. Banks," Federal Reserve Bank of Chicago, Working Paper Series, no. WP-92-11, June 1992.

[17]Capital strength, however, is also an important determinant of asset growth in unregulated industries. Eli Remolona and Kurt Wulfekuhler have shown that the single most important variable predicting asset

Table 3

**Detailed Transitions across Risk-based Capital Groups between 1990-III and 1992-I**

| | Bank Holding Companies | | Assets as of 1990-III | |
|---|---|---|---|---|
| | Number | Percentage of Total | Billions of Dollars | Percentage of Total |
| Well capitalized at 1990-III | 776 | 100 | 1,063 | 100 |
| Well capitalized at 1992-I | 695 | 90 | 971 | 91 |
| Adequately capitalized at 1992-I | 29 | 4 | 57 | 5 |
| Undercapitalized at 1992-I | 4 | 1 | 4 | 0 |
| Exited sample by 1992-I | 48 | 6 | 30 | 3 |
| Adequately capitalized at 1990-III | 195 | 100 | 1,185 | 100 |
| Well capitalized at 1992-I | 93 | 48 | 881 | 74 |
| Adequately capitalized at 1992-I | 63 | 32 | 154 | 13 |
| Undercapitalized at 1992-I | 21 | 11 | 54 | 5 |
| Exited sample by 1992-I | 18 | 9 | 96 | 8 |
| Undercapitalized at 1990-III | 111 | 100 | 755 | 100 |
| Well capitalized at 1992-I | 34 | 31 | 85 | 11 |
| Adequately capitalized at 1992-I | 32 | 29 | 430 | 57 |
| Undercapitalized at 1992-I | 12 | 11 | 128 | 17 |
| Exited sample by 1992-I | 33 | 30 | 112 | 15 |

Notes: Bank holding companies are assigned to capital groups according to their risk-based capital as follows: 1) well capitalized if their tier 1 risk-based capital ratios are above 6 percent, total risk-based capital ratios are above 10 percent, and leverage ratios are above 5 percent; 2) undercapitalized if their tier 1 risk-based capital ratios are below 4 percent, total risk-based capital ratios are below 8 percent, or leverage ratios are below 4 percent; and 3) adequately capitalized if neither well capitalized nor undercapitalized.

To measure the independent impact of regulatory capital requirements on relative asset growth, we estimated regressions relating asset growth to tier 1 risk-based capital ratios and public bond ratings.[18] We collected a sample of eighty-eight bank holding companies assigned senior debt ratings by Moody's or Standard and Poor's. (When senior debt ratings were unavailable, they were inferred from subordinated debt ratings.) A second sample was created from the first by dropping nine bank holding companies whose assets grew substantially through mergers during the sample period.

The results, presented in Table 4, show that capital adequacy has an independent effect on asset growth. Both initial capital ratios and bond ratings appear strongly correlated with asset growth, particularly when the large acquirers are excluded from the sample. Moreover, although credit ratings and capital ratios are themselves correlated (the magnitude of each estimated coefficient declines when the other regressor is added to the specification), they have independent strong effects on asset growth. The specifications also include as regressors *changes* in the capital ratios and credit ratings over the sample period. When both capital ratios and credit ratings are included in the regressions, the change in credit ratings has a positive and significant partial correlation with asset growth, but the change in the capital ratio is not significant. These results are consistent with the idea that initial financial strength, rather than subsequent performance, is the key determinant of near-term asset growth. Since rating agencies are often slow to adjust ratings to new information, credit rating downgrades during the sample period may have been associated with weak asset growth because they were anticipated by the affected bank holding companies.[19]

### Which are more constraining: risk-based ratios or leverage ratio requirements?

In aggregate data, we observed a larger improvement in the risk-based capital ratios than in the leverage ratio. To understand what type of regulatory pressure has been most effective in prompting bank holding companies to increase their capital strength, we compared the difficulty of meeting the different capital requirements. In practice, the three ratios are highly correlated: bank holding companies that have high (low) risk-based cap-

*Footnote 17 continued*
growth for finance companies is the credit rating, which for banking organizations tends to be correlated with capital ratios. See "Finance Companies, Bank Competition, and Niche Markets," this *Quarterly Review*, Summer 1992.

[18]Results obtained from regressions using other measures of capital adequacy were not significantly different from those reported here.

[19]For example, during the sample period, the average credit rating fell, although by the end of the period, the average capital ratio had risen.

Table 4

**Relationships among Asset Growth, Capital Ratios, and Bond Ratings**

Dependent variable: bank holding company asset growth

| Explanatory Variables | Sample 1 | | | Sample 2 | | |
|---|---|---|---|---|---|---|
| Constant term | 3.70** (10.13) | −22.73** (7.25) | 29.15** (5.94) | −8.58 (6.17) | −32.88** (4.77) | 22.56** (4.66) |
| Initial tier 1 risk-based ratio | 2.75** (0.86) | 3.33** (0.89) | | 3.84** (0.51) | 4.35** (0.58) | |
| Change in tier 1 risk-based ratio | 1.35 (1.63) | 4.03** (1.45) | | −0.23 (1.01) | 2.42** (0.98) | |
| Initial senior bond rating | 2.14** (0.69) | | 2.42** (0.70) | 1.92** (0.43) | | 2.09** (0.54) |
| Increase in senior bond rating | 2.83* (1.26) | | 3.94** (1.11) | 2.76** (0.75) | | 3.54** (0.82) |
| $R^2$ | 0.30 | 0.20 | 0.22 | 0.60 | 0.50 | 0.30 |
| Number of observations | 88 | 88 | 88 | 79 | 79 | 79 |

Notes: Standard errors are given in parentheses below the coefficient estimates. Bond ratings were converted to numerical values; high ratings correspond to large numbers. Moody's bond ratings were used in most cases. When Moody's ratings were not available, Standard and Poor's were used. In some cases, senior debt ratings were inferred from subordinated debt ratings. Sample 1 consists of eighty-eight bank holding companies with debt ratings by Moody's or Standard and Poor's. Sample 2 consists of seventy-nine bank holding companies with debt ratings by Moody's or Standard and Poor's that did not acquire a large bank holding company between September 30, 1990, and March 31, 1992. Changes in asset growth, risk-based ratios, and bond ratings occurred between September 30, 1990, and March 31, 1992.

*Significantly different from zero at the 5 percent level.

**Significantly different from zero at the 1 percent level.

ital ratios tend to have high (low) leverage ratios.

Comparisons between the risk-based and leverage capital requirements are complicated because the minimum leverage requirement varies from one depository institution to another. Broadly speaking, however, smaller bank holding companies tend to have higher risk-based capital ratios relative to their leverage ratios than do larger bank holding companies for two reasons: 1) the small bank holding companies rely more on low-risk security holdings as a source of liquidity, and 2) large bank holding companies typically have more off-balance-sheet exposures. Small bank holding companies tend to satisfy their total risk-based capital requirement with tier 1 capital and loan loss reserves because the issuance of supplemental capital instruments such as subordinated debt or convertible bonds generally involves large fixed costs.[20]

[20]Although the supplemental capital components of tier 2 capital are valued by the regulators (since they serve as a buffer preventing losses to the deposit insurance fund), market participants report that the credit rating agencies measure capital adequacy almost exclusively by tier 1 capital because the agencies are concerned with the likelihood of default on all debt instruments.

Some observers have argued that, in practice, the leverage requirement is more constraining than the risk-based standards. A Federal Reserve Bank of Chicago study shows that asset growth rates of bank holding companies are more correlated with their leverage ratios than with their total risk-based capital ratios.[21] Another study, published by the Federal Reserve Bank of Boston, argues that the leverage requirement has been a particular impediment to loan growth because regulators require higher leverage ratios at troubled institutions to head off large losses to the deposit insurance fund.[22]

In contrast to these studies, the evidence presented in Table 5 suggests that the leverage ratio requirement is slightly less binding than the risk-based standards for most bank holding companies. In the table, the two

[21]Herbert Baer and John McElravey, "Capital Adequacy and the Growth of U.S. Banks," Federal Reserve Bank of Chicago, Working Paper Series, no. WP-92-11, June 1992.

[22]Richard Syron and Richard Randall, "The Procyclical Application of Bank Capital Requirements," Federal Reserve Bank of Boston, *Annual Report 1991*.

Table 5

**Risk-based Capital versus Leverage Capital Adequacy Groups**

| | Bank Holding Companies | | Assets | |
|---|---|---|---|---|
| | Number | Percentage of Total | Billions of Dollars | Percentage of Total |
| **As of September 30, 1990** | | | | |
| All bank holding companies | 1,082 | 100 | 3,003 | 100 |
| Risk-based capital groups | | | | |
| Well capitalized | 776 | 72 | 1,063 | 35 |
| Adequately capitalized | 195 | 18 | 1,185 | 40 |
| Undercapitalized | 111 | 10 | 755 | 25 |
| Leverage ratio capital groups | | | | |
| Well capitalized | 927 | 86 | 1,723 | 57 |
| Adequately capitalized | 82 | 7 | 903 | 30 |
| Undercapitalized | 73 | 7 | 376 | 13 |
| **As of March 31, 1992** | | | | |
| All bank holding companies | 983 | 100 | 2,965 | 100 |
| Risk-based capital groups | | | | |
| Well capitalized | 800 | 81 | 2,205 | 74 |
| Adequately capitalized | 124 | 13 | 613 | 21 |
| Undercapitalized | 59 | 6 | 147 | 5 |
| Leverage ratio capital groups | | | | |
| Well capitalized | 877 | 89 | 2,432 | 82 |
| Adequately capitalized | 49 | 5 | 389 | 13 |
| Undercapitalized | 57 | 6 | 144 | 5 |

Notes: Sample consists of all bank holding companies filing FR Y-9C reports for 1990-III. Bank holding companies are assigned to capital groups according to their risk-based capital as follows: 1) well capitalized if tier 1 risk-based capital ratio is greater than 6 percent and total risk-based capital ratio is greater than 10 percent; 2) undercapitalized if tier 1 risk-based capital ratio is less than 4 percent or total risk-based capital ratio is less than 8 percent; and 3) adequately capitalized if neither well capitalized nor undercapitalized. Bank holding companies are assigned to capital groups according to their tier 1 leverage ratios as follows: 1) well capitalized if leverage ratio is greater than 5 percent; 2) undercapitalized if leverage ratio is less than 4 percent; and 3) adequately capitalized if neither well capitalized nor undercapitalized.

standards of capital adequacy produce different distributions of bank holding companies among the three capital adequacy zones. At both the beginning and end of the sample period, the leverage standard appears modestly more generous than the risk-based capital ratio standard. That is, a greater number of bank holding companies, with greater assets, would be classified as undercapitalized if the risk-based capital ratio rather than the leverage ratio were the sole standard.

Two factors help to explain the difference between this finding and the conclusions reached in earlier studies. First, although other studies show that bank holding company asset growth rates are more correlated with leverage ratios than with *total* risk-based capital ratios, they do not examine the ability of variations in *tier 1* risk-based capital ratios to explain differences in asset growth.[23] Second, desired risk-based capital ratios may have increased relative to desired leverage ratios since the adoption of an explicit regulatory definition of a well-capitalized bank. Because the effective minimum leverage ratio requirement in place over the last three years was 4 to 5 percent for most banks, the recent requirement that well-capitalized banks maintain a leverage ratio in excess of 5 percent is relatively easy to achieve. In contrast, the tier 1 and total risk-based capital minimum requirements of 4 percent and 8 percent, respectively, are substantially less than the new well-capitalized standards of 6 percent and 10 percent, respectively.

The results of a recent survey support the view that for most institutions, desired leverage ratios are not more constraining than desired risk-based ratios. In August 1992, fifty-nine large U.S. banks with combined assets of almost $1 trillion were asked to respond to the following question on capital adequacy:

> Taking into account regulatory requirements, expected loan demand, the quality of loans and other assets in your bank's portfolio, and its prospects for earnings and raising new capital, your bank's current risk-based capital ratio and tier 1 leverage ratio could best be described as 1) very comfortable, 2) fairly comfortable, 3) about adequate, 4) fairly tight, or 5) very tight.[24]

The banks' responses are strikingly consistent for the two capital requirements:

| | Risk-based Capital Ratio | | Leverage Ratio | |
|---|---|---|---|---|
| Choices | Number of Banks | Percent of Total | Number of Banks | Percent of Total |
| Very comfortable | 28 | 47.5 | 28 | 47.5 |
| Fairly comfortable | 23 | 39.0 | 23 | 39.0 |
| About adequate | 5 | 8.5 | 6 | 10.2 |
| Fairly tight | 0 | 0.0 | 1 | 1.7 |
| Very tight | 3 | 5.1 | 1 | 1.7 |

Thus, banks themselves have professed a very similar degree of comfort with their risk-based capital ratios and their leverage capital ratios.

**Stock market rewards for capital ratio improvements**

The remainder of this article analyzes how the stock market has reacted to changes in bank holding company capital ratios. We find that bank holding companies that improved their capital ratios experienced above-average stock price appreciations, particularly if they were weakly capitalized at the beginning of the sample and became well capitalized by the end. Assuming that this appreciation reflects more than a stock market response to strong earnings, the question arises, Why has the stock market been rewarding reductions in leverage at this time? We explore this question by considering the theoretical relationship between stock prices and changes in capital structure and by analyzing in detail the correlation between stock prices and capital ratio improvements in our sample. Finally, we examine how stock market rewards have varied with the different strategies employed by bank holding companies to improve their capital ratios.

*The theoretical relationship between changes in capital ratios and stock prices*

A substantial portion of both theoretical and empirical research in finance is devoted to the relationship between stock prices and firm capital structures. The standard analytical framework begins with an idealized model that excludes taxes, bankruptcy costs, and the agency costs arising from differential information between investors and firm managers. In this setting, managerial decisions regarding changes in capital structure have no effect on stock prices, except that changes in equity due to common stock dividends have a dollar-for-dollar effect on the value of common shares.[25] By contrast, models that incorporate taxes,

[23]Tier 1 risk-based capital ratios are, of course, more highly correlated with leverage ratios than are total risk-based capital ratios. We found very little difference between the choice of the tier 1 risk-based capital ratio and the leverage ratio in regressions (not reported here) relating capital ratios to asset growth rates.

[24]See the "Senior Loan Officer Survey on Bank Lending Practices," Board of Governors of the Federal Reserve System, August 1992.

[25]The pioneering paper in this area is Franco Modigliani and Merton Miller, "The Cost of Capital, Corporation Finance, and the Theory of Investment," *American Economic Review*, vol. 48 (June 1985), pp. 261-97.

bankruptcy costs, and agency costs imply the existence of a theoretically optimal capital ratio for each firm; in this framework, the financial decisions made by managers can affect stock prices.[26] Firms limit their use of debt because the marginal cost of borrowed funds is an increasing function of leverage.

Factors other than taxes, bankruptcy costs, and agency costs may also be important in the determination of the desired capital structure of regulated firms and, in particular, bank holding companies.[27] Banks with liabilities consisting entirely of government-insured deposits have funding costs that are independent of their capital structures. Such institutions might therefore desire to operate at the minimum capital ratios permitted by their regulators. Under these circumstances, an increase in a bank holding company's capital ratio above the required minimum might cause its stock price to decline (unless the decline in leverage was due to a rise in equity from surprisingly strong earnings). In practice, however, bank holding companies are funded in part by uninsured liabilities, so the desire to drive capital ratios down to their regulatory minimums is not absolute.

The finance literature suggests that, other things being equal, changes in capital structure that have not already been anticipated by the market and that move firms toward their optimal capital ratios should lead to stock price appreciations. In fact, however, one cannot predict unambiguously the algebraic sign of the change in stock prices following increases in capital ratios because many firms are likely to be above and many are likely to be below their optimal capital ratios. Moreover, some changes in capital ratios are anticipated by the market, others are not.

The current environment does suggest, however, that capital ratio improvements at bank holding companies might on average be rewarded by the stock market. Following a period of widespread weak earnings that eroded capital in 1989 and 1990, many bank holding companies presumably fell below their desired capital ratios. Yet over the past two years many of these companies have needed a reasonably high capital ratio to take on certain high-return investment projects such as (1) financing future credit expansion, (2) taking advantage of the acquisition opportunities posed by the current period of industry consolidation, (3) entering new business lines requiring regulatory approval, and (4) competing in the growing markets for swaps or credit guarantees, for which strong credit ratings are a prerequisite.[28] In addition, FDICIA, adopted in 1991, contains powerful incentives for banks to become well capitalized through its provisions relating to risk-based deposit insurance premiums, access to brokered deposits, and capital ratio "tripwires" prompting corrective regulatory actions.

The particular strategies employed by bank holding companies to boost their capital ratios may have incidental effects that alter the expected impact on stock prices, as the following examples suggest:

—A rise in the capital ratio due to earnings growth would likely raise stock prices if earnings were stronger than previously expected and if the market did not expect the gains to be reversed by future losses.

—A rise due to a suspension of dividend payouts might depress prices if the change in dividend policy were viewed by the market as a signal of weak future earnings.

—An increase stemming from direct equity issuance would probably depress stock prices, perhaps because earnings would be diluted or because the market would believe that firm managers issued equity only when their stock was overvalued.[29]

—An increase achieved through asset shrinkage might depress prices if the market interpreted this action as a negative signal of future earnings.

The existing literature has little to say about changes in capital structure that occur in the process of growing or shrinking assets because the standard analysis takes the level of assets to be funded as given.

In summary, it appears likely that many bank holding companies were below their target capital ratios in 1990 and 1991. Recent earnings performance was poor and new regulatory incentives were pushing target ratios upward. Hence, on average, increases in capital ratios that were not already anticipated by the market ought to have led to higher stock prices in 1992. The different methods of achieving capital ratio improvements, however, were likely to have been rewarded differently

[26]For a discussion of the role of taxes in determining the optimal capital structure, see Merton Miller, "Debt and Taxes," *Journal of Finance*, vol. 32 (May 1977), pp. 261-76. The relationship between agency costs and optimal capital structure is developed in Michael Jenson and William Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics*, vol. 3 (October 1976), pp. 305-60; and in Stewart Myers and Nicholas Majiluf, "Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have," *Journal of Financial Economics*, vol. 13 (June 1984), pp. 187-221.

[27]The determinants of desired capital ratios for bank holding companies and nonfinancial firms are compared in Larry Wall and Pamela Peterson, "Valuation Effects of New Capital Issues by Large Bank Holding Companies," *Journal of Financial Services*, vol. 5 (March 1991), pp.77-87.

[28]Bank holding companies can engage in these activities through highly rated, well-capitalized subsidiaries, but the need to segregate capital for these purposes reduces its availability to other parts of the organization.

[29]See, for example, Paul Asquith and David Mullins, "Equity Issues and Offering Dilution," *Journal of Financial Economics*, vol. 15 (January-February 1986), pp. 61-89.

by the market. Capital growth through earnings would probably have been the most generously rewarded, since strong current earnings would signal strong future earnings. It is more difficult, however, to predict how the stock market would have responded to other ways of improving capital ratios—reductions in dividend payouts, stock issuance, and asset shrinkage.

*Empirical results*

The correlation between stock price appreciation and the capital ratio in our sample was strong, and the relationship was the strongest for those institutions that improved their standings as measured by the capital adequacy zones. Chart 2 and Table 6 present stock price data for a sample of 281 bank holding companies, which together accounted for $2.4 trillion in assets as of March 31, 1992.[30] The average stock price appreciation between September 30, 1990, and May 15, 1992, was 62 percent.[31] In the table, bank holding companies are divided into categories on the basis of their initial capital adequacy groups and their subsequent record in improving, worsening, or maintaining their group standing over the period.

The stock market clearly rewarded those bank holding companies that substantially improved their capital ratios.[32] As Chart 2 shows, those institutions that improved their capital adequacy standing averaged stock price growth in excess of 100 percent, while those that slipped in ranking averaged slightly negative stock price performance. Table 6 provides additional insights, including the observation that bank holding companies that rose to the well-capitalized group were able to do so while still expanding assets.

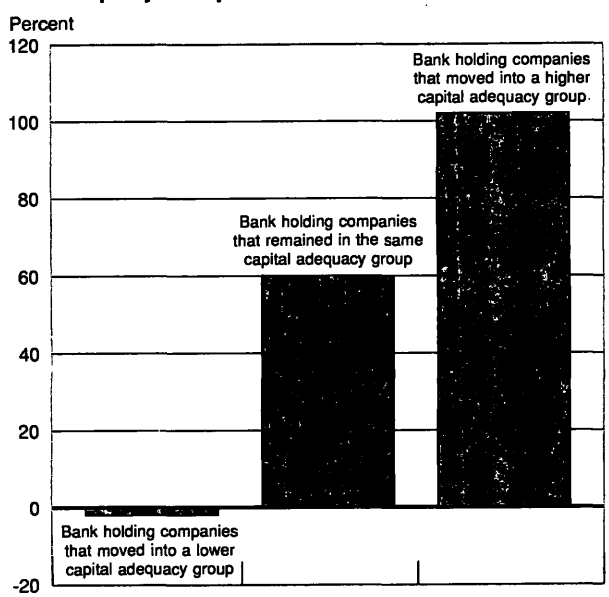
Bank holding companies that were initially weakly capitalized were rewarded more by the stock market for capital ratio improvements than were bank holding companies that were initially well capitalized. Table 7 details the correlations between stock price growth and increases in the various capital ratios. A 1 percentage point increase in the tier 1 risk-based capital ratio led to an increase of almost 25 percent in stock prices for weakly capitalized bank holding companies, whereas well-capitalized institutions experienced only a 7 percent increase for the same increase in capital.[33] The stock prices of weakly capitalized bank holding companies also responded more to increases in their total risk-based ratios and their leverage ratios than did well-capitalized institutions. Changes in capital ratios explain much of the variation in stock price appreciation for weakly capitalized bank holding companies but explain little for well-capitalized institutions; the "R-squares" reported in the Table 7 regressions are high for the former and extremely low for the latter.

We examine next whether the stock price response varies with the strategy employed by the bank holding

[30]Bank holding companies that were known to be merger targets by the end of the period are not included in the sample.

Chart 2

**Average Stock Price Appreciation and Movement of Bank Holding Companies across Capital Adequacy Groups**




Notes: Sample consists of 281 bank holding companies that met the following three criteria: 1) company had filed FR Y-9C reports, including details on risk-weighted assets, on September 30, 1990, and March 31, 1992; 2) company had not been a known merger target before May 15, 1992; 3) company's stock price data were available. Movement in capital adequacy groups occurred between September 30, 1990, and March 31, 1992. Stock price appreciation occurred between September 30, 1990, and May 15, 1992.

[31]Stock price data were made available to us by the staff of the Board of Governors of the Federal Reserve System. We chose May 15 as the ending date because end-of-quarter financial statements are normally made available to the public within forty-five days.

[32]This statement assumes that causality runs from capital ratio improvement to stock prices, and not vice versa. Although it is not unusual for firms to issue more common stock after large stock price appreciations, that relationship does not appear very strong in our data set. (See the discussion of Table 9 below.)

[33]Many specifications were tried for the regressions reported in Tables 7, 8, and 9. Some of the explanatory variables used—in particular, changes in earnings, growth in loan loss reserves, and growth in nonperforming assets—had coefficient estimates that were economically sensible and significant. The estimated coefficients on capital and assets were, however, not sensitive to the inclusion or exclusion of these additional variables. For ease of exposition, therefore, we have not reported the estimates from these other regressions.

Table 6

**Stock Price Appreciation by Capital Adequacy Groups**

From September 30, 1990, to May 15, 1992

| Capital Group as of 1990-III | Capital Group as of 1992-I | Average Stock Price Growth (Percent) | Number of Bank Holding Companies | Assets as of 1992-I (Billions of Dollars) | Asset Growth From 1990-III to 1992-I† (Percent) |
|---|---|---|---|---|---|
| Well capitalized | | | | | |
| | Well capitalized | 65 | 174 | 694 | 16.2 |
| | Adequately capitalized | 24 | 14 | 61 | 14.8 |
| | Undercapitalized | −45 | 1 | 3 | −12.7 |
| Adequately capitalized | | | | | |
| | Well capitalized | 106 | 39 | 887 | 13.9 |
| | Adequately capitalized | 43 | 22 | 179 | 4.3 |
| | Undercapitalized | −31 | 11 | 27 | −13.5 |
| Undercapitalized | | | | | |
| | Well capitalized | 92 | 5 | 151 | 9.4 |
| | Adequately capitalized | 92 | 10 | 389 | −2.3 |
| | Undercapitalized | −35 | 5 | 19 | −16.3 |
| Totals | | 62 | 281 | 2,410 | 12.3 |

Note: Sample consists of 281 bank holding companies that met the following three criteria: 1) company had filed FR Y-9C reports, including risk-weighted assets, on September 30, 1990, and March 31, 1992; 2) company had not been a known merger target before May 15, 1992; and 3) company's stock price data were available. Bank holding companies are assigned to capital groups according to their risk-based capital as follows: 1) well capitalized if their tier 1 risk-based capital ratios are above 6 percent, total risk-based capital ratios are above 10 percent, and leverage ratios are above 5 percent; 2) undercapitalized if their tier 1 risk-based capital ratios are below 4 percent, total risk based capital ratios are below 8 percent, or leverage ratios are below 4 percent; and 3) adequately capitalized if neither well capitalized nor undercapitalized.

†The high average asset growth is due to merger activity.

Table 7

**Relationship between Stock Price Appreciation and Changes in Capital Ratios**

Dependent variable: bank holding company stock price growth

| Explanatory Variables | Sample: Weakly Capitalized Bank Holding Companies | | | Sample: Well-Capitalized Bank Holding Companies | | |
|---|---|---|---|---|---|---|
| Constant term | 45.1 (7.0) | 40.5 (7.0) | 60.5 (6.7) | 57.6 (4.4) | 58.2 (4.5) | 61.3 (4.1) |
| Change in the tier 1 risk-based ratio | 24.5 (3.3) | | | 6.8 (1.8) | | |
| Change in the total risk-based ratio | | 23.3 (2.9) | | | 5.1 (1.7) | |
| Change in the leverage ratio | | | 30.3 (4.4) | | | 19.0 (3.5) |
| $R^2$ | 0.39 | 0.41 | 0.35 | 0.04 | 0.04 | 0.07 |
| Number of observations | 92 | 92 | 92 | 189 | 189 | 189 |

Notes: All variables are measured in percentage points. All coefficient estimates are significantly different from zero at the 1 percent level (standard errors are given in parentheses). The weakly capitalized sample comprises undercapitalized institutions (tier 1 risk-based capital ratios below 4 percent, total risk-based capital ratios below 8 percent, or leverage ratios below 4 percent) and adequately capitalized institutions (defined as neither well capitalized nor undercapitalized). The well-capitalized sample comprises institutions with tier 1 risk-based capital ratios above 6 percent, total risk-based capital ratios above 10 percent, and leverage ratios above 5 percent. The capitalization groups are based on capital ratios as of September 30, 1990. Stock price growth occurred between September 30, 1990, and May 15, 1992. Changes in capital ratios occurred between September 30, 1990, and March 31, 1992.

*Significantly different from zero at the 5 percent level.
**Significantly different from zero at the 1 percent level.

company to improve its capital ratio (Table 8). We first compare the stock price response to an increase in the numerator of the ratio, capital, with the stock price response to a decrease in the denominator, assets. For simplicity, we limit the analysis to factors affecting the tier 1 capital ratio.[34] We then examine whether stock prices respond differently to changes in risk-weighted assets than to changes in total assets. Finally, we decompose the change in capital into its various sources—net earnings, dividends, stock issuance, and equity acquired through mergers.

The estimated coefficients from the regressions reported in the first and third columns of Table 8 reveal the responsiveness of stock prices to growth in tier 1 capital and risk-weighted assets. Both weakly capitalized and well-capitalized bank holding companies experienced large stock price increases as their tier 1 capital rose, although the increase was almost twice as large for the weakly capitalized institutions. The stock price increase following a reduction in risk-weighted assets was also very strong (although slightly less than the increase following a capital increase) for weakly capitalized bank holding companies. Asset shrinkage was also rewarded, but less strongly, for well-capitalized institutions.

Columns two and four of Table 8 reveal the responsiveness of stock prices to growth in tier 1 capital, risk-weighted assets, and total assets for weakly capitalized and well-capitalized bank holding companies, respectively. For both capital adequacy groups, the estimated response to the capital growth was basically the same as that reported in columns one and three when risk-weighted assets but not total assets were included in the regressions. Moreover, for both groups, the responses of stock prices to total growth in risk-weighted assets and total assets were about equal in size and sum to the coefficients on risk-weighted assets reported in the regressions in columns one and three. It appears that the stock market did not differentiate between reductions in risk-weighted assets and total assets.[35]

Table 9 focuses on the returns to different strategies for increasing tier 1 capital. Regressions for weakly capitalized and well-capitalized firms are presented in columns one and two, respectively. The first regression reported in the upper half of the table relates stock

[34]We also compared the stock market responses to growth in risk-weighted assets and growth in total assets and found no material differences; therefore, the analysis applies to the leverage ratio as well as the tier 1 risk-based ratio. Furthermore, we did not uncover any systematic relationships in the data between stock prices and growth in the supplemental capital components included in tier 2 capital.

[35]We feared that merger activity might be driving some of these results since acquirers were likely to experience large increases in capital, total assets, and risk-weighted assets. We therefore reran the regressions underlying Table 7 after dropping the fifty-nine bank holding companies that reported merger activity in their equity flows. We found no significant differences in the results.

Table 8

**Relationship between Stock Price Appreciation and Growth Rates of Capital and Assets**

Dependent variable: bank holding company stock price growth

| Explanatory Variables | Sample: Weakly Capitalized Bank Holding Companies | | Sample: Well-Capitalized Bank Holding Companies | |
|---|---|---|---|---|
| Constant term | 41.78** | 49.33** | 50.96** | 58.21** |
| | (7.76) | (3.21) | (4.94) | (5.17) |
| Growth in tier 1 risk-based capital | 2.38** | 2.71** | 1.29** | 1.50** |
| | (0.37) | (0.35) | (0.26) | (0.30) |
| Growth in risk-weighted assets | −2.02** | −1.07 | −0.57* | −0.36 |
| | (0.49) | (0.67) | (0.26) | (0.26) |
| Growth in total assets | | −1.39* | | −0.44 |
| | | (0.69) | | (0.31) |
| $R^2$ | 0.35 | 0.38 | 0.11 | 0.12 |
| Number of observations | 92 | 92 | 189 | 189 |

Notes: All variables are measured in percentage points. All coefficient estimates are significantly different from zero at the 1 percent level (standard errors are given in parentheses). The weakly capitalized sample comprises undercapitalized institutions (tier 1 risk-based capital ratios below 4 percent, total risk-based capital ratios below 8 percent, or leverage ratios below 4 percent) and adequately capitalized institutions (defined as neither well capitalized nor undercapitalized). The well-capitalized sample comprises institutions with tier 1 risk-based capital ratios above 6 percent, total risk-based capital ratios above 10 percent, and leverage ratios above 5 percent. The capitalization groups are based on capital ratios as of September 30, 1990. Stock price growth occurred between September 30, 1990, and May 15, 1992. Growth in capital and assets occurred between September 30, 1990, and March 31, 1992.

*Significantly different from zero at the 5 percent level.

**Significantly different from zero at the 1 percent level.

price appreciation to risk-weighted asset growth and two variables that in combination sum to tier 1 capital growth—that is, tier 1 capital growth due to net earnings (less preferred stock dividends) and all other sources of tier 1 capital growth. The estimated coefficient on capital growth through earnings was large and significant for both groups. Other contributions to capital growth were also rewarded by the market, but the absolute magnitude of the stock price response was considerably less than the response to earnings for both groups. The stock market responded more favorably to strong earnings (and negatively to weak earnings) because earnings not only raised current capital levels but may also have signaled long-run improvements in profitability.

In the second regression reported in the lower part of the table, the growth in tier 1 capital is further decomposed. Here we see that the stock market responded positively to efforts by both groups to build capital through stock issuance and dividend cutbacks, although rewards were somewhat greater for well-capitalized bank holding companies than weakly capitalized institutions. In addition, for both groups, capital growth through mergers was positively correlated with stock prices.

Table 9

**Relationships between Stock Price Appreciation and Growth Rates of Assets and Capital Components**

Dependent variable: bank holding company stock price growth

| Explanatory Variables | Sample: Weakly Capitalized Bank Holding Companies | Sample: Well-Capitalized Bank Holding Companies |
|---|---|---|
| | **Regression** | |
| Constant term | 47.67** | 37.48** |
| | (8.83) | (5.96) |
| Contribution to tier 1 capital growth from net earnings after preferred dividends | 2.19** | 1.50** |
| | (0.27) | (0.27) |
| Contributions to tier 1 capital growth from all other factors | 0.50* | 0.36 |
| | (0.26) | (0.23) |
| Growth in risk-weighted assets | −1.51** | −0.44* |
| | (0.46) | (0.22) |
| $R^2$ | 0.45 | 0.16 |
| | **Regression** | |
| Constant term | 53.30** | 53.64** |
| | (12.45) | (8.97) |
| Contribution to tier 1 capital growth from net earnings after preferred dividends | 2.36** | 1.89** |
| | (0.34) | (0.31) |
| Contribution to tier 1 capital growth from common stock issuance | 0.38 | 0.58* |
| | (0.30) | (0.29) |
| Tier 1 capital growth from preferred stock issuance | 1.12 | 0.97 |
| | (0.73) | (0.90) |
| Contribution to tier 1 capital growth from common stock dividends | −1.32 | −3.22* |
| | (2.09) | (1.48) |
| Contribution to tier 1 capital growth from business combinations (mergers) | 1.01* | 1.02* |
| | (0.52) | (0.53) |
| Growth in risk-weighted assets | −1.60** | −0.55** |
| | (0.48) | (0.24) |
| $R^2$ | 0.46 | 0.18 |
| Number of observations | 92 | 189 |

Notes: All variables are measured in percentage points. All coefficient estimates are significantly different from zero at the 1 percent level (standard errors are given in parentheses). The weakly capitalized sample comprises undercapitalized institutions (tier 1 risk-based capital ratios below 4 percent, total risk-based capital ratios below 8 percent, or leverage ratios below 4 percent) and adequately capitalized institutions (defined as neither well capitalized nor undercapitalized). The well-capitalized sample comprises institutions with tier 1 risk-based capital ratios above 6 percent, total risk-based capital ratios above 10 percent, and leverage ratios above 5 percent. The capitalization groups are based on capital ratios as of September 30, 1990. Stock price growth occurred between September 30, 1990, and May 15, 1990. Growth in capital components and assets occurred between September 30, 1990, and March 31, 1992.

*Significantly different from zero at the 5 percent level.

**Significantly different from zero at the 1 percent level.

## Conclusion

The strength of the U.S. banking system has been improving as bank holding companies strive to become well capitalized. Regulatory pressure has probably been the principal force propelling these efforts, but private incentives have also played a role. Bank holding companies, motivated in part by the strategic business opportunities available to institutions with capital to invest, have been moving to repair their balance sheets following a period of weak earnings. The markets have clearly rewarded reductions in leverage, but the preference for higher capital ratios is not without limit: the rewards for capital ratio improvements are significantly less for bank holding companies that are already well capitalized than for weakly capitalized institutions.

The stock market has assigned different rewards to the different strategies employed to improve capital ratios. For well-capitalized institutions, stock price increases were proportionately larger for increases in capital than for shrinkage in assets. For weakly capitalized institutions, however, the stock market made little distinction between the capital ratio improvements achieved through capital growth and the improvements achieved through asset reduction. For all institutions, the price responses to reductions in risk-weighted assets and reductions in total assets were about the same, perhaps because the leverage ratio and risk-based capital ratios appear to be about equally constraining for most bank holding companies. Of the means of raising capital, increased earnings yielded the largest stock price increases. Dividend retention and stock issuance, methods of raising capital that financial officers often fear will depress stock prices, were in fact correlated in our sample with stock price increases. This finding underscores the market's enthusiasm for all forms of capital ratio improvement in recent quarters.