THE EFFECT OF CREDIT RISK ON BANK AND BANK HOLDING COMPANY BOND YIELDS: EVIDENCE FROM THE POST-FDICIA PERIOD

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**Abstract**

In this article we examine whether the federal safety net is viewed by the market as being extended beyond *de jure* deposits to other bank debt and even the debt of bank holding companies (BHCs). We extend previous research by focusing on the post-FDICIA period and by examining the risk-return relation of bonds issued directly by banks, not BHCs. Our results provide evidence that both bank and BHC bonds are priced by the secondary market in relation to their underlying credit risk, particularly for less capitalized issuers, suggesting that proposals requiring banks to issue subordinated debt may enhance market monitoring and discipline and be useful in supplementing regulatory discipline.

**JEL Classifications:** G21, G28, G20

**I. Introduction and Objective**

The relative roles of market and regulatory discipline in banking have long been a subject of controversy. Most recently, the effectiveness and desirability
of government regulation have been questioned, in part because the increasing operating complexity of large banks has both reduced faith in the ability of regulators to accurately measure and monitor their risk exposure and increased greatly the costs of attempting to do so. As a result, many banking analysts have advocated using market discipline to supplement regulatory discipline. To implement such discipline, some propose that banks be required to issue a minimum amount of subordinated debt. The pricing of such debt would provide additional publicly available information about the market’s evaluation of the financial strength of the issuing institution and help discipline both potentially excessively risky behavior by banks and potentially tardy behavior by regulators. Research by the Board of Governors (1999), Benston et al. (1986), and Evanoff and Wall (2000) offers a broad discussion of these issues.

The effectiveness of market discipline and monitoring in banking, however, is also in dispute, particularly when government-sponsored safety nets may stretch beyond their de jure boundaries and de facto protect other banks’ claimants, so that they do not perceive themselves at risk. We provide new evidence on the ability of the financial markets in the United States to price de jure noninsured subordinated debt of U.S. banks and bank holding companies (BHCs) according to the perceived risk of default of the issuer. If markets cannot or do not price these securities in relation to their credit risk, the markets cannot be expected to monitor or discipline the issuing banks adequately.

Before enactment of the FDIC Improvement Act (FDICIA) in 1991, the de facto federal safety net often extended beyond insured deposits. This was because the FDIC protected uninsured depositors and many other creditors (e.g. fed funds sellers) as well as insured depositors in full while resolving the majority of failed banks (Benston and Kaufman 1997). These implicit safeguards reduced the credit risk of most bank liabilities, not just insured deposits. This implicit coverage may have allowed banks to raise funds at a cost lower than the market would have required on riskier securities if, as the evidence suggests, the insurance was underpriced in much of this period.1

We examine whether the market perceives that the protection is passed through beyond explicitly insured depositors to debtholders of the issuing bank and beyond to debtholders of the bank’s parent BHC since the enactment of FDICIA in 1991. In particular, we investigate empirically whether the market prices the debt of banks and BHCs for credit risk by testing the relation between the yields on these securities and the accounting and market risk measures of the issuer’s credit quality. Our results have important policy implications for evaluating (a) whether market discipline can effectively supplement regulatory discipline, (b) whether the subordinated debt proposal can enhance market discipline,

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1Standard & Poor recognizes this possibility (see Standard & Poor 1996, p. 1).
II. Literature Review

Many studies examine the relation between the credit risk characteristics of banks and BHCs and the pricing of *de jure* uninsured deposits and other debt, including Flannery and Sorescu (1996), Flannery (1998), DeYoung et al. (2001), and Jagtiani and Lemieux (2001). Except for Flannery and Sorescu, who find a positive relation between the yields on subordinated debt issued by BHCs and measures of credit risk, the results of these studies are inconclusive, although they suggest a stronger relation than is reported. The studies that examine BHC bonds tend to find a significant relation more often than those that examine the pricing of uninsured deposits, particularly for more recent periods. Because the bonds have lower *de jure* or *de facto* priority in case of liquidation of the bank than uninsured deposits, their prices (yields) are expected to be more sensitive to risk. Moreover, studies that report little or no relation find a significant relation between the yield and the credit rating assigned to the instrument by private rating agencies, such as Moody’s and Standard & Poor. This suggests that these studies may fail to identify or misspecify the more important risk characteristics included by the rating agencies. Finally, most of the studies are limited to observations before 1992, when the market’s perception of the coverage of the federal safety net may have been broader than in the post-FDICIA environment. Thus, they are less relevant to current policy issues.

We extend the literature in two important directions. First, in contrast to the earlier studies, we examine the behavior of the market in the post-FDICIA period since 1991, when the breadth of the safety net beyond *de jure* insured deposits has been greatly restricted. Since 1993, all bank-issued bonds are subordinated in liquidation to the claims of the FDIC and uninsured domestic depositors (Kaufman 1997). Thus, their prices may be expected to be more sensitive to the risk characteristics of the issuing bank than before 1993. Second, we examine the risk factors affecting the pricing not only of debt issued by BHCs, as do most of the earlier studies, but also of the bonds issued by the commercial banks themselves. Many of the current proposals for increasing market discipline on banks through requiring subordinated debt apply to bank debt only. However, banks have issued subordinated debt in large quantities only since the early 1990s. Thus, in their sample of 422 bonds, Flannery and Sorescu (1996) include only 3 bank debt issues (all by the same bank). The remaining 419 bonds were issued by BHCs.

The difference between bonds issued by banks and BHCs is important, as they have different legal standing in case of bank failure. Bonds issued by banks have a higher priority claim on the bank’s assets in liquidation than the bonds of BHCs, whose primary claim on the bank is equity. In addition, to the extent that the parent BHC owns other banks and permissible nonbanks, the prices of BHC bonds
reflect the risk of more than just the subsidiary bank that issued its own bonds. On the other hand, BHCs, particularly in the period before the full implementation of interstate branching under the Riegle-Neal Act of 1994 and the Gramm-Leach-Bliley Act of 1999, were able to engage in a broader range of activities and operate in a wider geographical area through out-of-state subsidiary banks than could banks. Thus, BHCs could reduce their risk through greater diversification. Nevertheless, unless the perception of the safety net is expanded beyond bank bonds, one would expect the prices of BHC bonds to be more sensitive to the risk of the issuer than bank-issued bonds.

III. Model Specification and Estimation Method

Our model relates the interest rate spread (SPREAD) on bank or BHC bonds in the secondary market over a Treasury security of equal maturity to accounting measures of default risk. The greater the risk measures, the larger should be the spread charged by the market on the issuer’s bonds. However, the spread reflects not only the probability of default, but also the expected loss if there is a default. Similar to earlier studies, we do not account for this latter component in the model. However, to gauge the reliability of the accounting risk measures, we estimate a similar model specifying only the bond ratings assigned by private credit ratings agencies—Moody’s and Standard & Poor (S&P)—and the banking organization’s rating assigned by federal regulators. These ratings may include more analysis of the risks involved, including on-site inspection of the operations, than is feasible in statistical models that rely on only secondary accounting data. The general model is:

\[ \text{SPREAD}_{it} = \alpha_{it} + \sum_{m} \beta_{m} X_{mit} + \sum_{n} \beta_{n} Y_{nit} + \varepsilon_{it}. \]

(1)

The dependent variable SPREAD_{it} is the difference between the yield on the observed option-free bank or BHC subordinated bonds on the secondary market and the estimated concurrent yield on a U.S. Treasury security with the same term to maturity. The independent variables X_{m} and Y_{n} are matrixes of m credit risk variables and n control variables, respectively, for institution i in period t.

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2 The spread also includes liquidity premiums, options premiums for bonds with embedded options, and adjustment for state and local income taxes to which Treasury securities are not subject. However, most of the variation in spreads across bonds may reasonably be assumed to reflect differences in the risk of default.

3 The comparable maturity Treasury yield is obtained from year-end yield curves estimated by straight-line extrapolation from year-end market yields reported by Bloomberg for 3-, 6-, and 9-month and 1-, 2-, 3-, 5-, 7-, 10-, 15-, and 30-year Treasury securities. Spread and the accounting risk characteristics are both observed on December 31 of each year, even though the market generally cannot observe the reported risk measures on bank financial statements until they are publicly released a few weeks later. We also estimate the regressions with the spread observed on January 31 of each following year. Although qualitatively the same, the results are weaker and are not reported. This suggests the market may correctly anticipate the issuers’ financials.
To examine whether the market prices the bonds of the two issuers differently, we allow both the intercept and the slope coefficients to differ between banks and BHCs by using dummy variables. In addition, previous studies (e.g., Flannery and Sorescu 1996) suggest that the risk measures may not affect the market’s pricing of bonds linearly. Rather, the market may price perceived riskier values of the risk measures proportionately more unfavorably than less risky values, so that interest rate spreads are nonlinearly related to the risk characteristics of the issuers. Spreads may increase at an increasing rate with increases in the riskiness of the issuers. For example, the market may view a given ratio of nonperforming loans to assets or of insured deposits to total deposits more adversely at less capitalized institutions than at better capitalized institutions. Thus, the accounting risk measures specified both stand alone to capture linear relations and interactively with the issuer’s leverage ratio to capture nonlinear effects. The basic model specifying both the stand-alone and interactive risk and control variables is as follows (for institution \( i \), bond \( j \), at time \( t \)):

\[
\text{SPREAD}_{ijt} = \alpha + \beta_1 \text{LOGTA}_{it} + \beta_2 \text{INSURED}_{it} + \beta_3 \text{LEVMKT}_{it} + \beta_4 \text{NPLOAN}_{it} + \beta_5 \text{ROA}_{it} + \beta_6 \text{XINSURED}_{it} + \beta_7 \text{XPLOAN}_{it} + \beta_8 \text{XROA}_{it} + \beta_9 \text{BKINSURED}_{it} + \beta_{10} \text{BKLEVMKT}_{it} + \beta_{11} \text{BKNPLOAN}_{it} + \beta_{12} \text{BKROA}_{it} + \beta_{13} \text{DUMBANK}_i + \varepsilon_{ijt} \tag{2}
\]

The independent variables specified are defined as follows. \( \text{LEVMKT} \) is the leverage ratio. For BHCs, this is the ratio of book value of total consolidated liabilities to the sum of the market value of the BHC’s common stock and the book value of its preferred stock. For banks, whose shares are not publicly traded, the market value of common stock is proxied by the ratio of each bank’s assets to the respective parent BHC’s consolidated assets scaled by the market value of the BHC’s common stock. The higher the leverage, the more likely bondholders will incur losses and demand larger bond spreads. Thus, a positive coefficient is expected.

\( \text{NPLOAN} \) is the ratio of the sum of nonperforming and defaulted bank loans plus other real estate owned, which represents collateral obtained through foreclosure, to total on-balance-sheet assets (using consolidated figures for BHCs). Nonperforming loans include loans past due for more than ninety days that may be accruing or nonaccruing. The larger the nonperforming loan ratio, the greater the likelihood of loss and the larger the required bond spread. A positive coefficient

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\(^4\)This assumes that all of the BHC’s subsidiaries are equally risky and that proportionately equal capital is assigned to each subsidiary. Book value leverage was also specified, but yielded poorer results.
is expected. ROA is the ratio of annual net income to year-end, on-balance-sheet assets (consolidated figures for BHCs). The more profitable the firm, the less likely the default, and the smaller the bond spread.

INSURED is the ratio of insured deposits to total deposits at banks and at all the BHC’s subsidiary banks. The greater the bank’s reliance on insured deposits, the less likely the bank will be subject to market monitoring and discipline and the greater the potential for moral hazard. Billet, Garfinkel, and O’Neal (1998) report that BHCs shifted to greater use of insured deposits to fund their banks as their financial condition deteriorated. Jordan (2000) documents such behavior by banks that failed in New England in the early 1990s. Thus, the greater a bank’s reliance on insured deposits, the riskier the bank is perceived and the higher the required spread. A positive coefficient is expected.5

Because issuer size may affect the market’s perception of credit risk and the spread, the log of total consolidated on-balance-sheet assets (LOGTA) is specified as a control variable. This may also pick up any “too-big-to-fail” perceptions by the market. DUMBANK takes the value of 1 for bank bonds and 0 for BHC bonds.

To capture any nonlinear risk relations, INSURED, NPLOAN, and ROA are scaled by LEVMKT to form XINSURED, XNPLOAN, and XRROA. The variables BKKINSURED, BKLLEVMKT, BKNPLOAN, and BKROA are bank-interactive slope dummies, which are the multiplicative terms of each of the stand-alone risk measures and DUMBANK (0 or 1). Alternative interactive specifications are estimated, but the results do not vary greatly.

To check whether the accounting risk measures specified in equation (2) account for most of the effect on spread, alternative specifications using ratings by credit rating agencies and by bank regulators are modeled in equations (3) and (4), respectively:

\[
\text{SPREAD}_{ijt} = \alpha + \beta_1 \text{LOGTA}_{it} + \beta_2 \text{SP Moody}_{ijt} + \beta_3 \text{DUMBANK}_i + \varepsilon_{ijt},
\]

(3)

\[
\text{SPREAD}_{ijt} = \alpha + \beta_1 \text{LOGTA}_{it} + \beta_2 \text{REGRATE}_{it} + \beta_3 \text{DUMBANK}_i + \varepsilon_{ijt},
\]

(4)

where SPMOODY is the average credit rating specific to the security assigned by S&P and Moody’s. Following Jewell and Livingston (1998), the ratings are cardinalized. The higher the SPMOODY rating, the higher is the credit quality and

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5To the extent that banks decide between funding with insured and uninsured deposits on the basis of the interest rate spread between the two types of deposits, INSURED and SPREAD may be simultaneously determined. Our specification does not account for this simultaneity.
the lower is the cardinalized number. Thus, a positive coefficient is expected. It may be expected that the SPMOODY ratings in equation (3) would explain SPREAD more completely than the accounting risk measures used in equation (2), as these agencies evaluate both the expected loss from default (which is not specified in equation (2)) and the probability of default.

REGRATE is regulator’s credit rating (CAMEL for banks and BOPEC for BHCs). These ratings are assigned by the primary federal regulator for banks and the Federal Reserve for BHCs. The ratings range from a high of 1 to a low of 5. Thus, a positive coefficient is expected. Because CAMEL and BOPEC ratings are not assigned on the same date across the sampled banking firms, there is a problem of aging. Large banks and BHCs are examined annually. Thus, at any given point, the ratings could be as much as twelve months old. Older ratings may contain less accurate information about the BHC’s current situation than more recent ratings. To adjust for this, we average the ratings that were assigned immediately before and immediately after the associated observation date. S&P and Moody’s ratings are issue specific, whereas CAMEL and BOPEC ratings are firm specific.

Although regulatory ratings for individual banks are not released publicly, it is of interest to see whether they are related to the market’s evaluation of the financial condition of the institution as reflected in the spreads. In addition, some private vendors, such as Sheshunoff, attempt to replicate the regulatory ratings and provide it for their clients on a current basis.

The equations are estimated using a version of the Fuller-Battese feasible generalized least square (FGLS) model to fit unbalanced, time-series, cross-sectional data sets. For our data set, there are four sources of variation outside of the risk and control variables specified in the equation: time-specific variations, firm-specific variations, issue-specific variations, and the normal random disturbances. Failure to control for the first three sources of variation would cause these factors to be aggregated in the estimated error term, potentially leading to biased estimates of the coefficients. To control for these variations, one can either assume that these variations are fixed or random. The random-variation assumption provides greater flexibility through imposing fewer constraints. The Fuller-Battese procedure eliminates the need for either bank-specific dummies or year dummies because the estimator segregates the effect of these factors from the random error term. The estimation procedure measures the variance-covariance matrix by year.
and banking organization. The reported statistical significance tests are adjusted accordingly, and the estimated coefficients are unbiased.

IV. Data and Sample

Our sample is derived from the 100 largest U.S. commercial banks and their parent BHCs at year-end 1997. For these banks and BHCs, we collected detailed information on their outstanding bonds from Bloomberg Data Services. We selected one representative subordinated bond for each bank and one representative subordinated bond for each BHC. To be included in the sample, the selected debt securities had to meet the following seven criteria: (a) publicly traded in the secondary market (to be able to trace historical prices and yields); (b) in issues of at least $100 million; (c) U.S. dollar denominated; (d) issued and traded in the U.S. capital market; (e) rated by either or both S&P and Moody’s; (f) straight bonds with no callable, putable, convertible, or other option features; and (g) outstanding on December 31, 1997. The sample is restricted to option-free bonds for two reasons: first, to obtain a more homogeneous group of bonds, and second, to avoid excessive noise introduced by the models used for computing option-adjusted spreads, which vary substantially among market participants. If issuers had more than one qualifying bond issue outstanding, we picked the issue that had been outstanding for the most years. Because all of the sampled bank bonds were issued in 1992 or later, the results are based on bond price data from only 1992 to 1997 for both banks and BHCs. The few bank bonds issued before 1992 had matured by 1997, and their historical prices are not available on Bloomberg. Thus, all observations are for the post-FDICIA and, with only a few exceptions, the post-depositor preference period.

The final sample includes nineteen subordinated bond issues for nineteen banks and thirty-nine subordinated bond issues for thirty-nine BHCs. As noted earlier, all except one of these sampled banks are subsidiaries of sampled BHCs. No more than one bank subsidiary is included in the sample for each of the sampled BHCs. We observed the market prices of these securities outstanding at year-end 1992 through 1997. Issuers did not necessarily have bonds outstanding in each year. The overall sample includes 203 observations for BHCs and 65 observations for banks, for a total of 268 observations. Bond yields were computed from the prices of the bonds on December 31 of each year.

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9 The identities of the sampled banks and BHCs may be obtained from the authors.
10 Bloomberg reports BGN bond prices, which are a volume-weighted average of transaction prices in each day. When securities are not traded in a day, quoted prices by a number of pricing providers are used. All Bloomberg bond prices are a weighted average based on at least two price sources and must be within a tight range.
### TABLE 1. Summary Statistics.

**Panel A. Thirty-Nine Sampled Bank Holding Companies (Consolidated) as of December 31, 1997**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total assets ($ million)</td>
<td>$83,980</td>
<td>$89,929</td>
<td>$8,093</td>
<td>$365,521</td>
</tr>
<tr>
<td>Insured to total deposits</td>
<td>60.92%</td>
<td>21.28%</td>
<td>0.67%</td>
<td>82.68%</td>
</tr>
<tr>
<td>Leverage ratio</td>
<td>4.313</td>
<td>2.140</td>
<td>2.369</td>
<td>12.176</td>
</tr>
<tr>
<td>Asset liability GAP</td>
<td>24.15%</td>
<td>10.62%</td>
<td>1.27%</td>
<td>39.46%</td>
</tr>
<tr>
<td>Banking assets to total</td>
<td>85.81%</td>
<td>14.51%</td>
<td>40.78%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Nonbank) BHC assets

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonperforming loans to assets</td>
<td>0.642%</td>
<td>0.353%</td>
<td>0.216%</td>
<td>1.848%</td>
</tr>
<tr>
<td>Return on assets</td>
<td>1.19%</td>
<td>0.26%</td>
<td>0.56%</td>
<td>1.84%</td>
</tr>
<tr>
<td>BOPEC rating</td>
<td>1.410</td>
<td>0.498</td>
<td>1.000</td>
<td>2.000</td>
</tr>
<tr>
<td>SPMOODY (Sub Debt)</td>
<td>6.846</td>
<td>1.338</td>
<td>3.500</td>
<td>9.500</td>
</tr>
</tbody>
</table>

**Panel B. Nineteen Sampled Banks as of December 31, 1997**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total assets ($ million)</td>
<td>$55,458</td>
<td>$76,979</td>
<td>$10,672</td>
<td>$297,062</td>
</tr>
<tr>
<td>Insured to total deposits</td>
<td>57.65%</td>
<td>20.73%</td>
<td>0.68%</td>
<td>81.12%</td>
</tr>
<tr>
<td>Leverage ratio</td>
<td>4.281</td>
<td>3.574</td>
<td>1.323</td>
<td>17.018</td>
</tr>
<tr>
<td>Nonperforming loans to assets</td>
<td>0.607%</td>
<td>0.219%</td>
<td>0.325%</td>
<td>1.064%</td>
</tr>
<tr>
<td>Return on assets</td>
<td>1.22%</td>
<td>0.32%</td>
<td>0.51%</td>
<td>1.73%</td>
</tr>
<tr>
<td>CAMEL ratings</td>
<td>1.444</td>
<td>0.511</td>
<td>1.000</td>
<td>2.000</td>
</tr>
<tr>
<td>SPMOODY (Sub Debt)</td>
<td>5.861</td>
<td>1.173</td>
<td>2.500</td>
<td>7.500</td>
</tr>
</tbody>
</table>

**Panel C. Mean (Standard Deviation) for Banks and Bank Holding Companies (1992–97)**

<table>
<thead>
<tr>
<th></th>
<th>SPREAD</th>
<th>SPMOODY</th>
<th>BOPEC or CAMEL</th>
<th>No. of Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHC subordinated</td>
<td>0.7508%</td>
<td>7.1133</td>
<td>1.5665</td>
<td>203</td>
</tr>
<tr>
<td></td>
<td>(0.2710%)</td>
<td>(1.5731)</td>
<td>(0.5211)</td>
<td></td>
</tr>
<tr>
<td>Bank subordinated</td>
<td>0.6940%</td>
<td>5.7846</td>
<td>1.4692</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>(0.1497%)</td>
<td>(1.5612)</td>
<td>(0.4750)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Leverage ratio is defined as book value of liabilities to the sum of market value of equities and book value of preferred stocks. Asset liability GAP is defined as the ratio of one-year assets minus one-year liabilities to total assets. SPMOODY is the average credit rating assigned by S&P and Moody’s (the cardinalization method is based on Jewell and Livingston 1998). SPREAD is bond spread above Treasuries of the same maturity.

Information on the accounting risk characteristics of the security issuers is obtained from the Report of Condition and Income (Call Report) for banks and Federal Reserve Y-9 and Y-9LP Reports for BHCs. Regulator’s CAMEL and BOPEC ratings are from the National Examination Database (NED). S&P and Moody’s bond ratings are obtained from Bloomberg or directly from S&P and Moody’s, if not reported by Bloomberg.

Summary statistics for the sample observations at year-end 1997 are shown in Table 1. In Panel A, the sampled BHCs have average assets of almost $84 billion
as of year-end 1997, with about 61% of the deposits of their affiliate banks insured. They are rated between 1 and 2 by the composite BOPEC measure (average of 1.41), and their average S&P and Moody’s ratings range from AA to BBB– and average around A/A– or 6.8.

Characteristics of the sampled banks are shown in Panel B. Their average size is approximately $55 billion. On average, about 58% of their total deposits are insured. They are rated between 1 and 2 by the composite CAMEL measure (average of 1.44), and their S&P and Moody’s ratings range more widely from AA+ to BBB+ (average around A+/A or 5.9). Panel C indicates that the market requires a larger spread on BHC subordinated debt than on bank subordinated debt. This may reflect less risk for banks than for BHCs because of the lower priority claim of BHCs on bank assets or the perceived extension of the federal safety net beyond bank deposits to cover bank, but not BHC, debtholders.

V. Results

The regression estimates for the accounting risk characteristics specified in equation (2) are reported in Table 2. Results are shown for a number of alternative specifications of the risk and control measures. Column 1 shows the estimates only for the control variables in equation (2). When only the accounting risk measures per se (without interactive terms), control variables, and the intercept dummy (DUMBANK) are specified (column 2), three of the four risk measures are statistically significant with the expected signs. The higher the issuer’s return on assets (ROA), the lower is the bond spread over comparable Treasuries. The greater the issuer’s nonperforming loan ratio (NPLOAN) and reliance on insured deposits (INSURED), which induce less monitoring by the market, the higher is the spread. Only issuer leverage is insignificant. The larger the issuer (measured by on-balance-sheet assets), the smaller is the spread. The insignificant coefficient on DUMBANK indicates that, holding measured risk constant, BHC subordinated debt and bank subordinated debt trade at approximately the same spread. However, the risk measures add little explanatory power to that provided by the two control variables alone. The adjusted $R^2$ is about 60% in both models. Nonetheless, a marginal $F$-test performed to test the robustness of the incremental predictive power contributed by the four risk measures specified as a group over the control variables alone is significant at the 5% level. The $R^2$ may not be higher, in part, because the risk variables specified proxy only the probability of default and not the expected loss in case of default, which is also reflected in the observed spreads.

\[\text{11The very low minimum ratio of insured to total deposits reflects the inclusion of J.P. Morgan, which conducts next to no retail business.}\]
The results are unchanged when the leverage-scaled risk variables are substituted (column 3) for the stand-alone risk variables. All three interactive risk measures (XPLOAN, XINSURED, and XROA) are significant with the expected signs. Again, BHC-issued and bank-issued subordinated debt trade at yield spreads
that are not statistically different from each other when controlling for risk. A marginal $F$-test to test the robustness of the incremental predictive power contributed by the three leverage-scaled risk measures (column 3) over the control variables alone (column 1) is again significant at the 5% level. The adjusted $R^2$ for this specification is higher than for the earlier stand-alone specification, suggesting that the nonlinear specification is a better fit.\textsuperscript{12} This suggests that the market charges a higher interest spread for equal risk exposures at less capitalized issuers than at better capitalized issuers.

The results for specifying both the risk measures per se and leverage-scaled risk variables in the same equation are reported in column 4. Two of the four stand-alone risk measures—leverage and nonperforming loans (LEVMKT and NPLOAN)—are statistically significant with the expected sign, as are two of the three leverage-scaled risk measures (XINSURED and XROA). This suggests that the market impounds information on the nonperforming assets and leverage of all issuers in pricing their bonds. In addition, the market further penalizes highly leveraged issuers with lower earnings and highly leveraged issuers that rely more on insured deposits by requiring higher interest rates than for comparable better capitalized institutions. A marginal $F$-test of the robustness of the incremental predictive power contributed by the leverage-scaled interactive risk measures as a group (column 4) over the stand-alone specification (column 2) is significant at the 5% level. This suggests that leverage is important in the pricing of bank and BHC bonds above the stand-alone risk measures. The adjusted $R^2$ is slightly higher for this specification than for the two previous specifications.

Because an increase in ROA reduces spread only for less capitalized institutions, a higher return on assets appears to be perceived by the market as a signal of good performance rather than as a reflection of higher returns from greater risk taking. The coefficient for leverage-scaled nonperforming loans (XNPLOAN) is negative and weakly significant (at the 10% level), suggesting that the market demands a lower interest spread at less capitalized institutions with more nonperforming loans than at comparable better capitalized institutions. However, the coefficient is small. When evaluated at the mean, a 1-percentage-point (or 1.2 standard deviation) increase in the proportion of nonperforming loans to assets would reduce the spread by approximately only 3 basis points (or 0.1 standard deviation); that is, a large increase in nonperforming loans to assets is associated with a small decline in the spread. Moreover, when combined with the direct effect on higher nonperforming loans per se, the spread increases by 6 basis points, on average.

\textsuperscript{12}We also compute alternative goodness-of-fit measures, such as Schwartz’s Bayesian criterion and Akaike’s information criterion. On the whole, they provide the same relative ranking of the alternative specification as does the adjusted $R^2$. 
Slope dummies (i.e., bank interactive terms between DUMBANK and the risk variables) are introduced in addition to the intercept dummy in the specification with the stand-alone risk measures (column 5) and the specification with the leverage-scaled risk measures (column 6) to test whether required spread differences between bank and BHC debt are associated with risk-specific variables. In column 5, the same three stand-alone risk variables as before—ROA, INSURED, and NPLOAN—remain significant with the expected signs. None of the slope dummies is significant. Together with the insignificant DUMBANK intercept coefficient, this provides additional evidence that spreads on BHC subordinated debt are not significantly different from those on bank subordinated debt during the sample period, when controlling for the risk characteristics of the issuing firms.

When the slope dummies are included in the leverage-scaled risk specification (column 6), the results remain unchanged from the specification without these slope dummies (column 3). Spread is again significantly affected by all three leverage-scaled risk measures in the expected directions. None of the slope dummies or the intercept dummies is significant, reinforcing the previous results that the market does not differentiate greatly between the risk characteristics of bank and BHC debt during our sample period.\textsuperscript{13} When all of the risk measures, dummies, and interactive risk variables are specified (column 7), the results are basically consistent with those discussed earlier. One stand-alone (NPLOAN) and all three interactive risk measures are significant and no dummy variables are. The adjusted $R^2$ also remains unchanged. Thus, the market prices the credit risk of both banks and BHCs, and particularly of those poorly capitalized, but does not distinguish between the types of issuer—banks versus BHCs.

The interest rate spreads are regressed on SPMOODY in column 1 of Table 3. The estimated coefficient is highly significant in the expected direction. The lower the credit rating, the higher is the interest spread. Asset size remains significant, so that spreads are smaller for larger issuers than for equally rated smaller issuers. Unlike in the earlier specifications in Table 2, DUMBANK is significant at the 1% level with a positive sign. Bank subordinated debt trades at a higher spread on the secondary market than comparably rated BHC subordinated debt. This suggests that S&P and Moody’s ratings, which usually rate bank-issued bonds one notch better than the parent BHC-issued bonds, may overestimate the perceived FDIC protection to banks’ bondholders when compared with the market’s view. The marginal $F$-test indicates that the credit ratings contribute significantly in explaining the variation in the yield spread across the sampled bonds. The adjusted $R^2$ for this specification is in the same range (60% to 65%) as the earlier specifications that include only a limited number of accounting measures of risk. This suggests

\textsuperscript{13}When the model is specified to include only the slope dummies and to exclude the intercept dummy (DUMBANK), the results remain the same.
that the earlier models captured most of the causes of the observed interest spread differentials, even though the private rating agencies consider a far larger and wider number of accounting, financial, economic, and managerial factors.

The regulatory rating REGRATE (CAMEL for banks and BOPEC for BHCs) is included in the specification in column 2. The coefficients for these ratings are significant with the expected sign. The regulatory agencies’ examination ratings explain the risk spreads to about the same extent as either the accounting risk variables or the rating agencies’ ratings, as reflected in the adjusted $R^2$. This suggests that the market relies on some of the same information in evaluating the financial strength of banks and BHCs as do the regulatory agencies, but neither is statistically superior. This is consistent with the findings of Berger, Davies, and Flannery (2000) that both the regulators and the market use some information available to the other and some that is unique to themselves.

We conducted a number of robustness tests to ensure that our empirical results are not dependent on the sample of securities used, the sample of banks and BHCs included, or the independent variables specified. Thus, we estimated the model including senior and subordinated BHC debt for only BHCs whose subsidiary banks were included in the sample, and including additional independent variables.
that were available for BHCs but not for banks. The results are qualitatively similar to those reported in this section.¹⁴

VI. Conclusions and Policy Implications

Whether, in light of the government-sponsored safety net, the private market prices the riskiness of the debt liabilities of commercial banks and BHCs is a subject of much controversy. Thus, an understanding of how the market prices bank debt is important in evaluating a number of current policy proposals for improving the safety and efficiency of the banking system, including proposals for requiring banks and BHCs to issue subordinated debt. De jure insurance, in the United States, extends only to deposit accounts of $100,000 or less. But because in the past the guarantee has at times been extended to uninsured depositors, other creditors, including bank bondholders and even, in the Continental Illinois Bank rescue in 1984, to bondholders of the BHC, there is uncertainty about the de facto coverage of the federal safety net in the future.

More recent previous studies find that the market did price debt issued by BHCs according to the credit risk of the issuer. However, no studies examine the pricing of subordinated debt issued by the banks themselves. This study is the first to extend the previous literature by examining bank debt as well as BHC debt. In addition, our study uses more recent data since the enactment of FDICIA, which may be expected to have narrowed the implicit coverage of FDIC insurance, and depositor preference legislation, which lowered the liquidation standing of bank subordinated debt.

The interest spread between the market interest rate on option-free bonds issued by large banks and BHCs and the rate on Treasury securities of the same maturity is modeled as a function of the issuer’s accounting credit risk characteristics. The sample includes nineteen subordinated debt issues of nineteen of the largest hundred commercial banks that had publicly traded issues outstanding at year-end 1997, and thirty-nine subordinated debt issues of thirty-nine BHCs that were parents of one of the hundred largest banks and that were publicly traded at year-end 1997. The observation period is annually from 1992 through 1997. The models were fitted by multiple regression analysis using the Fuller-Battese FGLS technique, for year-end secondary market yield observations.

Overall, the results suggest that the market prices, at least, credit risk for the debt of both banks and BHCs according to the accounting risk characteristics of the issuer. The riskier the institution, the higher is the interest spread that the market

¹⁴A detailed description of these tests and the results is available from the authors on request.
requires over Treasury securities of equal maturities. Additionally, the risk-spread relation appears to be nonlinear. The market tends to price risk more severely at less capitalized institutions. The accounting risk measures specified in the model explain the interest spread differentials among issuers about as well as do both the Moody’s and S&P’s credit ratings and the regulatory agencies’ bank examination ratings. They do this despite the fact that both the rating and the regulatory agencies spend considerable time and effort on- and off-site in analyzing factors beyond the accounting variables specified in our model, and that the rating agencies take into account both the loss in case of default (not captured in our model) and the probability of default. The results are robust to alternative specifications. Moreover, the results may be even stronger if greater disclosure and transparency of current bank financial information, which are considered poorer in banking than in most other industries, were required.

These findings suggest that requiring larger banks or BHCs to issue a minimum amount of subordinated debt is likely to reveal additional information about the financial condition of the issuing bank or BHC and supplement prudential regulatory discipline. It should be noted that most proposals for subordinated debt specify bonds with a homogeneous set of characteristics. This effectively reduces the number of omitted variables in our model and should improve the estimated relation between the measures of credit risk and the market yield spreads. Because the market appears to penalize less capitalized issuers with the same credit risk exposures as better capitalized issuers, the results also support the emphasis bank regulators put on capital in evaluating the financial health of banks and BHCs, particularly for poorly capitalized institutions. Most of the specifications do not find a significant difference in the sensitivity of interest rate spreads to the risk of the issuer between bank subordinated debt and BHC subordinated debt. Thus, at least in terms of potential market discipline, it appears to matter little whether the debt requirement is imposed on banks or BHCs. Because most banks were performing strongly in the sample period examined in this study, further research extending the analysis to periods when the banks were under great financial stress would provide a more complete picture about how the market prices the debt of banks and BHCs.

References

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