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76-4

Financial Disclosure and Market Evaluations of Bank Debt Securities

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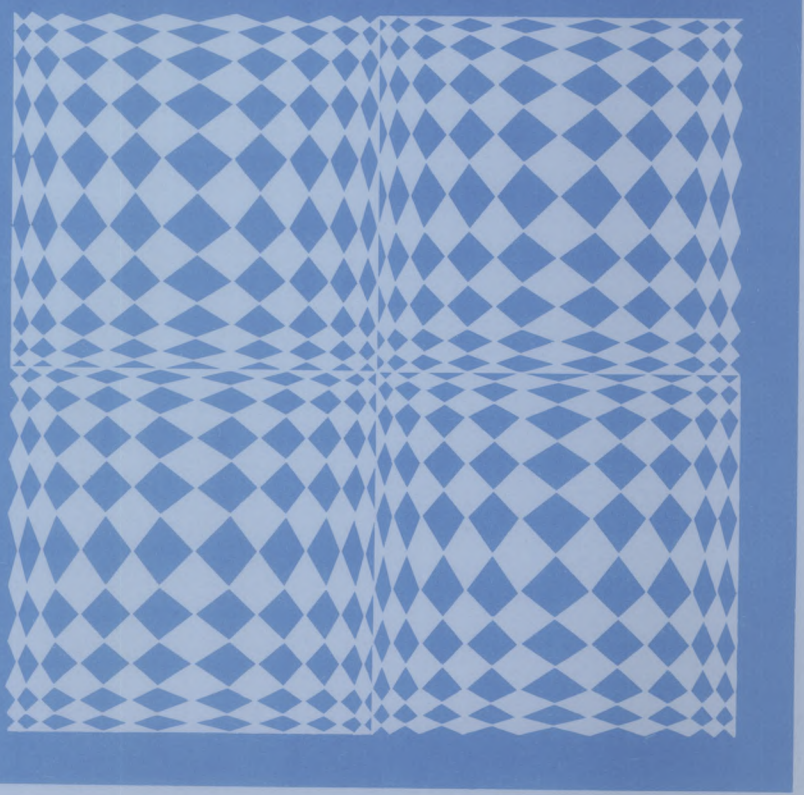

Research Paper No. 76-4

FINANCIAL DISCLOSURE

AND

MARKET EVALUATIONS OF BANK DEBT SECURITIES

By

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MARKET EVALUATIONS OF BANK DEBT SECURITIES*

> Among all the checks that have been devised to the imprudence of banks, there is no one of greater efficacy than giving publicity to their actual condition...[1]

I. Introduction

Financial disclosure ranks with capital adequacy as one of the great recurrent issues in banking. Indeed, the two cannot be entirely separated theoretically, empirically, or in the public mind. Intensified pressure for greater bank disclosure requires careful research to determine the costs and benefits of fuller disclosure, so that public policy can achieve its desired goals.

Federal bank regulators have long expressed their conviction that free markets are unable to evaluate the condition of commercial banks. Markets are said to be relatively naive in matters of bank operations and accounting:

> It has been suggested that the free play of the market should determine the adequacy of a bank's capital, and that the supervisory agencies should not presume to enforce a different judgment of their own. This approach presupposes, however, a much more knowledgeable market than we have today --at least for the vast majority of the nation's 14,000 banks.[2]

The case is often stated even more strongly on the issue of market evaluation of leverage:

> In most industries, as the debt equity ratio increases, the cost of debt normally increases, reflecting creditor's [sic] demands for higher risk premiums. This market discipline does not seem as effective in banking.
>
> ...I do not think it can be effectively argued that the market itself can be relied upon to police the rate of bank asset expansion financed through leveraging.[3]

In somewhat caricatured form, the regulatory argument is this: a) markets lack information to make "good" decisions about bank condition; b) even if markets had adequate information, the decisions they made would not be "good"; c) therefore:

> In a sense, the bank regulatory agencies are exercising for most banks the judgment as to capital adequacy which a perfectly informed market might be able to exercise.[4]

Notwithstanding such regulatory pronouncements, it is an empirical question whether or not markets are able to evaluate the condition of commercial banks and whether or not their evaluations are "good" or adequate. The empirical question can be decomposed into three pieces: (1) do markets make consistent and systematic use of the information currently available to them? (2) do market evaluations accord closely with regulatory judgments? (3) if market evaluations depart systematically from regulatory judgments, whose judgments are superior?

This paper addresses part 1 of the empirical question. An economic point of view is adopted, which is to say that markets are seen as efficient information processing institutions. An empirical finding that markets are able to incorporate available information systematically and consistently into price-quantity decisions will be taken as sufficient

evidence to warrant further investigation into the relationship between market and regulatory assessments of bank condition. A finding to the contrary, however, cannot be taken as presumptive evidence that market judgment is inadequate, since regulatory agencies have the power to retard the development of well-functioning markets by restricting the flow of raw data. To this extent the case for disclosure is stacked in favor of greater dissemination of information. Our attention in this paper, however, will be confined to the issue whether or not markets use the information currently available.

The philosophical bias in favor of greater disclosure will be balanced by an empirical bias in favor of the proposition that the market cannot use even that information which it already has. In particular, "information currently available" is defined to be the Reports of Income and Condition. As an approximation to the amount of information the market has, these two documents certainly represent at best the greatest lower limit: they are the greatest lower limit only if they contain no misleading information. For the type of securities studied in this paper, additional information frequently is available and forthcoming from banks.

The type of security examined in this paper is a newly issued capital note or debenture. In principle there is no reason why seasoned capital notes could not be used. Indeed, using a single cross-section of previously issued capital notes has the advantage of avoiding some econometric problems of pooling several cross-sections. In practice, however, very few bank debt issues are traded with sufficient activity to generate an adequate sample for study and one which reflects a range of bank sizes.

The hypothesis of the paper, simply stated, is that the rate of return required by the market (the yield to maturity) systematically incorporates information concerning the issuing bank's condition and earnings prospects.

Only securities issued directly by banks are included in this study. Issues of holding companies, even though the proceeds were channeled directly to the bank subsidiary, are excluded for two basic reasons. The financial structures of holding companies are considerably more complex even than those of banks, which makes comparisons between banks and holding companies quite difficult. There is, in addition, some evidence that financial markets are still in the process of learning how to evaluate holding companies and their financial conditions.[5] Despite the exclusion of direct issues by holding companies, it is impossible to avoid such complications entirely since many banks are holding company affiliates. To the extent possible, however, such a compartmentalization will be attempted.

II. The Model

It is assumed that investors maximize utility functions which are increasing in rate of return and decreasing in risk. When a security is offered to an investor for purchase, the amount of the issue, the coupon rate, and the term to maturity are data. A bid price then determines the yield to maturity. In assessing the risk-return characteristics of any security, the investor will compare (at least intuitively) that issue with a security free of credit risk which matures on the same day. The risky security must then offer sufficient increased return to compensate for the increased risk over the life of the security.[6]

In pricing security issues, the market will consider both characteristics of the debt instrument itself and characteristics of the issuer. The following characteristics of the instrument were considered relevant to the market pricing mechanism (their presence or absence will be indicated by dummy variables): convertibility; callability; subordination to other debt; provision for payment in instalments; provision for sinking fund; private placement; issuer a holding company affiliate; restrictions on dividend payout; restrictions on issuance of other debt.[7]

A multitude of variables describing the condition and prospects of a bank can be constructed from the Income and Condition Reports. Fortunately, literature does exist to guide the empiricist in devising his variables. Proper use of analytical concepts and available data requires some considered thought, however. Two points are especially important, namely, the implications of focusing on investors in debt (as opposed to equity) securities and the manner of accounting for the new security in the bank's financial condition.

The proper definition of income hinges on the type of security under consideration. Payments of interest have a claim on gross revenues prior to payments of taxes or dividends. Thus, income before taxes is the relevant earnings measure for purposes of this paper. By the same logic, one should not adjust pre-tax earnings to reflect tax-exempt earnings on a "fully taxable basis." Tax-exempt earnings benefit holders of equity securities because a larger proportion of pre-tax earnings flow through to after-tax earnings. Since returns to debt holders come out of pre-tax income, tax-exempt status is of no benefit.

This is not to imply that tax-exempt status of earnings is of no consequence to debt holders; for, other things equal, holders of debt should prefer a given dollar volume of taxable securities to the same dollar volume of tax-exempt securities, since the taxable securities will generally give rise to a larger flow of pre-tax earnings.

No clear answer can be given to the question of how to account for a (proposed) new issue of debt in evaluating a bank's financial condition. Given the nature of the decision model outlined above, all financial information was gathered for the year prior to the year in which the security was issued. One then has two more or less limiting views of the bank, one pessimistic, the other optimistic. According to the pessimistic view, the new debt issue raises the degree of leverage and financial risk. Therefore, in calculating, e.g., a debt/equity ratio, one should include the new issue in the numerator. The optimistic view holds that the bank is an ongoing enterprise and can be expected to restore the previous degree of leveraging. According to this view, one would exclude the new issue from the debt/equity ratio on the grounds that to include it would misrepresent the long-term financial structure of the bank. The truth is likely to be somewhere in between. The only fair way to conduct the analysis is to try both methods. The inclusion or exclusion of the new debt applies also to interest coverage ratios.[8]

With these considerations out of the way, we can present the financial variables used in this study. They fall into two basic categories, variables constructed from the balance sheet alone, and variables using information from the income statement.

Balance sheet variables correspond, for the most part, to ratios well known in banking literature. Given the great problems inherent in such rudimentary summary ratios as capital to deposits or capital to assets, some attempt to improve upon these was made.

(1) Ratios to total assets.

As a general measure of the riskiness of the bank's portfolio, a ratio of (credit) riskless to total assets was constructed. Riskless assets are defined as cash and due from banks, Treasury securities, and U.S. agency securities.

As a measure of the ability of capital to absorb losses in the asset portfolio, the ratio of capital available to absorb losses to assets was taken. Capital available to absorb losses is equity capital less capital stock.[9] This exclusion was made because in many, if not most, jurisdictions impairment of capital stock requires the immediate liquidation or forced merger of the institution.

Total borrowings, total borrowings less time and savings deposits, and debt capital were expressed as percentages of total assets in the attempt to measure financial leverage of assets.

(2) Ratios to total loans.

The loan portfolio displays a wide range of asset liquidities and risks. Four percentages of the loan portfolio were calculated in the attempt to measure liquidity and risk better: a) secured loans, where secured loans are loans secured by farmland, mortgage loans on one- to four-family dwellings and on multi-family residential properties, loans secured by nonfarm nonresidential properties, auto loans, loans on mobile homes, and instalment loans to repair and modernize residential property;

b) financial loans, which are loans to financial institutions and loans for purchasing or carrying securities; c) commercial and industrial loans; and d) personal loans, which are credit card and related loans, instalment loans to purchase retail consumer goods other than mobile homes, instalment loans other than those already mentioned under a), and single-payment loans for household or personal expenditures.

The ratios of loan loss reserves and actual loan losses to loans were calculated as measures of risk in the loan portfolio. The ratio of "core deposits" to loans measures the proportion of loans which are supported by relatively stable liabilities.[10]

(3) Ratios to total securities.

The ratio of municipal securities to total securities was discussed above, in connection with tax-exempt income. The ratio of reserves on securities to total securities was calculated as a rough measure of the degree of risk inherent in the securities portfolio.

(4) Ratios to equity capital

Two measures of leverage in the capital account were calculated, debt capital to equity capital and total debt to equity capital, where total debt includes total deposits, federal funds purchased, other indebtedness, capital notes previously outstanding, and preferred stock. The new security issue was included in these two ratios, in accordance with the discussion above.

Several earnings coverage ratios were constructed. These include fixed charges to gross income, fixed charges to expenses, and times-charges-earned (based on net income). Each of these three was calculated using both net and gross occupancy expense, including debt service on the newly issued security, but excluding interest on deposits.

The ratio of securities income to total income was calculated to indicate stability of the income stream.

Three other income ratios were calculated, based upon the writings of well-known analysts. Net operating earnings are expressed as a proportion of total deposits.[11] The "margin of safety" is the ratio of dividends plus retained earnings to gross income from operations before deduction of expenses or charges. "On an assumption that costs and non-operating income are completely rigid, the margin of safety would represent the maximum proportion by which total sales might shrink and fixed charges still be earned in full."[12] Since this measure is based upon the ratio of after-tax income to gross earnings, it would seem to be overly conservative: if gross revenues fall to a level that covers only fixed charges and expenses, no taxes need be paid. Therefore, a pre-tax margin of safety was also calculated.

Finally, the rate of return on stockholder equity (book value) was calculated, on the grounds that investors in bank debt securities are only well protected when the bank can adjust its capital structure by issuing new equity.[13]

III. Findings of Previous Research

Four pieces of research are of interest for this study, in that they have presented results of considerable interest for the present topic. The seminal article on determinants of risk premia was written by Lawrence Fisher.[14] He selected a sample of outstanding corporate bonds in five different years, calculated risk premia as the difference in yield to maturity between the corporate issue and a government issue maturing at the same time, and regressed the risk premium on four var-

iables. The independent variables he used were earnings variability, period of solvency, equity/debt ratio, and size of the issue; all were usually significant. The model was specified in logarithmic form, on the grounds that one expected strong interaction among the independent variables. It is not clear from the article, however, whether or not he experimented with straight linear forms.

Peter E. Sloane was interested in yield curves and the determinants of yield differentials at various points along the yield curve.[15] The yield curves he constructed, for Treasury securities and for corporates rated Aaa or Baa, were based on averages of the yields for individual securities. Two findings of this research are important for present purposes. First, a linear regression model was used with success in explaining yield differentials. Second, Sloane also found that the yield differential should be expressed as an absolute, not percentage, difference.

Richard H. Pettway has recently carried out a study quite similar to this one, testing a model of the determinants of risk premia for a sample of capital notes issued by commercial banks and holding companies.[16] The question of interest in that study was whether or not the yield to maturity on capital note issues is influenced by the capital structure of the firm and in particular by measures of capital adequacy. The two capital adequacy ratios used were equity capital to assets and borrowings (including deposits but excluding debt capital) to total capital. The most important finding for present purposes is that yield to maturity was not related to the capital adequacy variables. Within the context of financial disclosure, the conclusion from Pettway's article is that the

market does not make any consistent use of financial information relating to caital adequacy in pricing note issues.

In another recent article, Beighley, Boyd, and Jacobs studied valuation models of bank holding company equities.[17] Their interest focused on whether or not securities markets are sensitive to financial structure of bank holding companies in pricing their equities. The salient empirical result of this study is that the market became increasingly sensitive to financial leverage from 1970 to 1973, the period of time over which the sample was drawn. In 1970 and 1971, variables measuring leverage were not statistically significant in explaining share price. By 1972 consolidated financial leverage was moderately significant in the regression equation, and in 1973 it was highly significant. Furthermore, increasing leverage exerted a negative influence on share price, which influence was greater in 1973 than in 1972. The conclusion from this study is that markets are apparently still learning to value holding company securities, and in particular still learning to assess financial leverage.

To gather the results of these four studies together, Fisher's work indicates that a logarithmic specification is appropriate, while Sloane and Pettway used linear specifications. All three expressed the risk premium as the absolute difference in yield to maturity between the corporate issue and a Treasury issue maturing at the same time. Finally, Pettway found that differences in capitalization exerted no influence on risk premium for bank and holding company issues, while Beighley, Boyd and Jacobs found that, for holding companies at least, the market was going through a learning process in evaluating financial leverage.

Since Pettway's sample covers 1971 to 1974, it may be that the same learning phenomenon is occurring; and thus restricting the sample to later years may reveal significant effects of capitalization.

IV. Sample and Data Construction

The sample to test the model described above was assembled by comparing end of year call report data for two consecutive years, which allows one easily to determine which banks issued capital notes during the year elapsed.[18] In practice what was done was to obtain a listing, as of December 31, of all banks in the United States reporting non-zero amounts of capital notes outstanding in year T and a comparable listing for year T-1. All banks appearing in the listing for year T but not for year T-1 and all banks showing a larger amount of notes outstanding in year T than in year T-1 were identified as having issued capital notes during year T. This procedure was repeated for years 1970 through 1973.

Observations were deleted from the initial sample if any of the following data items were not available: amount of issue, coupon rate, years to maturity, price at issue. Moody's Bank and Finance Manuals were relied upon in order to gather as much information as possible from publicly available sources.

Income and balance sheet data were obtained for all sample banks from the Reports of Income and Condition for the year prior to the year of issuance. Because substantial revisions were made in the income report, 1969 and 1968 data are not directly comparable. Furthermore, it is impossible to duplicate for 1968 or earlier the increased detail available in 1969 or after. For these reasons, 1970 is the earliest year represented in the sample.

The above procedure resulted in a total sample of 28 banks, distributed by year of issue as follows: 1970, 1; 1971, 15; 1972, 11; 1973, 1. The two major data constraints limiting the size of the sample are the price of the issue, and the precise dates of issue and maturity (note that the exact day the issue went to market need not be the same as the formal issuance date on the security).

Given the extremely small sample available, no strong empirical conclusions can be drawn regardless of actual results. While the model was formulated in the expectation of using multiple regression analysis, the few degrees of freedom prompted the use of regression on principal components. A brief discussion of this method and the nature of the information available from this type of analysis may be useful.

Principal components are linear combinations of the original set of variables (hereafter referred to as the "independent variables"). Naturally, some specific criteria are needed to select certain components from among the infinite possible linear combinations of the independent variables. Two criteria are in fact used, the first being a criterion of maximum variance and the second being a criterion of orthogonality. The first principle component is that linear combination of the independent variables which has maximum variance among all possible linear combinations. The second principal component is that linear combination with maximum variance among all linear combinations that are orthogonal to the first principal component. The third principal component has maximum variance among all linear combinations that are pair-wise orthogonal to both the first and second principal components. The process is continued, there being at a maximum as many principal components as there

are independent variables. By their nature, principal components are useful when one faces problems of multicollinearity or insufficient degrees of freedom. Their value for overcoming multicollinearity arises from the fact that all components are pair-wise orthogonal. Their value for overcoming insufficent degrees of freedom arises from the criterion of maximum variance. That is, the first few components typically account for upwards of 80 percent of the total variance of the independent variables.

Two problems arise in using principal components as regressors in place of the independent variables. First, in a regression model the aim is to locate those variables whose partial correlations with the dependent variable are largest. It will typically not be the case that the criterion of maximum variance and the criterion of maximum correlation with the dependent variable will rank the components in the same way. That is, one may well find that, for example, the sixth principal component of a set of twelve will display the largest correlation with the dependent variable, yet encompass only 4 percent of the variance of the set of independent variables. The most significant components, in other words, may contain a very small proportion of the total information of the independent variables. Second, while it is possible to translate regression coefficients of components into regression coefficients of the independent variables, it is extremely difficult to calculate standard errors for the independent variables. Thus, knowing which components are important regressors does not imply knowledge of which independent variables are important regressors.

Table of Independent Variables
for Regression on Principal Components

Variable number	Variable name	Variable description
3	ISSUE	size of issue
5	TERM	term to maturity in years from issue date
10	CONVERT	dummy variable for convertibility
11	CALL	dummy variable for callability
14	SINKING	dummy variable for sinking fund provisions
15	PRIVATE	dummy variable for private placement
16	HC	dummy variable for holding company affiliation
17	DIV RES	dummy variable for dividend restrictions
18	OTH RES	dummy variable for restrictions on other debt
25	%ASSET2	capital available to absorb losses over assets
29	%LOAN1	secured loans over loans
30	%LOAN2	financial loans over loans
34	%LOAN6	loss rate on loans
35	%LOAN7	core deposits over loans
40	%INC1	securites income over total income
42	FIXED2	fixed charges (gross occupancy) over income
50	RETURN	rate of return on equity
51	MARGIN3	margin of safety before taxes

V. Empirical Results

The entire set of independent variables described in section III was input into a principal components routine. Regressions were then run on the principal components.[19] Due to extreme collinearity among a few of the independent variables, the empirical results from this step were unstable. Consequently they are not reported.

As a second step, a smaller set of 18 independent variables was used as input. Those 18 variables are listed in the preceeding table. Regression runs were made entering components in order of eigenvalues and also in order of correlation with the dependent variable (risk premium, expressed as the absolute difference between yield to maturity on the capital note and yield to maturity on a Treasury security maturing at the same time).

Results When Debt is Defined to Include the New Issue

Table 1 shows regression results when components are entered by eigenvalue (note the index of components entering the regression equation). The number of components entered into the regression equation was limited by the stipulation that only components having eigenvalues greater than or equal to one be entered. This resulted in a total of six components being entered into the equation.

An analysis of variance table is generated by the computer program. Judging by the F-values, one can easily conclude that the first six principal components, which in total account for just over 77 percent of the total variance of the independent variables, are not significant in explaining risk premium. One can also note that several of the calculated coefficients for the original independent variables are quite unstable as regards both sign and size, and that the signs of many independent varia-

DEPENDENT VARIABLE 54 PREMIUM

TOTAL SUM OF SQUARES 4720.2031
DEGREES OF FREEDOM 27.
MEAN SQUARE 174.82233

CORRELATION BETWEEN PRINCIPAL COMPONENTS AND DEPENDENT VARIABLE

-0.07557	-0.16761	-0.02644	-0.00971	-0.08061	-0.10066

REGRESSION COEFFICIENTS OF PRINCIPAL COMPONENTS

CONSTANT (MEAN OF Y)	COMPONENTS				
3.52589	-0.45425	-1.28837	-0.24213	-0.10152	-0.88206	-1.30958

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS

INDEX OF COMPONENTS ENTERING	RESIDUAL SUM OF SQUARES	F-VALUES REGRESSION MODEL	F-VALUES COMPONENT TO ENTER	R2	CONSTANT	VARIABLES 3 ISSUE	5 TERM	10 CONVERT	11 CALL	14 SINKING	15 PRIVATE
1	4693.24609	0.15	0.15	0.0057	4.6292	-0.0057	0.0028	0.3238	-0.1772	-0.0402	-0.2534
2	4560.64062	0.44	0.73	0.0338	5.3065	-0.0080	-0.0428	-0.6343	-0.5771	-1.0021	-0.9732
3	4557.33984	0.29	0.02	0.0345	4.7435	-0.0091	-0.0287	-0.6019	-0.3898	-0.7989	-0.8979
4	4556.89453	0.21	0.00	0.0346	5.1355	-0.0089	-0.0277	-0.7187	-0.4783	-0.7379	-0.6804
5	4526.21875	0.19	0.15	0.0411	3.2925	-0.0115	-0.0192	-1.6765	-1.2901	-0.5084	-2.2283
6	4478.39453	0.19	0.22	0.0512	3.0722	-0.0287	-0.0245	-2.0244	-0.8676	-0.2832	-3.6980

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS (CONTINUED)

VARIABLES 16 HC	17 DIV RES	18 OTH RES	25 %ASSET2	29 %LOAN1	30 %LOAN2	34 %LOAN6	35 %LOAN7	40 %INC1	42 FIXED2
-0.28758	0.25749	-0.11770	-0.07020	0.00957	-0.01204	0.48564	0.00554	0.02074	-0.03444
-0.26394	-0.75040	0.39139	-0.40827	0.02868	-0.05367	-3.92914	0.00809	0.02551	-0.01124
-0.21285	-0.74101	0.49780	-0.45613	0.03014	-0.05807	-4.15610	0.00990	0.01277	-0.01393
-0.18657	-0.78583	0.43361	-0.48375	0.03072	-0.05938	-4.25293	0.00964	0.01176	-0.00851
0.55943	-0.33886	1.24830	-0.36817	0.03404	-0.06215	-1.98292	0.00609	0.04233	-0.00830
0.54884	-2.25996	1.61589	0.21935	0.03389	-0.05830	-3.04109	0.02103	0.00620	0.04178

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS (CONTINUED)

VARIABLES 50 RETURN	51 MARGIN3
-0.02040	-0.02419
0.15323	0.01975
0.19333	0.02285
0.18430	0.01600
0.23370	-0.00687
0.05595	-0.05918

Table 1

bles are counter to what one would expect from an ordinary least squares regression (for example, variable 11, call provision; variable 18, restrictions on other debt issuances; variable 25, capital available to absorb losses; variable 29, secured loans over total loans; variable 42, fixed charges over income; and variable 50, return on equity).

Table 2 shows regression results when the principal components are entered in decreasing order of their correlation with the dependent variable (note again the index of components entering the model). The number of components entered into the regression equation was limited by the stipulation that only components having simple correlations greater than or equal to 0.15 be entered. This resulted in a total of three components being entered into the equation.

Analysis of variance for this regression model reveals that component ten is the only significant explanatory variable. This one component achieves an R-square of nearly 0.21, significant at the 5 percent level by the F test.

Calculated coefficients for many of the original independent variables again have signs counter to what one would expect in an ordinary least squares regression. In addition, coefficients of the independent variables are quite dissimilar from the regression model in which components are entered by eigenvalues.

Great differences in sign and size of coefficients between this regression run and the previous one are to be expected. Only one principal component was entered into the model in both regression runs, component number 2. Furthermore, components 10, 18, and 2 altogether encompass only 14 percent of the total variance of the independent variables, of which component 2 by itself makes up nearly 12 percent.

DEPENDENT VARIABLE 54 PREMIUM

TOTAL SUM OF SQUARES 4720.2031
DEGREES OF FREEDOM 27.
MEAN SQUARE 174.82233

CORRELATION BETWEEN PRINCIPAL COMPONENTS AND DEPENDENT VARIABLE

-0.07557	-0.16761	-0.02644	-0.00971	-0.08061	-0.10066	0.09198	-0.02286	-0.05407	-0.45476
0.08994	-0.04758	-0.11152	0.13155	0.07536	-0.12767	-0.07081	-0.17592		

REGRESSION COEFFICIENTS OF PRINCIPAL COMPONENTS

CONSTANT (MEAN OF Y)	COMPONENTS								
3.52589	-0.45425	-1.28837	-0.24213	-0.10152	-0.88206	-1.30958	1.34292	-0.34904	-0.84428	-7.61399
	1.87164	-1.32035	-3.38431	4.30386	4.31991	-8.30844	-5.43838	-30.07352		

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS

INDEX OF COMPONENTS ENTERING	RESIDUAL SUM OF SQUARES	F-VALUES OF REGRESSION COMPONENT MODEL	F-VALUES OF REGRESSION COMPONENT TO ENTER	R2	CONSTANT	VARIABLES 3 ISSUE	5 TERM	10 CONVERT	11 CALL	14 SINKING	15 PRIVATE
10	3744.01880	6.78	6.78	0.2068	25.8788	0.0360	-0.2027	0.0351	4.1402	-2.1076	12.5524
18	3597.93359	3.90	1.02	0.2378	2.3326	0.3230	-1.9884	28.2172	12.1873	30.1972	14.2896
2	3465.33130	2.90	0.92	0.2659	3.0099	0.3207	-2.0340	27.2590	11.7875	29.2353	13.5698

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS (CONTINUED)

VARIABLES 16 HC	17 DIV RES	18 OTH RES	25 %ASSET2	29 %LOAN1	30 %LOAN2	34 %LOAN6	35 %LOAN7	40 %INC1	42 FIXED2
7.06732	-2.27115	3.97911	-1.64179	-0.06529	-0.00377	5.25114	0.06120	-0.04459	-1.01440
-2.01528	-7.78109	16.51372	-0.92918	-0.08232	-1.01619	44.28165	-0.00648	0.41394	0.37123
-1.99163	-8.78898	17.02280	-1.26725	-0.06321	-1.05783	39.86685	-0.00394	0.41872	0.39442

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS (CONTINUED)

VARIABLES 50 RETURN	51 MARGIN3
-0.68219	-0.23237
0.47359	-0.80282
0.64721	-0.75888

The problem of interpreting the results of regressing on principal components is evident in this study. On the one hand, the first six principal components (those with eigenvalues greater than or equal to one), which encompass just over 77 percent of the total variance of the original independent variables, exhibit very low correlation with the dependent variable. On the other hand, the one component which is significantly correlated with the dependent variable encompasses very little of the total variance of the original data set (about 2 percent).

An attempt to utilize a straight-forward multiple regression analysis was made, in the hopes of avoiding the difficult problem of interpretation discussed above. Before calculating principal components, all original variables were standardized for mean and variance. The standardized variables thus all have mean zero and unit variance. Eigenvectors for the principal components therefore indicate which original independent variables are more heavily weighted in each component. Based upon the eigenvector for component 10, three sets of regressions were run using ordinary least squares. Results from these regressions are presented in the next three tables.

The independent variables in the regression of Table 3 are those variables having the three largest values in the eigenvector of the tenth principal component (eigenvector values are: variable 42, 0.5428; variable 16, -0.4414; variable 15, -0.3116). The coefficients of variables 15 and 16 have plausible signs. The sign of variable 42 is counter to expectations, indicating that banks with higher ratios of fixed charges to income pay smaller risk premia. None of the coefficients is significant by normal statistical criteria.

REGRESSION TITLE. . . . . .RUN1 DATA: INCLUDES NEW ISSUE
DEPENDENT VARIABLE. . . . . 54 PREMIUM
TOLERANCE 0.0100
ALL DATA CONSIDERED AS A SINGLE GROUP

MULTIPLE R 0.3315 STD. ERROR OF EST. 13.2309
MULTIPLE R-SQUARE 0.1099

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO	P(TAIL)
REGRESSION	518.859	3	172.953	0.988	0.41511
RESIDUAL	4201.343	24	175.056		

VARIABLE		COEFFICIENT	STD. ERROR	STD. REG COEFF	T	P(2 TAIL)
INTERCEPT		10.787				
PRIVATE	15	-2.890	13.689	-0.041	-0.211	0.835
HC	16	8.278	5.941	0.298	1.393	0.176
FIXED2	42	-1.021	0.697	-0.315	-1.465	0.156

REGRESSION TITLE. . . . . .RUN1 DATA: INCLUDES NEW ISSUE
DEPENDENT VARIABLE. . . . . 54 PREMIUM
TOLERANCE 0.0100
ALL DATA CONSIDERED AS A SINGLE GROUP

MULTIPLE R 0.4539 STD. ERROR OF EST. 13.3587
MULTIPLE R-SQUARE 0.2061

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO	P(TAIL)
REGRESSION	972.648	6	162.108	0.908	0.50782
RESIDUAL	3747.559	21	178.455		

VARIABLE		COEFFICIENT	STD. ERROR	STD. REG COEFF	T	P(2 TAIL)
INTERCEPT		4.663				
TERM	5	-0.370	0.302	-0.250	-1.223	0.235
PRIVATE	15	2.683	15.029	0.038	0.179	0.860
HC	16	10.579	7.500	0.384	1.424	0.169
OTH RES	18	0.975	6.515	0.036	0.150	0.882
%LOAN7	35	0.141	0.119	0.306	1.189	0.248
FIXED2	42	-0.795	0.768	-0.245	-1.035	0.313

Table 4

REGRESSION TITLE. . . . . .RUN1 DATA: INCLUDES NEW ISSUE
DEPENDENT VARIABLE. . . . . 54 PREMIUM
TOLERANCE 0.0100
ALL DATA CONSIDERED AS A SINGLE GROUP

MULTIPLE R 0.3817 STD. ERROR OF EST. 13.5390
MULTIPLE R-SQUARE 0.1457

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO	P(TAIL)
REGRESSION	687.536	5	137.507	0.750	0.59478
RESIDUAL	4032.671	22	183.303		

VARIABLE		COEFFICIENT	STD. ERROR	STD. REG COEFF	T	P(2 TAIL)
INTERCEPT		16.278				
TERM	5	-0.270	0.683	-0.183	-0.396	0.696
SINKING	14	-0.342	12.875	-0.013	-0.027	0.979
PRIVATE	15	-0.741	14.687	-0.011	-0.050	0.960
HC	16	8.529	6.512	0.307	1.310	0.204
FIXED2	42	-1.139	0.730	-0.351	-1.560	0.133

Table 5

In Table 4, variables corresponding to the six largest values in the eigenvector for the tenth principal component are entered into the regression model. The sign of variable 15 switches to positive and variable 42 becomes even less significant. The dummy variable for holding company affiliation is the only one to approach statistical significance. Its coefficient's positive sign, implying that holding company banks must pay higher risk premia to float their debt, is consistent with the findings of Beighley, Boyd, and Jacobs (see footnote 5), that holding companies tend to over-leverage themselves.

The regression of Table 5 adds the two most important variables from the eighteenth principal component to the three most important from the tenth component. The dummy variable for private placements is seen to be highly unstable in the three regression equations. The two new variables do not contribute at all to the regression equation.

Results When Debt is Defined to Exclude the New Issue

Tables 6 through 10 repeat the analysis of Tables 1 through 5. Table 6 shows that the six principal components with eigenvalues greater than or equal to one, accounting again for just over 77 percent of the total variance of the independent variables, do not correlate significantly with the dependent variable.

Five components have correlations with risk premium greater than or equal to 0.15. The analysis of variance in Table 7 indicates, however, that component ten is again the only significant component. The R-square due to component 10 alone is 0.16, considerably less than the 0.21 achieved when debt was defined to include the new issue.

DEPENDENT VARIABLE 54 PREMIUM

TOTAL SUM OF SQUARES 4720.2031
DEGREES OF FREEDOM 27.
MEAN SQUARE 174.82233

CORRELATION BETWEEN PRINCIPAL COMPONENTS AND DEPENDENT VARIABLE

-0.08388	-0.16913	-0.03658	-0.01871	-0.06601	-0.04080

REGRESSION COEFFICIENTS OF PRINCIPAL COMPONENTS

CONSTANT (MEAN OF Y)	COMPONENTS				
3.52589	-0.50949	-1.30287	-0.33371	-0.19735	-0.72147	-0.52537

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS

INDEX OF COMPONENTS ENTERING	RESIDUAL SUM OF SQUARES	F-VALUES REGRESSION MODEL	F-VALUES COMPONENT TO ENTER	R2	CONSTANT	VARIABLES 3 ISSUE	5 TERM	10 CONVERT	11 CALL	14 SINKING	15 PRIVATE
1	4686.98828	0.18	0.18	0.0070	4.8432	-0.0064	0.0031	0.3576	-0.2043	-0.0481	-0.2762
2	4551.96875	0.46	0.74	0.0356	5.4974	-0.0081	-0.0435	-0.6349	-0.5771	-1.0254	-1.0043
3	4545.65234	0.31	0.03	0.0370	4.7868	-0.0093	-0.0243	-0.5862	-0.3108	-0.7494	-0.8931
4	4543.99609	0.22	0.01	0.0373	5.4945	-0.0089	-0.0222	-0.8440	-0.4934	-0.6242	-0.4937
5	4523.42578	0.19	0.10	0.0417	3.5527	-0.0120	-0.0151	-1.5197	-1.0819	-0.4714	-1.9418
6	4515.56641	0.16	0.04	0.0434	3.1750	-0.0203	-0.0168	-1.6212	-0.8673	-0.3943	-2.5011

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS (CONTINUED)

VARIABLES 16 HC	17 DIV RES	18 OTH RES	25 %ASSET2	29 %LOAN1	30 %LOAN2	34 %LOAN6	35 %LOAN7	40 %INC1	42 FIXED2
-0.32472	0.28165	-0.13037	-0.08597	0.01106	-0.01402	0.48674	0.00637	0.02321	-0.03595
-0.27236	-0.76541	0.40769	-0.41763	0.02929	-0.05491	-3.99553	0.00838	0.02637	-0.02457
-0.20074	-0.75758	0.55645	-0.48291	0.03106	-0.06063	-4.31083	0.01082	0.00879	-0.03426
-0.12986	-0.84650	0.45025	-0.53476	0.03220	-0.06345	-4.46607	0.01016	0.00699	-0.02551
0.44734	-0.43629	1.15615	-0.41825	0.03497	-0.06532	-2.57164	0.00778	0.03139	-0.01510
0.41815	-1.12016	1.24930	-0.19294	0.03547	-0.06567	-3.02721	0.01316	0.01373	0.02610

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS (CONTINUED)

VARIABLES 50 RETURN	51 MARGIN3
-0.02159	-0.02734
0.15857	0.02095
0.21434	0.02611
0.19967	0.01296
0.24501	-0.00227
0.18136	-0.02158

Table 6

DEPENDENT VARIABLE 54 PREMIUM

TOTAL SUM OF SQUARES 4720.2031
DEGREES OF FREEDOM 27.
MEAN SQUARE 174.82233

CORRELATION BETWEEN PRINCIPAL COMPONENTS AND DEPENDENT VARIABLE

-0.08388	-0.16913	-0.03658	-0.01871	-0.06601	-0.04080	-0.16282	0.17623	-0.12603	0.40200
-0.08241	0.06001	0.10814	0.10162	0.04949	0.13593	-0.02868	-0.18964		

REGRESSION COEFFICIENTS OF PRINCIPAL COMPONENTS

CONSTANT (MEAN OF Y)	COMPONENTS								
3.52589	-0.50949	-1.30287	-0.33371	-0.19735	-0.72147	-0.52537	-2.35074	2.58475	-1.99250	6.50381
	-1.73112	1.67175	3.27082	3.44721	2.69648	8.54583	-2.13871	-30.60114		

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS

INDEX OF COMPONENTS ENTERING	RESIDUAL SUM OF SQUARES	F-VALUES REGRESSION MODEL	F-VALUES COMPONENT TO ENTER	R2	CONSTANT	VARIABLES 3 ISSUE	5 TERM	10 CONVERT	11 CALL	14 SINKING	15 PRIVATE
10	3957.41235	5.01	5.01	0.1616	20.5829	-0.0365	-0.2235	1.3226	4.5806	-2.9816	12.5138
18	3787.65381	3.08	1.12	0.1976	-3.8392	0.2892	-2.0853	29.0793	13.4784	29.8527	16.3464
8	3641.06665	2.37	0.97	0.2286	8.0570	0.3279	-2.0997	29.1277	13.3751	29.7607	8.1592
2	3506.04785	1.99	0.89	0.2572	8.7112	0.3262	-2.1463	28.1352	13.0023	28.7834	7.4310
7	3380.91528	1.74	0.81	0.2837	9.1152	0.3531	-2.1216	27.7071	11.8487	29.5388	9.1748

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS (CONTINUED)

VARIABLES 16 HC	17 DIV RES	18 STH RES	25 %ASSET2	29 %LOAN1	30 %LOAN2	34 %LOAN6	35 %LOAN7	40 %INC1	42 FIXED2
7.36550	2.06674	3.22770	-0.89552	-0.04598	-0.04326	4.32093	0.03932	-0.11966	-0.46841
-2.07389	-1.57960	16.55031	0.57295	-0.01240	-0.98582	30.94792	-0.04250	0.21557	0.72987
-1.84767	-2.27672	16.32765	-0.48637	-0.01956	-0.95292	31.96846	-0.02969	0.05067	0.63583
-1.79531	-3.32379	16.86571	-0.81803	-0.00135	-0.99382	27.48618	-0.02768	0.05383	0.64721
-2.12791	-6.16217	18.11189	-0.32966	-0.00797	-0.95511	25.15753	-0.00990	0.16789	0.30082

COEFFICIENTS OF VARIABLES OBTAINED FROM REGRESSION ON PRINCIPAL COMPONENTS (CONTINUED)

VARIABLES 50 RETURN	51 MARGIN3
-0.66024	-0.23300
0.87217	-1.09429
0.64184	-1.20282
0.82200	-1.15453
0.72097	-1.13643

REGRESSION TITLE. . . . . .RUN2 DATA: EXCLUDES NEW ISSUE
DEPENDENT VARIABLE. . . . . 54 PREMIUM
TOLERANCE 0.0100
ALL DATA CONSIDERED AS A SINGLE GROUP

MULTIPLE R 0.2216 STD. ERROR OF EST. 13.6753
MULTIPLE R-SQUARE 0.0491

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO	P(TAIL)
REGRESSION	231.892	3	77.297	0.413	0.74494
RESIDUAL	4489.312	24	187.013		

VARIABLE		COEFFICIENT	STD. ERROR	STD. REG COEFF	T	P(2 TAIL)
INTERCEPT		3.766				
TERM	5	-0.205	0.297	-0.138	-0.689	0.497
PRIVATE	15	-3.991	14.169	-0.057	-0.282	0.781
HC	16	4.481	5.588	0.161	0.802	0.430

REGRESSION TITLE. . . . . .RUN2 DATA: EXCLUDES NEW ISSUE
DEPENDENT VARIABLE. . . . . 54 PREMIUM
TOLERANCE 0.0100
ALL DATA CONSIDERED AS A SINGLE GROUP

MULTIPLE R 0.4336 STD. ERROR OF EST. 13.5097
MULTIPLE R-SQUARE 0.1880

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO	P(TAIL)
REGRESSION	887.448	6	147.908	0.810	0.57352
RESIDUAL	3832.759	21	182.512		

VARIABLE		COEFFICIENT	STD. ERROR	STD. REG COEFF	T	P(2 TAIL)
INTERCEPT		18.510				
TERM	5	-0.336	0.306	-0.227	-1.101	0.283
CALL	11	3.329	6.855	0.113	0.559	0.582
PRIVATE	15	-1.080	15.069	-0.015	-0.072	0.944
HC	16	5.892	6.837	0.248	1.008	0.325
OTH RES	18	2.074	6.439	0.077	0.322	0.751
FIXED2	42	-1.289	0.732	-0.378	-1.760	0.093

REGRESSION TITLE. . . . . .RUN2 DATA: EXCLUDES NEW ISSUE
DEPENDENT VARIABLE. . . . . 54 PREMIUM
TOLERANCE 0.0100
ALL DATA CONSIDERED AS A SINGLE GROUP

MULTIPLE R 0.2262 STD. ERROR OF EST. 13.9545
MULTIPLE R-SQUARE 0.0511

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO	P(TAIL)
REGRESSION	241.433	4	60.358	0.310	0.86833
RESIDUAL	4478.773	23	194.729		

VARIABLE		COEFFICIENT	STD. ERROR	STD. REG COEFF	T	P(2 TAIL)
INTERCEPT		2.261				
TERM	5	-0.067	0.691	-0.046	-0.098	0.923
SINKING	14	-2.913	13.161	-0.108	-0.221	0.827
PRIVATE	15	-3.058	15.060	-0.044	-0.203	0.841
HC	16	5.082	6.314	0.183	0.805	0.429

A comparison of Tables 2 and 7 indicates that empirical results for this model may differ significantly according to whether one defines debt to include or exclude the new issue. Examining the two tables that transform the regression coefficients of the tenth principal component back into regression coefficients for the original independent variables (that is, looking at "coefficients of variables obtained from regression on principal components," the first line only), one notes that two variables, issue size and dividend restrictions, change sign and that several variables' coefficients experience large changes in size--up to two orders of magnitude for variable 10. Although the sample is too small to generate stable results, this finding indicates that strikingly different empirical results emerge depending upon whether one tests an optimistic or pessimistic model of bank capital structure. Given the substantial difference in R-squares between Tables 2 and 7, on the basis of this limited test one could conclude that investors subscribe rather more to the pessimistic view.

Tables 8, 9, and 10 present ordinary regression results paralleling Tables 3, 4, and 5. The actual variables entering regression equations differ somewhat from those of Tables 3-5 due to differences in the eigenvectors for components ten and eighteen. No variable in any of these three regressions has a coefficient with both the expected sign and even marginal statistical significance.

VI. Summary and Conclusions

This paper has developed a model of market pricing of new debt securities issued by commercial banks. Two versions of the model were

tested, one including and the other excluding the new issue of debt. The two sets of results did display some differences, but overall statistical performance of the model was poor. It was found in both versions of the model that the first six principal components, encompassing about 77 percent of the variance of the independent variables, were not correlated with risk premium, the dependent variable. Only the tenth principal component, which accounted for just 2.2 percent of the variance of the independent variables, was significant in explaining risk premium.

Based upon results of the principal components analysis, selected independent variables were entered into a standard multiple regression equation. This analysis was undertaken in the attempt to utilize the information gained from principal components analysis while avoiding some difficult problems of interpreting results. Results of regression using ordinary least squares and the original independent variables were generally negative, a result not unexpected from the principal components analysis.

The purpose of this paper was to address the question, Do securities markets make use of the information currently available in pricing new issues of debt securities by banks? Empirical inference was considerably hampered by the small sample size.

No clear answer to the question posed can be given based upon empirical results reported. If one considers, on an intuitive level, that the total variance of a data set is a measure of its informational content, then the results of principal components regression indicate

that not very much information is being used by the market. The results of ordinary multiple regression indicate that the useful information is not captured by just a few standard financial variables. Nonetheless, a single linear combination of eighteen variables did produce R-squares of 0.20 and 0.16, indicating that some information from the Reports of Condition and Income are used by financial markets. Further testing with a larger sample is warranted.

FOOTNOTES

*The author wishes to acknowledge helpful comments from several of his colleagues, especially from Bob Laurent. Thanks are due to Nancy J. Peterson for extensive research assistance and to Robert W. Keyt for data processing support.

[1]George Tucker, The Theory of Money and Banks Investigated, Reprints of Economic Classics (New York: Augustus M. Kelley, Bookseller, 1974), originally published in 1839, p. 210.

[2]Frank Wille, "The FDIC Views Questions of Capital Adequacy", address by the Chairman of the Federal Deposit Insurance Corporation before the National Correspondent Banking Convention of the American Bankers Association, San Francisco, California, November 6, 1973, p. 1.

[3]John E. Sheehan, "Bank Capital Adequacy--Time to Pause and Reflect," Remarks of John E. Sheehan, Member, Board of Governors of the Federal Reserve System before the National Correspondent Banking Conference of the American Bankers Association, San Francisco, California, November 6, 1973, pp. 3, 11.

[4]Frank Wille, op. cit., p. 2.

[5]Donald P. Jacobs, H. Prescott Beighley, and John H. Boyd, The Financial Structure of Bank Holding Companies, A Study Prepared for the Trustees of the Banking Research Fund, Association of Reserve City Bankers, 1975. See also, by the same authors: "Financial Structure and the Market Value of Bank Holding Company Equities," Proceedings of a Conference on Bank Structure and Competition, Federal Reserve Bank of Chicago, 1975, pp. 61-72; and "Bank Equities and Investor Risk Perceptions: Some Entailments for Capital Adequacy Regulation," Banking Research Center, Northwestern University Graduate School of Management.

[6]Ideally, one would like to compare the risk security with a risk-free security having the same coupon, as well as the same date of maturity, so that one bond does not sell at a substantial discount relative to the other. In practice it is not possible to achieve this comparability since one must frequently compare a newly issued bank security with a Treasury security issued several years previously but maturing on nearly the same day.

[7]By the provisions of Regulations Q and D that exempt capital notes from interest rate ceilings and reserve requirements, capital notes must be unsecured. Therefore, this characteristic, which on a priori grounds would be considered important, was excluded.

[8]In this connection, it may be well to mention a controversy in the financial literature on banking. The argument concerns whether or not to include interest on deposits in fixed charges. The approach used here is

to exclude interest on deposits, on the two related grounds that interest costs are quite flexible for all deposits except long-term certificates and that other costs of maintaining deposits are much more rigid than interest costs. See David C. Cates, "Bank Analysis for Bond Buyers," Bankers Monthly, September 15, 1964, pp. 25 et seq.

[9]Richard V. Cotter, "Capital Ratios and Capital Adequacy," National Banking Review, Vol. 3 No. 3 (March 1966), p. 335.

[10]"Core Deposits" are demand deposits, apart from correspondent balances, and savings deposits, less investments. This measure of the stability of deposits to support lending is widely used by financial analysts; see, e.g., Harry V. Keefe, Jr., "Capital Funds in the Banking System--No More Free Lunches for Borrowers," an address before the association of Reserve City Bankers, New York, New York, February 3, 1975.

[11]Cates, op. cit., pp. 21-22.

[12]W. Braddock Hickman, Corporate Bond Quality and Investor Experience, National Bureau of Economic Research, Studies in Corporate Bond Financing, Volume 2, (Princeton: Princeton University Press, 1958), p. 396.

[13]David C. Cates, "Bank Debentures, Leverage, and Debt Capacity," Bankers Monthly, November 15, 1963, p. 48.

[14]Lawrence Fisher, "Determinants of Risk Premiums on Corporate Bonds," Journal of Political Economy, Vol. LXVII No. 3 (June 1959), pp. 217-237.

[15]Peter E. Sloane, "Determinants of Bond Yield Differentials--1954-1959," Yale Economic Essays, Vol. 3 No. 1 (Spring 1963), pp. 3-55.

[16]Richard H. Pettway, "Market Tests of Capital Adequacy of Large Commercial Banks," Journal of Finance (forthcoming, June 1976).

[17]H. Prescott Beighly, John H. Boyd, and Donald P. Jacobs, "Financial Structure and the Market Value of Bank Holding Company Equities," Proceedings of a Conference on Bank Structure and Competition, Federal Reserve Bank of Chicago, 1975, pp. 61-72.

[18]Banks which retired an outstanding note and issued a new note of equal or smaller size will not be picked up by this procedure.

[19]Calculations were performed using the Biomedical Computer Programs, series BMDP. Regression on principal components is program BMDP4R; multiple linear regression is program BMDP1R.