Bank Performance and Risk: Evidence from the Energy-Producing States

Dr. John E. Martinez, Economics, Cameron University
Dr. John M. Courington, Economics, Cameron University

Abstract

This paper investigates the causes of variation in loan performance among banks located in the energy producing states of Louisiana, Oklahoma, and Texas. The findings of this study indicate that a substantial portion of the variation in loan performance can be ascribed to the unusually poor performance of particular industries like energy. However, the findings also suggest that excessive risk-taking was a major factor in the loan problems encountered by many of the region's banks.

Introduction

The latter part of the 1980s was a strenuous period for many firms in energy-producing states. Dramatic changes in world oil markets in 1986 had a profound affect on domestic energy markets, which significantly affected economic conditions in energy-producing states.[1] In turn, the disruptive influence on domestic energy markets, along with burgeoning financial difficulties in the agricultural sector, placed downward pressure on commercial and residential property values generating financial tensions in the real estate development industry as well.[2]

The impact of falling oil and farm commodity prices, as well as generally declining local economic conditions, are commonly cited as primary factors accounting for the financial difficulties encountered by banks in the region. Receiving less attention has been the role of excessive risk-taking as a potential factor in the severe asset problems endured by banks in this area.[3] The degree to which each of these factors have been responsible for the plight encountered by many financial lenders in the region is especially significant for policy makers who must establish policies to impede their reoccurrence.[4]

Purpose of Study

The cumulative effect of troubled energy, real estate and agricultural loans drastically increased loan write-offs for many banks in the region; at the same time, other lenders in the region fared relatively well, experiencing only slight increases, if any at all, in their loan write-offs. This paper investigates the causes of the recent variation in asset performance among commercial banks located in smaller metropolitan areas of the energy-producing states of Louisiana, Oklahoma, and Texas.

The findings of this study indicate that a substantial portion of the total variation in troubled assets can, in fact, be ascribed to differences in local economic conditions as well as to the unusually poor performance of particular industries like energy and agriculture. However, the findings also suggest that excessive risk-taking played a critical role in the loan problems experienced by many of the region's banks; and, thus, was a contributing force to the diversity in loan performance throughout the region. After controlling for the effects of location and industry, significant differences in loan performance remain, differences which this study argues can be attributed to the varying propensities of bank managers to bear and accept risk.

The diversity in loan performance mentioned above has important public policy ramifications. If a considerable part of the total variation in troubled assets is attributed to differences in local economic conditions and the poor performance of particular industries such as agriculture and energy, then measures that support geographic expansion should be given high preference in restructuring the banking system. The basis for pursuing such a strategy is that geographic barriers to expansion make diversification difficult, causing some banks to be needlessly vulnerable to local economic downturns. But if other factors are also found to be key determinants of poor loan performance, then geographic deregulation

alone will not be sufficient to ensure a stable banking system. An alternative hypothesis stresses the role of excessive risk-taking, rather than the lack of diversification opportunities, as the critical factor most responsible for the poor loan performance of banks in the region.[5] If the excessive risk-taking hypothesis is correct, then what is required is a different set of initiatives. Such initiatives might include stricter supervision, variable insurance premiums, risk-based capital standards, or any other set of policies designed to curb excessive risk-taking.

Concurrent Measures of Risk

The essential issue of this paper is the causal role of risk-taking, as a deliberate choice of action, in the loan problems encountered by many commercial banks in the energy-producing region. If the excessive risk-taking hypothesis is correct, then banks with a high tolerance for risk should not only have been willing to make loans with a higher probability of default but should have also been willing to assume other forms of risk as well. If preferences for or aversions against risk are inherent traits, then managerial decisions to undertake risk should be consistent across a broad spectrum of policy options. Accordingly, decisions to invest in riskier loan portfolios should also be accompanied by a willingness to invest more funds in loans and, as a corollary, less in safe, short-term liquid assets such as U.S. Treasury securities. Likewise, there should be more willingness to rely on volatile sources of funds, and less of a tendency to support assets with equity capital.

Two concurrent measures of risk, loans to assets and securities to assets, serve as surrogates for a bank's exposure to asset risk. Loans are generally regarded as the riskiest assets that banks hold. U.S. Treasury securities, on the other hand, are usually considered to have no default risk, affording banks a high degree of safety. Thus, decisions which lead to relatively higher loan-asset ratios (and corresponding lower security-asset ratios) should convey riskier asset portfolios.

Banks can generally expect to earn higher profits by lending in local markets than by investing in U.S. Treasury securities or other open market assets. However, banks which invest a higher portion of their assets in loans are apt to experience greater variability in profits. In addition to higher default risk, loans to local borrowers tend to be less liquid than securities, making it more troublesome for banks when in need of emergency funds. Consequently, since loans involve relatively greater default and liquidity risk than other assets, banks that are willing to invest more of their assets in loans and correspondingly less in securities (assuming all other factors constant) are likely to be those with greater tolerance for risk.

One of the most important managerial duties in the operation of a bank is ensuring that the bank has adequate liquidity. Recent research indicates that inadequate liquidity is often one of the most important warning signs that a bank is in dire financial straits. However, there are trade-offs in ensuring adequate liquidity and maintaining high profitability. Ceteris paribus, the more resources a bank allocates to meeting its liquidity needs, the lower will be its expected profitability.[6]

There are two broad strategies banks can use to meet their liquidity needs; they can accumulate liquidity in the form of short-term assets or they can rely on borrowed liquidity. Achieving liquidity by investing in short-term assets is less risky, though potentially less profitable, than a strategy of relying on borrowed funds. Borrowing as a source of liquidity is the most risky approach to solving liquidity problems; however, the volatility of money market interest rates makes borrowing liquidity the strategy with the highest expected rate of return.

The ratio of net liquid assets to total assets is one of the most widely used yardsticks for determining a bank's ability to meet its unanticipated cash demands. Net liquid assets are defined as the difference between short-term liquid assets and short-term highly volatile liabilities. Although a bank can strengthen its liquidity position by holding more liquid assets, it will not necessarily be in a strong liquidity posture if the demands for liquidity being made against it are excessive. Banks which rely on large, highly volatile sources of funds (such as negotiable CD's and other liabilities with short time maturities) are more likely to have unanticipated deposit outflows. Thus, banks whose strategy is to adopt lower net liquidity ratios (either because they hold a smaller fraction of liquid assets, or because they rely more on volatile sources of funds) are those likely to be more favorably predisposed to accept risk.

Core deposits to total deposits are included to measure vulnerability to deposit outflows. Core deposits are defined as total deposits less time deposits over $100,000. Thus core deposits are small-denomination accounts from local customers that are unlikely to be withdrawn on short notice and are not particularly interest-rate sensitive. Large negotiable CD's and other funds purchased in the open market have a much greater risk of being suddenly withdrawn than do core deposits that are obtained from local customers. Purchased funds tend to be more sensitive to changes in interest rates and, hence, may provide a less steady source of funds to banks than do deposits like demand and passbook savings deposits which are included in the core deposit variable.

By depending more on volatile funds and less on core deposits a bank might be able to acquire more assets

and earn higher average profits. But such an approach could make liquidity strains more commonplace, increasing the variability of a bank's profits. For that reason, banks with high ratios of core deposits to total assets (and, conversely low ratios of volatile funds to total assets) are more apt to be risk-averse than banks with low core deposit ratios.

A final form of concurrent risk derives from decisions to adopt low capital (equity to total assets) ratios. For some banks, the growth in troubled assets in recent years is closely associated with a decline in their capital ratios. Lower capital ratios provide less cushion against any given loss, creating the impetus for banks to make loans with potentially both higher returns and higher probabilities of default.[7] Since the incentive to increase asset risk and bankruptcy risk increases as capital ratios decline, banks may choose to hold much riskier loan portfolios than they would had they had higher capital-asset ratios. As capital ratios fall, bank owners have less to lose in the event their investments fare poorly. On the other hand, they stand to gain significantly if the risky loans perform as hoped for. Several research studies suggest that poorly capitalized institutions have vigorously sought to assume additional risk, corroborating the go-for-broke strategy.[8] Alternatively, those banks eager to avoid losses should also be averse to making high-risk loans and other high risk investments.

Sample Data

The regression equation for analyzing loan performance among banks was estimated using data from commercial banks located in smaller to medium-size metropolitan statistical areas (MSAs) in the three-state region. The sample consists of a set of pooled observations on banks over a six year interval and across 15 geographic markets (MSAs).[9] The period covered in this study was from December 1985 through June 1990. Annual data were collected for each bank for each of the six years it was in existence.[10] Altogether, the sample contains 888 observations, consisting of 148 banking institutions with six years of annual data. In some years information may not have been available for a bank, possibly because it had failed or was merged out of existence prior to June 1990.

To control for the influence that market structure exerts on bank performance, only banks located in MSAs with less than 150,000 inhabitants were included in the sample.[11] The number and size distribution of firms (market structure) is generally more homogeneous across smaller metropolitan markets than it is for larger consolidated metropolitan markets. During the survey period, the number of banks in any one geographic market area was between seven and eleven. The size distribution of banks, as measured by the Herfindahl index, was fairly consistent across the 15 geographic markets.

The Estimating Model

Assume that a bank's loan performance can be analyzed according to the model specified in Table 1. To reduce possible problems associated with heteroskedasticity in the residuals, all variables (other than those that are binary-coded) in the model are formed by dividing the various measures by total assets. Tests were also performed to determine if variances were equal across the different geographic markets as well as across

Table 1

Variable Definitions and Model Specifications

$$y = a + m*M + l*L + d*D + r*R + t*T + e \quad (1)$$

y = N x 1 vector of observations measuring nonperforming loans
M = N x i matrix of binary observations defining MSA
m = i x 1 vector of estimated coefficients
L = N x i matrix of observations on loan composition
l = i x 1 vector of estimated coefficients
D = N x i matrix of observations measuring diversification potential
d = i x 1 vector of estimated coefficients
R = N x i matrix of observations of concurrent risk
r = i x 1 vector of estimated coefficients
T = N x i matrix of binary observations defining year
t = i x 1 vector of estimated coefficients
e = N x 1 vector of normally distributed random errors with zero mean, constant variance, and zero covariance over time and MSAs, and
a = estimated intercept coefficient.

the six years covered in the study.

The two most direct measures of banks' asset problems are the percent of loans charged off during the year and the percent of loans classified as nonperforming. When a bank judges a loan to be uncollectible, it is written off its books and charged against its loan loss reserve. The rate at which a bank writes off its loans is influenced by a number of factors. To avoid the problems associated with banks charging off loans at different rates, nonperforming loans were used as the primary measure of a bank's loan problems.[12] To be consistent with other computed measures in the equation, nonperforming loans are divided by total assets to form the "loan loss ratio", the dependent variable (y) in the study. The loan loss ratio will also be referred to as the "loan loss rate".

Part of the variation in loss rates which exist among banks is possibly due to differences in local economic conditions. Some MSAs in the region have depended more on troubled industries such as agriculture and energy, while others may have experienced strictly random economic shocks from such diverse activities as abnormal weather patterns, the closing of a local plant, or the expansion of a local military base.[13] To account for the impact of local economic conditions on loan performance variation, the model incorporates a set of fourteen (one less than the number of MSA markets) binary variables (M) to delineate geographic markets.

Within markets, loan performance could differ because banks specialize to different degrees in loans to troubled sectors. Consequently, some banks could have ended up with a larger proportion of nonperforming loans only because their loan composition reflected their expertise in agricultural or energy lending, leading them to rely more heavily on these types of loans, or at least more so than other banks in the same market. Four variables defining a bank's loan composition (L) are included in the model to sort out the potential effects of sectoral and industry specialization on loss rates. The components used to measure the effects of specialization on loan portfolios are four loan categories: commercial and industrial, real estate, agricultural, and consumer -- all expressed as a percent of total assets.

Even after controlling for whatever lending specialization exists, it is still possible that banks making similar loans in the same local market could have experienced varying degrees of adversity in their loan portfolios. A possible explanation for banks in the same market experiencing different loss rates, even when specializing in the same kinds of loans, is that some banks may have had more opportunities to diversify their loans and, consequently, were more willing to invest in loans with a higher probability of default. A bank's potential for diversification is influenced by a number of structural constraints. To account for this possibility, two structure-related variables (D) reflecting diversification potential are incorporated in the model. Within any market, large banks and banks affiliated with multibank holding companies (MBHC) are likely to have more diversification opportunities than smaller unaffiliated banks. Accordingly, the influence of size and holding company status must be taken into consideration when estimating a bank's loan performance.

Additionally, some banks may have been inclined to make loans with greater probability of default, not because they had more opportunities to diversify, but because they deliberately chose to make loans with greater probability of default with the expectation of greater profits. Banks with a high tolerance for risk should not only have been willing to make loans with a higher probability of default, but should also have been willing to incur other forms of risk as well. A set of financial ratios (R) serving as concurrent measures of risk are included as explanatory variables in the estimating equation. In selecting financial ratios to serve as risk proxies, it is necessary to consider only those variables over which managements exert significant direct influence.[14]

Because the data in this study cover a six-year period, a set of 5 (one less than the number of years surveyed) time-denominated binary variables (T) were added to the model. Their inclusion was for purposes of detecting any cyclical or trend components that may have been present during the 1985-90 period under study.

The regression model as formulated above incorporates numerous independent variables to estimate nonperforming loan rates. Initial efforts to include all the explanatory variables in the regression model resulted in multicollinearity, meaning a high degree of multiple correlation among several explanatory variables. Multicollinearity arose because too many variables measuring similar phenomena were included in the equation. The existence of multicollinearity tended to inflate the variances of the parameter estimates which resulted in coefficient estimates that were not statistically significant or had incorrect signs.

To combat the effects of multicollinearity, this study uses principal component analysis, a technique for finding interrelationships among a set of variables. This technique provides for the reduction in multicollinearity by transforming the original variables into a set of principal components.[15] In principal component analysis, linear combinations of the observed variables are formed with the first component accounting for the largest amount of variance in the sample. Successive components explain progressively smaller portions of the total sample variance and all are uncorrelated with each other.[16]

Findings

Regression analysis was used to estimate the relationship between the severity of asset problems (as measured by loan loss ratios) of the sampled banks and their risk-taking initiatives. The equation for estimating the loan loss ratio is reformulated as shown in Table 2 with the various coefficients and variables having the same interpretation as before, except for those subscripted with (pc). Variables subscripted with (pc) represent a matrix of observations designating uncorrelated principal components. Ratios constructed from the balance sheets of individual banks were used as concurrent measures of risk-taking and then combined into a single composite explanatory variable. Using principal component regression analysis, the estimates of the model are also shown in Table 2.

To help eliminate the effects of multicollinearity, stepwise regression was employed which further reduced the number of variables entering the equation. Only variables which significantly influenced the dependent variable were included in the final stage of the stepwise procedure.

The effects of location, loan specialization, and diversification opportunities were accounted for by including additional explanatory variables in the regression model. As revealed in Table 1, the statistical results (using stepwise regression) confirm the importance of risk-taking as a major factor contributing to the asset problems of banks in the region.[17] The results presented here also indicate that diversification within MBHC's will not necessarily reduce the risk of bank failures. MBHC's may choose instead to let their

Table 2
Principal Component Regression Model
Stepwise Method

$$y = a + m*M + l*L_{pc} + d*D + r*R_{pc} + t*T + e$$

Dependent Variable: Nonperforming loans to Total Assets

Explanatory Variables	Coefficient	T-ratio	Sig T
Location Dummies (M)			
MSA02 (1 if Laredo)	.7185	2.402	.0166
MSA10 (1 if Tyler)	2.3190	7.538	.0000
MSA11 (1 if Victoria)	1.3837	5.569	.0000
MSA13 (1 if Enid)	1.1914	3.988	.0001
MSA14 (1 if Alexandria)	.8470	3.798	.0002
Other MSA dummies[a]			
Loan Specialization (L)[b]			
Comm. & Ind. Loans	.0271	4.572	.0000
Real Estate Loans	.0289	5.675	.0000
Other Loan Categories[a]			
Risk Measures (R)			
Principal Component 1	-.1639	-2.157	.0314
Principal Component 2	.5370	7.009	.0000
Diversification Potential (D)			
BHC Status (1 if MBHC)	.3392	2.626	.0089
Size (Total Assets)[a]			
Year Dummies (T)			
All Year dummies[a]			
R^2	.5780		

[a] Insignificant at .05, and thus did not enter equation.
[b] As a percent of total assets

Source of Primary Data: Call Reports

troubled banks fail. While this forces the MBHC to give up the bank's future expected profits, it has the advantage of shifting the bank's current losses onto the FDIC.[18]

Principal components analysis was used to combine the risk-taking proxies into a single linear combination while retaining as much information about their total variation as possible. Five financial ratios were used in this study to model risk-taking.[19] The five ratios consisted of loans, securities, net liquid assets, core deposits, and equity capital, all expressed as a percentage of total assets. Each ratio served as a concurrent measure of risk, and was incorporated indirectly (as a principal component) as an explanatory variable in the regression model used to estimate loan loss ratios.

The results of the analysis supported the interpretation of the first principal component as a composite measure of risk-taking. The first principal component incorporated in the model to measure other concurrent forms of risk explained 42.2% of their standardized variance, with an eigenvalue of 2.11. As expected, only the loan ratio had a negative loading on the first eigenvector; the other four measures loaded positively on the same component and provided an unambiguous interpretation of the factor loadings as a realistic measure of risk.[20]

The statistical findings indicated that banks which made loans with a higher probability of default were those which concurrently engaged in other forms of risk. In particular, at the same time they were making high risk loans, these banks were also investing more of their funds in loans and less in securities and other liquid assets. Also, the high risk banks were concurrently relying more on volatile sources of funds; and, to a lesser extent, were not as willing to back their assets with equity capital.

Conclusions

The financial difficulties encountered by financial lenders in the energy producing states rose sharply after 1986 and has continued to be a problem throughout the 1990s.[21] The severity of loan problems has varied greatly, however, with nonperforming loans reaching very high levels at some banks but remaining relatively low at others in the region. This study investigated the factors responsible for the level and diversity of loan performance from 1986 to 1990, using a sample of 148 commercial banks from 15 metropolitan areas in the region.

A series of financial ratios constructed from the balance sheets and income statements of individual banks were compared and analyzed to determine the role which deliberate risk-taking may have played in explaining the severity of banks' loan problems. Regression analysis was used to investigate the relationship between nonperforming loans and several independent ratios designed to serve as proxies (or measures) of management's risk-taking preferences. To avoid problems of multicollinearity, principal components analysis was used to combine the risk-taking proxies into a smaller number of uncorrelated components and stepwise regression was employed to further reduce the number of variables in the estimating equation. The set of principal components were then used as explanatory variables in the regression equation.

To ensure that comparisons based on the uncorrelated components actually reflected differences in managerial attitudes (or dispositions) toward risk, it was necessary to control for a number of other factors. Also included in the estimation equation were the location of the sampled banks, their loan composition, as well as their size and legal status as affiliated or independent banks.

The statistical results indicate that between 1985 and 1990 a substantial part of the variation in loan performance was due to differences in local economic conditions found among the 15 metropolitan areas. The resulting impact from the unusually poor performance of particular industries like energy was also significantly adverse. However, local economic and industry conditions were not the only factors that accounted for the wide diversity in loan performance. The statistical results of this study are also consistent with the risk-taking hypothesis which attributes a significant part of the variation in loan losses to excessive risk-taking. After controlling for diversification opportunities, the evidence suggests that some banks deliberately sought to invest in loans with a higher probability of default, while others pursued more conservative strategies, seeking to avoid excessively risky lending opportunities.

While consistent with the risk-taking hypothesis, the results of this study also seem to suggest that banks would be less exposed to downturns in local markets if they were allowed greater geographic investment opportunities. Opportunities for diversification could be strengthened through policies that seek to liberalize interstate and intrastate branching restrictions. Nonetheless, given that excessive risk-taking was found to be a significant factor in explaining the wide diversity in loan performance, policies to promote greater diversification will not, by themselves, be adequate to ensure the health of the commercial banking system.

Suggestions For Future Research

While there may be practical limits to achieving significant diversification through policies designed to encourage secondary loan markets, further research is needed to determine if such means could potentially

achieve the same results as geographic deregulation. Because it is impractical to make loans below a given size, a very small bank may not be able to make enough loans to achieve the desired level of diversification through secondary loan markets. Larger banks may, indeed, have more opportunities to diversify their loan portfolios by exchanging their own loans for loans originated by others. However, in the absence of evidence to the contrary, this potentially useful policy option can not be dismissed until more empirical work is done in this area.

In a system of fixed-rate deposit insurance where premiums are assessed without regard of an institution's risk profile, the costs of excessive risk-taking are imposed on society as a whole. Historically, since banks have not had to bear the full cost of their risk-taking activities, they have been willing to make investments with a probability of failure greater than what they would have been willing to accept if they would have had to assume all the risk themselves. Consequently, achieving a safe and sound banking system also requires that steps be taken to curb excessive risk-taking.

Though there are practical and political limits to their implementation, initiatives which tend to reduce risk-taking incentives, either through tighter supervision, higher capital standards, or variable insurance premiums, should prove useful.[22] Further research is desperately needed to determine which of these policy options would prove to be the most fruitful. The government has partially attempted to address this situation by enacting the Federal Deposit Insurance Corporation Improvement Act of 1991, which ties the degree of federal supervision to a bank's capital level and requires the FDIC to eventually assess insurance premiums based on a bank's relative riskiness. It remains to be seen to what extent this will reduce a bank's incentive to take risk. ❧

*****Endnotes*****

1. The energy-producing region has been variously defined in the literature; but, for purposes of this study, it includes only three states: Louisiana, Oklahoma, and Texas.
2. See Tim R. Smith, "Financial Stress in the Oil Patch: Recent Experience at Energy Banks," Federal Reserve Bank of Kansas City, *Economic Review*, pp. 9-23, June 1987.
3. See William R. Keeton and Charles Morris, "Why Do Banks' Loan Losses Differ?," Federal Reserve Bank of Kansas City, *Economic Review*, pp. 3-21, May 1987. Their study focused on loan losses prior to 1987 and was concerned with the problems encountered by all energy banks in the country.
4. See C.F. Muckenfuss III, R.C. Eager, and C.H. Neilson, "The Treasury Department Report: Modernizing the Financial System--Recommendations for Safer, More Competitive Banks," *Bank Management*, pp. 12-22, April 1991.
5. For a general discussion of the role of managerial factors in the failure of commercial banks, see Lynn D. Seballos and James B. Thomson, "Underlying Causes of Commercial Bank Failures," Federal Reserve Bank of Cleveland, *Economic Commentary*, September 1990. See also William R. Keeton and Charles Morris, "Why Do Banks' Loan Losses Differ?," Federal Reserve Bank of Kansas City, *Economic Review*, pp. 3-21, May 1987. Their study is the seminal work in the area of risk-taking and its role as a causal factor in the loan loss problems of commercial banks. However, their study was completed prior to 1987 and focused on the impact of loan losses on all energy banks in the nation.
6. A general discussion of a banks liquidity can be found in Thomas S. Cargill, *Money, The Financial System, and Monetary Policy*, 4th ed., Prentice-Hall, Englewood Cliffs, New Jersey, pp. 161-163, 1991.
7. In banking, this phenomena is referred to as "moral hazard". An excellent discussion of the concept is found in Herbert L. Baer, "What We Know About the Deposit Insurance Problem," Federal Reserve Bank of Chicago, *Chicago Fed Letter*, 35, July 1990. For a discussion of the empirical connection of moral hazard as applied to Texas banking, see Jeffery W. Gunther and Kenneth J. Robinson "Moral Hazard and Texas Banking in the 1980s," Federal Reserve Bank of Dallas, *Financial Industry Studies*, pp. 1-8, December 1990.
8. A critical summary of capital forbearance as applied to the S&L crisis is provided by Elijah Brewer III, "Full-blown Crisis, Half-measure Cure," Federal Reserve Bank of Chicago, *Economic Perspectives*, pp. 2-17, November/December 1990. For a summary of this issue in banking, see Michael C. Keeley, "Bank Charter Values and Risk," Federal Reserve Bank of San Francisco, *Weekly Letter*, February 24, 1989.
9. Data were collected from the Reports of Condition (Call Reports) and Income which banks regularly file. The December reports were used as the source of information for each year except 1990 where only the mid-year report was available.
10. Data for this report was obtained from CD/Banking which is compiled from the authoritative Sheshunoff Information Services Database. Sheshunoff obtains its data from government sources: The Federal Deposit Insurance Corporation, Federal Reserve Board, and Federal Home Loan Bank Board. The product is a trademark of Lotus Development Corporation.
11. There are 15 MSAs in the three state region with populations less than 150,000. They include Alexandria and Monroe from Louisiana, Lawton and Enid from Oklahoma, and from Texas the following:

Abilene, Laredo, Midland ,Odessa, San Angelo, Wichita Falls, Bryan-College Station, Sherman-Denison, Texarkana, Tyler, and Victoria.

12. A nonperforming loan is a loan that has not been charged off but is 90 days or more overdue, failing to accrue interest, or renegotiated to facilitate repayment.
13. The role of regional influences on bank failures is discussed by Lynn D. Seballos and James B. Thomson, "Underlying Causes of Commercial Bank Failures," Federal Reserve Bank of Cleveland, *Economic Commentary*, September 1990.
14. See Eugene Short, "Bank Problems and Financial Safety Nets," Federal Reserve Bank of Dallas, *Economic Review*, pp. 17-28, March 1987. Though using a different estimating technique, this study used similar proxies for modelling risk.
15. Starting with a set of observed values on a given set of variables, this method uses a set of linear transformations to create a new set of variables called the principal components. Since the components are uncorrelated, there is no multicollinearity in the regression model. If the coefficients of the principal component transformations imply meaningful interpretation of the component variables, the regression may shed light on the underlying regression relationships.
16. For a more thorough explanation of principal components analysis, see William R. Dillon and Matthew Goldstein, *Multivariate Analysis*, John Wiley and Sons, Inc., New York, pp. 23-52, 1984. For an application to banking see Jeffery Gunther, "Texas Banking Conditions: Managerial Versus Economic Factors," Federal Reserve Bank of Dallas, *Financial Industry Studies*, pp. 1-18, October 1989.
17. Different subsets of variables were also tested for significance. In order of importance, the variable group names with their (significant F) values in parenthesis are as follows: Risk Proxies (.0000), Loan Specialization (.0000), Diversification Proxies (0001), and Location (.0000).
18. For a further discussion of this argument, see William R. Keeton, "Bank Holding Companies, Cross-Bank Guarantees, and Source of Strength," Federal Reserve Bank of Kansas City, *Economic Review,* Vol. 75, No. 3, pp.54-67, May/June 1990.
19. In analyzing the impact of risk decisions on banking problems similar proxies were used by Eugene Short, "Bank Problems and Financial Safety Nets," Federal Reserve Bank of Dallas, *Economic Review,* pp. 17-28, March 1987.
20. The coefficients of the eigenvector are as follows: loan-asset ratio, -.7201 ; security-asset ratio, .3811; net liquid asset ratio, .8369; core deposits ratio, .3607; and the capital-asset ratio, .7837.
21. See Keith R. Phillips, "Energy and the Southwest Economy," Federal Reserve Bank of Dallas, *The Southwest Economy,* November 1989, and Harvey Rosenblum, "The Texas Credit Crunch," Federal Reserve Bank of Dallas, *The Southwest Economy,* September 1990.
22. An excellent bibliographic guide to restructuring proposals is found in Mitchell Berlin, "Banking Reform: An Overview of the Restructuring Debate," Federal Reserve Bank of Philadelphia, *Business Review,* pp. 3-14, July/August 1988.

*****References*****

1. Baer, Herbert L., "What We Know About the Deposit Insurance Problem," Federal Reserve Bank of Chicago, *Chicago Fed Letter,* 35, July 1990.
2. Berlin, Mitchell, "Banking Reform: An Overview of the Restructuring Debate," Federal Reserve Bank of Philadelphia, *Business Review,* pp. 3-14, July/August 1988.
3. Brewer III, Elijah, "Full-blown Crisis, Half-measure Cure," Federal Reserve Bank of Chicago, *Economic Perspectives,* pp.2-17, November/December 1990.
4. Cargill, Thomas S., *Money, The Financial System, and Monetary Policy* (4th Ed.), Prentice-Hall, Englewood Cliffs, New Jersey, 1991.
5. Dillon, William R., and Matthew Goldstein, *Multivariate Analysis,* John Wiley and Sons, Inc., New York, 1984.
6. Gunther, Jeffrey W., "Texas Banking Conditions: Managerial Versus Economic Factors," Federal Reserve Bank of Dallas, *Financial Industry Studies,* pp. 1-18, October 1989.
7. Gunther, Jeffrey W. and Kenneth J. Robinson, "Moral Hazard and Texas Banking in the 1980s," Federal Reserve Bank of Dallas, *Financial Industry Studies,* pp. 1-8, December 1990.
8. Keeley, Michael C., "Bank Charter Values and Risk," Federal Reserve Bank of San Francisco, *Weekly Letter,* February 24, 1989.
9. Keeton, William R., "Bank Holding Companies, Cross-Bank Guarantees, and Source of Strength," Federal Reserve Bank of Kansas City, *Economic Review,* Vol. 75, No. 3, pp. 54-67, May/June 1990.
10. Keeton, William R. and Charles Morris, "Why Do Banks' Loan Losses Differ?," Federal Reserve Bank of Kansas City, *Economic Review,* pp. 3-21, May 1987.
11. Muckenfuss III, C.F., R.C. Eager, and C.H. Neilson, "The Treasury Department Report: Modernizing the Financial System--Recommendations for Safer, More Competitive Banks," *Bank Management,* pp. 12-22, April 1991.
12. Phillips, Keith R., "Energy and the Southwest Economy," Federal Reserve Bank of Dallas, *The Southwest Economy,* November 1989.
13. Rosenblum, Harvey, "The Texas Credit Crunch," Federal Reserve Bank of Dallas, *The Southwest Economy,* September 1990.
14. Seballos, Lynn D. and James B. Thomson, "Un-

derlying Causes of Commercial Bank Failures," Federal Reserve Bank of Cleveland, *Economic Commentary,* September 1990.
15. Short, Eugene, "Bank Problems and Financial Safety Nets," Federal Reserve Bank of Dallas, *Economic Review,* pp. 17-28, March 1987.
16. Smith, Tim R., "Financial Stress in the Oil Patch: Recent Experience at Energy Banks," Federal Reserve Bank of Kansas City, *Economic Review,* pp. 9-23, June 1987.