

Credit Risk Determinants of commercial bank: A Look from Texas Commercial Banking Industry

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Abstract

This paper examines and estimates the credit risk of commercial banks from Texas banking industry and finds that dominants factors influencing the credit risk of commercial banks are (i) bank's expectation towards higher ROA and ROE (ii) larger ratio of long term loans in bank assets portfolio, LTERMTA and (iii) bank size, LNTA. Regulatory capital requirement, REGCP, Real estate loans as a percentage of total loans (RESLL) and total assets (REALTA) are not significant factors.

The paper suggests some policy prescription to improve the credit risk management of commercial banks.

I. Introduction

It is well known in the banking market that banks deal with asymmetric information. Given economic condition and asymmetric information (faced by all banks), it is observed that some banks fail and some banks excel others. Some banks default rates are higher than that of others. These differences in bank performance are believed to be located in banks internal factors since all banks face the same economic conditions. The internal factors are those factors which are within the control of bank management. There are wide ranges of internal variables that may affect banks asymmetric performances. Banks attitude towards earning, decision towards the allocation of funds in asset and loan portfolio, leverage consideration, and the regulatory condition are, among others, believed to be important factors affecting bank credit risk. The difference in the structure and composition of loan portfolio might be a potential candidate for the difference in loan performance.

Since banks deal borrowers with asymmetric information, moral hazard and adverse selection is unavoidable in the credit markets. Given this asymmetric information, credit risk has been the major risk in the past and will remain the critical risk in the future for the commercial banks. Credit risk refers to the nonpayment of loans by borrowers. Since a majority of a bank's assets are in the form of loans, credit risk is the major risk for a bank. Credit risk is mainly a function of the quality of the bank's loan portfolio which can be associated with three main factors: (i) insider transaction called fraud risk. (ii)

Foreign risk, and (iii) normal domestic risk also known as nonfraud/nonforegin risk. Fraud type risk, usually takes the form of concentration of credits to friends, relatives and/or business associates of the bank's top manager, becomes an important source of current and past bank failures. In the U.S. history, three of the largest *de jure* bank failures—United States National Bank of San Diego in 1973, Franklin National Bank in New York in 1974, and United American Banks of Knoxville in 1983—are due to some kind of insider or fraud type of transaction (Sinkey 1992, pp. 402). However, it is hard to detect and difficult to get data.

Given that most bankers are honest and have no foreign loan risk, commercial banks' major credit risk is the non-fraud, non foreign or normal domestic risk. This normal domestic risk is attributable to several factors such as inefficient bank management, less diversification of loan portfolio, advancement of large amount of risky loans, high equity multiplier, and lower volume of risk based capital. The structure and composition of loan portfolio that might cause the difference in credit risk from bank to bank. These are bank's internal factors because they are within the control of bank. However, which of these internal factors are statically significant for the credit risk is yet unknown to bank managements, policy makers, and bank creditors.

In the past, credit risk is one of the main risks that dangerously affected banks' viability. This was evidenced from the 1977 financial crisis. The deep recession of the 21st century triggered by the failure of large financial institutions in the U.S.A. motivates financial economists to examine bank internal factors influencing credit risk. Such a critical issue as the bank credit risk deserves special attention from the financial economists. Both external and internal factors have important impact of bank credit performance. Since external factors such as economic recession, wars, law suits etc are beyond the bank management control, bank internal factors deserve analytical attention. Bank internal factors are factors which are available from the balance sheet and income statement of banks. Pantalone and Marjorie (1987) report that bank internal factors continue to be the significant factor contributing to at least one third of the bank failure

However, which of bank internal factors are significant in influencing credit risk have not been explored quantitatively and it deserve examination and exploration. This paper is motivated to provide answer in the context of Texas banking. Texas banking system provides wide variety of banks and has one of the largest numbers of total banks, over 600, in 2001.

By examining the relationship between banks' internal factors and credit risk, this paper aims to contribute to the existing literature in two important ways: (1) Identify the internal factors that are statistically significant in influencing the credit risk of bank. The identification of these factors can minimize bank's credit risk and losses (2) Determination of these factors is important valuable information for bank management, bank regulator, and bank creditors in improving the risk management of commercial banks.

This paper is organized as: A short survey of literature review is provided in Section II. Data and Methodology are outlined in Section III. Section IV provides empirical results, policy prescription. Conclusion is provided in Section V.

II. Literature Review

There are numerous studies relating to bank failures. Henage, (1995), Beaver, (1966), and Cates, (1985) examined bank failures. There are only a few studies involved in bank credit risk. Brewer, Jackson, and Mondschean (1996) studied commercial bank risk factors. They found that fixed rate mortgage loans, investment in service, and real estate loans are significant and negatively related to credit risk. The higher the fixed rate mortgage loans and real estate loans the lower the credit risk. However, non-fixed rate mortgage loan is found to be positively related to credit risk and is significant. Berger and DeYoung (1997) found that lagged risk-weighted asset is significant and positively related to risk measured by non-performance loan (NPL) as a percentage of total loans. They reasoned that a relatively risky loan portfolio would result in

higher NPLs. They also found that banks with relatively low capital face higher NPL i.e. the higher the equity multiplier (EM), the higher NPL. Fisher, Gueyine, and Ortiz (2000) found that loan loss provision, LLP, as a percentage of total loans are positively related to credit risk and bank size is negatively related to credit risk. That is, the larger the bank sizes the lower the credit risk for banks. Ross (1996) used loan loss provision (LLP) as a measure for credit risk. Angbazo, Mei, and Sounders (1998) examined the determinants of required credit spreads on highly leveraged transaction (HLT) and found “a positive HLT loan sensitivity to changes in the corporate bond market” (p. 1249). Shrieves(1992) investigated the relationship between the observed changes in risk and capital of large sample banks and found a positive relationship between them. Samad and Hassan (2000) measured equity multiplier (EM) as an index for bank risk. Pantalone and Marjorie (1987) identified several internal factors causing bank failure. These factors, among the most important, were: high equity multiplier, commercial and industrial loans to total loans and total loan to total assets

III. Data and Methodology

Data of all 680 banks operating in Texas in 2005 are obtained from the wave site: WWW.FDIC.GOV. Year 2005 is selected for the reason that year 2005 was considered as benchmark year because banking performance bubble begins to decline from 2005.

In order for determining the key risk factors influencing the credit risk of commercial bank and their predictive power, multivariable regression model is applied to two measures of credit default risk NPL and LLP. White (1980) procedure is used to ensure that the coefficients are heteroskedastic. The model is estimated from the set of following equations:

$$NPL = \lambda_0 + \lambda_1 ROA + \lambda_2 LTERM TA + \lambda_3 RESLSTA + \lambda_4 COMLN + \lambda_5 REGCP + \lambda_6 EQM + \lambda_7 LNTA + \varepsilon_1 \quad (1)$$

$$NPL = \lambda_0 + \lambda_1 ROA + \lambda_2 LTERM TA + \lambda_3 RESLL + \lambda_4 COMLN + \lambda_5 REGCP + \lambda_6 EQM + \lambda_7 LNTA + \varepsilon_1 \quad (2)$$

$$NPL = \lambda_0 + \lambda_1 ROE + \lambda_2 LTERM TA + \lambda_3 RESLSTA + \lambda_4 COMLN + \lambda_5 REGCP + \lambda_6 EQM + \lambda_7 LNTA + \varepsilon_1 \quad (3)$$

$$NPL = \lambda_0 + \lambda_1 ROE + \lambda_2 LTERM TA + \lambda_3 RESLL + \lambda_4 COMLN + \lambda_5 REGCP + \lambda_6 EQM + \lambda_7 LNTA + \varepsilon_1 \quad (4)$$

$$LLP = \lambda_0 + \lambda_1 ROA + \lambda_2 LTERM TA + \lambda_3 RESLSTA + \lambda_4 COMLN + \lambda_5 REGCP + \lambda_6 EQM + \lambda_7 LNTA + \varepsilon_1 \quad (5)$$

$$LLP = \lambda_0 + \lambda_1 ROA + \lambda_2 LTERM TA + \lambda_3 RESLL + \lambda_4 COMLN + \lambda_5 REGCP + \lambda_6 EQM + \lambda_7 LNTA + \varepsilon_1 \quad (6)$$

$$LLP = \lambda_0 + \lambda_1 ROE + \lambda_2 LTERM TA + \lambda_3 RESLSTA + \lambda_4 COMLN + \lambda_5 REGCP + \lambda_6 EQM + \lambda_7 LNTA + \varepsilon_1 \quad (7)$$

$$LLP = \lambda_0 + \lambda_1 ROE + \lambda_2 LTERM TA + \lambda_3 RESLL + \lambda_4 COMLN + \lambda_5 REGCP + \lambda_6 EQM + \lambda_7 LNTA + \varepsilon_1 \quad (8)$$

Dependent variables:

Based on the survey of related literature to risk management, this paper selects two measures of loan default risk. (i) Non performance loan (NPL) and (ii) Loan loss provision (LLP).

Non-performance loans (NPL) are defined as loans that are past due 90 day. Non-performance loans are represented by a set of two variables—90 day past due (NPL). The 90 day past due (90PD) is considered the actual credit loss. Loan loss provision (LLP) is, on the other hand, subjective and also used as a proxy for loan loss/default.

As both of these variables show positively, weak correlation (0.16) between them, both of them are used separately as regresand. NPL and LLP variables are transformed into natural log to correct for non-linearity

Independent variables:

A set of seven independent variables are considered in this paper for examining credit risk. These variables are obtained from individual bank balance sheet and income statements and classified under six predictive groups.

Group A: Management expectation/attitude. A bank management which expects a very high rate of return is prone to higher credit risk than a bank with which expect a lower rate of return. The banks that expect to have a low rate of return are a risk-averse. The higher the propensity of risk taking, the higher the return on asset (ROA) or return on equity (ROE) and the greater the credit risk and vice versa. In order to expect a higher rate of return bank management must have larger portfolio of risky loans. Both these variables are expected to be positively related to NPL and LLP. That is,

$$\frac{\partial NPL}{\partial ROA} > 0 \quad \frac{\partial NPL}{\partial ROE} > 0, \text{ and}$$

Group B: Risky loan: The higher the amount of risky loan, the higher the default risk for a bank. Real estate loans, whether collateralized or not, are considered risky loans due income loss or volatility of property value. There are various measures of default risk. Real estate loans in the portfolio of total loans, RESLL, or REALTA, real estate loans in the portfolio of total asset are both risky loans. RESLL is the amount of residential properties loans plus non-residential properties loans plus real estate loans plus construction loans plus consumption credit loans as a percentage of total loans. LTERMETA is the amount of long term, (total loans- earning investment) as a percentage of total assets. Since the correlation matrix, provided in Table 1, shows that both REALTA and RESLL show strong positive correlation (0.98), RALTA and RESLL are not used in the same equation as an independent variable.

It is expected that

$$\frac{\delta NPL/LLP}{\delta RESLL/REALTA} > 0$$

Another important measure of credit risk is the ratio of long term loan in asset portfolio, LTERMETA. Long term loan are more risky than the short term loan as the probability of long term loan payment prediction is more uncertain and may be affected by a host external factors such as recession, price uncertainty, etc. The higher the amount of long term loans as a

percentage of total assets, the higher the default risk for a commercial risk. LTERMATA, long term loan as a percentage of total assets, is determined by subtracting cash and income earning investment from the total asset and dividing by total assets. It is expected that real estate loans, (RESLL and REALTA) and the long term loans, LTERMATA may be linearly dependent. The correlation matrix, in Table 1, shows that LTERMATA has a very weak correlation with RESLL and REALTA, 0.09 and 0.11, respectively. It is expected that

$$\frac{\delta NPL/LLP}{\delta LTERMATA} > 0$$

Table 1 Correlation Matrix

	LTERMATA	RESLL	REALTA
LTERMATA	1.000	0.0936	0.1184
RESLL	0.0936	1.000	0.9820
REALTA	0.1184	0.9820	1.000

Group C. Loan diversification: A bank loan diversification tends to reduce its default risk. A geographic restriction for the advancement of loan is a manifest of less diversification. Commercial loans are considered as non-diversified loans. COMLN, the amount of commercial and industrial loans as a percentage of total loans represents less loan diversification. The higher the ratio the lower the loan diversification and the greater the default risk. Penn Square Bank, which closed in 1982, suffered from a lack of diversification. “Its loan portfolio had a heavy concentration of consumer and industrial loans (e.g. 71% in 1980) mainly in energy related areas”. Sinkey (1992, p. 540). It is thus expected that

$$\frac{\partial NPL}{\partial COMLN} > 0 .$$

Group D. Risk Based capital: The link between capital and credit risk can be described in the way that bank capital has the ability to absorb losses due to default by banks’ customers. Based on Basle Agreement, the amount of total regulatory capital, known as Tier 1, is required to be 4% of the total risk based assets. The presumption is that the higher the ratio of Tier 1 capital as a percentage of total assets (REGCP), the lower the credit risk. The higher the REGCP, the lower

the credit risk for a bank. $\frac{\partial NPL}{\partial REGCP} < 0$,

Group E. Leverage factor: When a bank generates a large amount of total assets with a low amount equity capital, the bank, in general, exposes to high default risk. A bank with a small equity capital is more vulnerable to economic or industry specific down turn that causes a portion of bank’s loan portfolio to default. Equity multiplier, EQM, is the amount of equity

capital as a percentage of total assets. It is expected that, $\frac{\partial NPL}{\partial EQM} > 0$

Group F. The size of bank is an important factor for credit risk. Usually, the larger the bank size, the higher the propensity of risk taking and the higher the credit risk. Small bank is less aggressive to risky loans. LNTA is the log of total assets. This variable is transformed into

natural log to correct for non-linearity. It is expected that, $\frac{\partial NPL}{\partial LNTA} > 0$.

IV. Empirical Results

Empirical findings are provided in Table 2 and Table 3.

Table 2
Regression Result with non-performance loan (NPL) as a dependent variable¹

EQ	Regressor	Coefficients	T-stats	R ²	F-statistic	Prob(F-statistics)	DW
1	ROA	-0.027	-0.68	0.02	2.21	0.03	1.9
	LTERMATA	0.0000006	1.97**				
	REALTA	0.005	1.06				
	COMLN	0.002	0.93				
	REGCP	.0001	0.97				
	EQM	0.0000065					
	LNTA	-0.0008	-3.09*				
2	ROA	-0.023	-0.66				
	LTERMATA	0.0000004	1.96**				
	RESLL	0.0004	0.1.06				
	COMLN	0.002	0.96				
	REGCP	0.0001	0.87				
	EQM	0.0000041	-0.27				
	LNTA	-0.0008	-2.99				
3	ROE	-0.003	-0.72	0.02	2.26	0.02	1.89
	LTERMATA	0.0000005	2.4*				
	REALTA	0.005	1.06				
	COMLN	0.002	0.92				
	REGCP	0.0001	0.55				
	EQM	0.0001	1.52				
	LNTA	-0.0008	-3.32*				
4	ROE	-0.003	-0.72				
	LTERMATA	0.0000041	2.78*				
	RESLL	0.0005	1.06				
	COMLN	0.003	0.99				
	REGCP	0.0001	0.71				

¹ Differences between equations 1 and 2 are the inclusion of REALTA and RESLL with ROA common and differences between equations 3 and 4 are the inclusion of REALTA and RESLL with ROE common.

	EQM	-0.0000068	0.050				
	LNTA	-0.0008	-3.14*	0.03	2.54	0.01	1.88

* Significant at 1% level of significance,** Significant at 5% level of significance

** *Significance at 10% level of significance

Table 2 shows that the major determinants of credit risk, measured in NPL, are LTERMATA, long term loans as a percentage of total assets and bank size measured in terms of total assets, LNTA. T-statistics for both variables show s that they are statistically significant in four equations.

Management attitude measured in ROA and ROE and variables such as equity multiplier, EQM and real estate loans, RESLL, REALTA as a percentage of total loans and total assets are not significant in any of the four equations.

In all four equations the sign for long term loans, LTERMATA, is consistent as expected in the model. The higher the ratio of LTERMATA, the higher the default risk of loans.

Large bank measured in terms of total assets can have more diversification of loans in its asset portfolio and thereby can reduce the credit risk of banks. This is reflected in the coefficient for LNTA. The coefficient of LNTA, is negative and significant indicating that NPL of large banks assets is negatively related to bank size.

Signs for ROE, ROA, and EQM are not consistent and are not significant. Signs for REGCP, REALTA and RESLL are consistent but significant in all equations. The R^2 of all the regression are between .02 and .04 and the F-statistics of these regressions are significant as supported by the p-value. This suggests that the overall explanatory power of all models is satisfactory.

The high value, close to 2, of Durbin Watson (DW) supports that there is no multicollinearity.

Table 3
Regression Result with loan loss provision (LLP) as a dependent variable²

Eq	Regressor	Coefficients	T-stats	R ²	F-statistic	Prob(F-statistics)	DW
1	ROA	0.12	2.61**	0.06	7.99	0.0000	1.98
	LTERMATA	-0.000004	0.88				
	REALTA	0.01	0.98				
	COMLN	0.006	2.41**				
	REGCP	0.001	0.76				
	EQM	0.0003	0.14				
	LNTA	-0.0002	1.67***				
2	ROA	0.11	2.70**				

² Differences between equations 1 and 2 are the inclusion of REALTA and RESLL with ROA common and differences between equations 3 and 4 are the inclusion of REALTA and RESLL with ROE common.

	LTERMATA RESLL COMLN REGCP EQM LNTA	-0.000005 0.0000004 0.006 0.0001 0.002 -0.002	-0.79 0.60 2.47** 0.70 0.14 -1.67				
				0.08	7.98	0.0000	1.98
3	ROE LTERMATA REALTA COMLN REGCP EQM LNTA	0.0000005 0.00000022 0.001 0.005 0.0003 0.0001 -0.0003	2.76** 0.72 0.97 2.25** 0.24 0.74 -1.90**				
				0.09	8.89	0.0000	1.89
4	ROE LTERMATA RESLL COMLN REGCP EQM LNTA	0.001 0.000003 0.000004 0.006 0.0003 0.0001 -0.0003	2.77* 0.45 0.67 2.27** 0.76 0.57 -1.84***				
				0.09	8.79	0.0000	1.89

* Significant at 1% level of significance, ** Significant at 5% level of significance

*** Significance at 10% level of significance

When loan loss provision is considered for measuring credit loss/default, Table 3 shows that factors influencing the credit losses are: (i) management return attitude i.e. ROA and ROE, (ii) COMLN, commercial loans and (iii) LNTA, bank size measured in total assets. T-statistics for both variables show that they are statistically significant in four equations.

Large bank measured in terms of total assets can have more diversification of loans in its asset portfolio and thereby can reduce the credit risk of banks. This is reflected in the coefficient sign for LNTA. The coefficient of LNTA, is negative and significant indicating that NPL of large banks assets is negatively related to bank size.

Signs for ROA and ROE are positive, as expected, and significant at the level of Bank attitude towards higher expected return is commensurate with higher risk and consequently bank must face higher default risk. Since ROA and ROE are positively and significantly related to NPL and LLP, it suggests that bank management should pursue a policy of moderate return for its asset and equity. A policy of higher rate of return jeopardizes the sound allocation of bank's loan portfolio.

The sign for COMLN is positive and significant but contrary to the expectation of model. This might be due to difference in the composition of commercial loans.

Sign for the coefficient of regulatory capital REGCP, EQM and real estate loans, RESLL and REALTA as a percentage of total loans and total assets are consistent as per the expectation

of model but not significant.

The F-statistics for all four regressions are significant. This suggests that the overall power of the model is satisfactory. The high value of Durbin Watson (DW), in all equations, supports that there is no multi-collinearity.

V. Conclusions

The paper builds up models for examining factors influencing the credit risk of the commercial bank and estimated the model with the data of 600 commercial banks from Texas. When default risk is measured in non performance loans, NPL, the dominant internal factors influencing the credit risk are: LTERMATA, long term loans as a percentage of total assets and bank size measured in terms of total assets, LNTA. The higher the ratio of long term loan in the portfolio of total assets, the higher the credit risk for commercial banks.

When credit risk is measured in loan loss provision, LLP, the major internal factors affecting credit risk are: management return attitude i.e. ROA and ROE, (ii) COML, commercial loans and (iii) LNTA, bank size measured in total assets.

The paper provides two policy prescriptions. (i) A bank management should pursue a policy of moderate return for its asset and equity. A policy of higher rate of return jeopardizes the sound allocation of bank's loan portfolio. (ii) Since long term loans are positively related to credit risk, bank should have smaller percentage of long term loans in the portfolio of total assets.

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