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Managing Credit Risk in Small and Large U.S. Banks: Indicators from the 2007-2013 Financial Crises

Pooran Lall
Department of Business and Economics, School of Business and Information Systems, York College,
City University of New York (CUNY) ,USA
plall@york.cuny.edu

ABSTRACT

Credit risk is the dominant risk problem faced by the U.S. banking industry. Understanding how credit risk responds to bank specific, market related and macroeconomic/location related variables in small and large banks in the U.S can help formulate more specific strategies to manage credit risk. Results, for the Period, 2007-2013, obtained using the generalized least square, indicate that credit risk had a negative correlation with the profitability (ROA, ROE), capitalization risk, market competition (Mkt1), diversification (Dvr) and macroeconomic (GDP/Capita) variables, but a positive correlation with interest rate risk in both small banks and large banks.

Except for the capitalization risk variable, the correlation coefficient for each variable considered was stronger in large banks compared with small banks, suggesting that, at the industry level, strategies aimed at improving the relationships between credit risk and these variables are likely to have a stronger impact on improving credit risk in large banks. Credit risk appeared to be greater in the Chicago and San Francisco regions compared with other regions.

The coefficient of determination (R-squared) was lower in small banks compared with large banks (about 35% vs 75 %), suggesting that additional information needs to be considered in order to better explain credit risk in small banks.

Keywords: *US banks, U.S. small banks, bank size, community bank, credit risk.*

1. INTRODUCTION

The U.S. banking industry, like banking industries in other country, is a very risky industry. The years, 2007-2013, marked the most recent wave of financial crises in the U.S. banking industry (Manuel, 2014), with bank risks emerging from many new and unexpected sources, from within the domestic financial markets, as well as, from foreign markets. Of all the bank risks, credit risk is regarded as the most costly risk faced by the banking industry. For many banking institutions, success or failure depends on how prepared these institutions are to cope with this risk. Managing the credit risk problem requires not just accurate detection and measurement of credit risk, but also prompt response to and efficient management of the problem (Gieseche, 2004). The Basel Committee on Banking Supervision (2001) advocates a more unified approach to credit risk management.

"Credit risk "is used to describe the probability that a borrower may default, either partially of wholly, on a loan(Raghavan, 2003), but the term is also usually associated with banking institutions failing to recover their credits as defined by the terms of the debts (Goodhart, 1998). From a creditor's view point, the default may be the result of the borrower not being willing and/or able to repay his debts to the lending institution, possibly because of loss of income or a business failure, or that he simply reneges on the contract because he has little or nothing to lose by doing so. From a bank's viewpoint, credit risks may arise from a failure to observe one or more of the facets of credit risk management (as presented in Santomero, 1997; FDIC, 2005; FDIC, 2011). Either party may be subject to limitations emerging out of unforeseen circumstances, arising out of business/macro – economic cycles, or unfavorable exchange rates, etc., which could precipitate a default.

To a bank, credit risk means a loss in the value of the credit asset, and/or a loss in current or future earnings from this credit. To mitigate this outcome, the banking industry, in the U.S., as is the case elsewhere, is always engaged in the pursuit of better systems of risk management which must not just enable it to monitor, measure and control credit risks, but all other risks that threaten to devalue portfolios of assets, loans or deposits in the industry, and to communicate and collaborate with other banking systems in this effort.

However, notwithstanding these precautions, the 2007-2013 U.S. financial crises, which emerged out of the subprime problem (Yanga, et. al., 2014; Jurek and Marszatek, 2014; Pais and Stork, 2011) and quickly developed systematic characteristics, significantly overpowered the U.S.banking industry, and drastically reduced its ability to contain the credit risk problems. During this period, credit risk soared. From a loan loss allowance (cost of credit risk, see FRS, 2013[1]) of 20% of net income in 2006, credit risk mounted and by 2010, the cost of credit risk had completely consumed income in many banks and had rendered them insolvent (FDIC, 2014). Between 2007 and 2013, apart from U.S. banks that merged or were consolidated, over 450 U.S. banks failed (FDIC, 2012). Many of the failed banks were large

[1] "The loan loss provision is a valuation reserve established and maintained by charges against the bank's operating income. As a valuation reserve, it is an estimate of uncollectible amounts that is used to reduce the book value of loans and leases to the amount that is expected to be collected" (Comptroller's Handbook, 2012). This means that an increase in loan loss provision reduces net income, while a decrease in loan losses increases net income.

banks, of the likes of J. P. Morgan and Wells Fargo (Perez, 2014), but the majority of them were small community banks.

Of the U.S. banking industry, small banks accounts for about ninety percent of the U.S. banking industry by number, and are the key providers of financial services to rural areas, sub-urban communities and small towns. They, however, control only about ten percent of the assets (FDIC, 2012). By contrast, large banks constitute about ten percent of the industry and control about ninety percent of the assets. Because of the volume of their financial dealings with counter parties, large banks set the conditions in the banking industry. Small banks, in spite of their weaker capital bases and restricted access to money markets, are subject to these conditions and must find ways to cope under the conditions if they are to survive in the industry. Within this context, it is important to determine the factors that affect credit risk and how they behave with respect to small banks compared with large banks, as this is more than likely to have strong bearings on strategies formulated to deal with this problem. The objective of this paper, therefore, is to examine how factors affecting credit risk behaved, during the period 2007-2013 U.S. financial crisis, and determine the comparative effect these factors have on small and large banks in the industry.

2. LITERATURE REVIEW AND DEFINITION OF THE INDEPENDENT VARIABLES

This paper examines the relationships between nineteen independent variables in seven categories and two measures of credit risk (CRisk1, CRisk2). These variables, their construction and hypothesized relationships with CRisk1 and CRisk2 are shown in Table 1. For convenience, the variables are classified into four major groups: profitability variables, bank specific risk related variables, market related variables and macroeconomic/location related variables.

2.1 Profitability Variables

In this group, two measures of profitability (ROE, ROA) (as defined in Gul, Irshad and Zaman, 2011, Gilbert and Wheelock, 2007; Kolapo, Ayeni and Ake, 2012; Samad and Glenn, 2012) are used to examine how credit risk responds to bank profitability.

ROE is calculated as Net Profit[2]/Equity and, ROA as Net Profit/Total Asset. When credit risk is used as an explanatory variable in profitability analysis, the relationship is usually negative, indicating that as credit risk increases profitability decreases. However, when profitability is used as an explanatory variable for credit risk, the relationship is not so straightforward. For example, Ötker-Robe and Podpiera (2010) argued that if profitability is due to better bank performance, then, from a cost point of view, credit risk should be lower, i.e., there should be a negative relationship. Zribi and Boujelbène (2011), on the other hand, observed a positive relationship and accredited this greater profitability to returns for greater risk taking. In terms of the expected relationship, although most studies (Louzis et al., 2010; Manab et. al, 2015) consider credit risk as cost which should decrease profitability, in this study, there is no a priory reason to believe that that relationship will hold. Consequently, the relationship between the profitability variables (ROE, ROA), and the credit risk variables (Loan Loss Allowance/Total Deposit or Loan Loss Allowance/Total Loan) cannot be determined a priory.

2.2 Bank Risk Related Variables

In this group, three variables that reflect the key bank specific internal factors that affect credit risk are examined: interest rate risk, liquidity risk and capitalization risk.

Interest rate risk (IRisk) arises from variability in interest rates, which affects a bank's net interest income and market values of its equity (Raghavan, 2003).In this model, following the suggestion of the Van den Heuvel (2014), interest risk is calculated as Net Interest Income/Total Income[3]. Net interest income represents the difference between interest income and interest expense.

Many studies have established a positive relationship between interest rate risk and credit risk. Garza-García, (2010) and Angabazo (1997), for example, have observed a positive correlation between interest rate risk and credit risk. Yanga et. al. (2014) noted that the credit risk problem observed in many countries, following the U.S. subprime problem, were the results of interest rate risk. These observations were also made by Reinhart & Rogoff (2009) and Liebeg and Schwaiger (2006), which altogether suggest that higher interest rate risks is correlated with increased credit risk. Based on these observations, a positive correlation is expected between the interest rate risk variable and the credit risk variables.

Liquidity risk (LRisk) arises from banking institutions failing to maintain needed funds for loan growth and deposit withdrawals (Raghavan, 2003; Mohammad, 2013).Liquidity funds, particularly in the short run, are obtained from deposits retained (required

[2] Net profit is computed as the sum of interest income and non-interest income less the sum of interest expense and non-interest expense. Interest income accrues from such activities as issuing loans and leases, and from trading accounts. Non-interest income derives from such activities as trading, investments, insurance and from fees. Interest expenses are expenses arising from liabilities and debts. Non-Interest expense accrues from personnel expense, occupancy and operating expenses. Interest expenses are expenditures made on liabilities and debts.

[3] Net interest income is calculated as interest income less interest expense. Total income is the sum of interest income and non-interest income.

reserve), cash reserves, short-term assets such as short-term government securities, or from credit lines established with other financialinstitutions. In the longer run, additional liquidity funds may be obtained by liquidating bank owned assets (capital) or by borrowing, usually at higher rates. In this analysis, liquidity risk is measured using the liquidity ratio, Total Deposit/Total Asset (Gul, Irshad and Zaman, 2011). The relationship between credit risk and liquidity risk, with credit risk being the explanatory variable, is usually positive. However, with liquidity risk being the explanatory variable, the relationship is not so clear. Safari. et. al. (2014) observed a positive relationship between the amount of liquid assets and credit risk. Manab (2015), on the other hand, using the liquidity ratio, working capital /total assets, observed a negative relationship between liquidity risk and credit risk. Ötker-Robe and Podpiera (2010) proposed that the link between liquidity risk and credit risk might be in the cost of acquiring additional funds to maintain liquidity and create credit (loans).

In this sense, the "higher-cost" liquidity risks are likely to be positively associated with "higher-cost" credit risk. In this analysis, the relationship between liquidity risk (Total Deposit/Total Asset) and credit risk (Loan Loss Allowance/Total Deposit or Loan Loss Allowance/Total Loan) cannot be determined a priory.

Table 1: Description of variables, their expected relationship with ROE, ROA and the rationale for the relationships

Name	Description	Acronym	H_0	Rationale [a]
Dependent Variables				
Credit risk	Loan Loss Allowance/ Total Deposit Loan Loss Allowance/ Loan	CRrisk1 $_{ij}$ CRrisk2 $_{ij}$		Measure of Credit Risk (CRisk1). Measure of Credit Risk (CRisk2).
Independent Variables				
Profitability Variables				
Return to equity	Net profit/Equity	ROE $_{ij}$	+ or-	As Net Profit/Equity, Net Profit/Asset ratios increases
Return to asset	New profit/Total Asset	ROA $_{ij}$	+ or -	credit risk may increase or decrease
Bank Risk Related Variables				
Interest rate risk Liquidity risk Capitalization risk	Net Interest Income/ Total Income Total Deposit/Total Asset Equity/Total Asset	IRisk $_{ij}$ LRisk $_{ij}$ Cap Risk $_{ij}$	+ + o- -	As net interest income/total income ratio increases credit risk also increases. As the ratio of deposit/total asset increases, credit risk may increase or decrease. Higher equity/asset ratio means better prepared for risky market, implies a negative impact on credit risk.
Market Related Variables				
Loan Market Competition	Net Loan/Total Asset Net Loan/Total Deposit	Mkt1 $_{ij}$ Mkt2 $_{ij}$	+or-	Greater loan/asset, loan/deposit ratios may mean better bank performance or careless lending which means greater or lesser credit risk.
Diversification	Non-Interest Income/Total Income	Dvr $_{ij}$	+or-	Greater/lesser non-interest income/total income ratio could result in increased or decreased credit risk.
Macroeconomic/Location Related Variables				
Bank size (Dummy Variable)	$Control_{small}$= <$100Million 1=$100-<1Billion,0 =otherwise $Control_{large}$=$1B-10Billion, 1=>$10Billion, 0=otherwise	Size1 $_{ij}$ Size2 $_{ij}$ Size3 $_{ij}$ Size4 $_{ij}$	+ or – + or-	The sign for each of these variables is to be determined empirically.

National Income	GDP/Capita	INC_{ij}	-	Increased GDP/Capita means increased ability to repay loans, and decreased credit risk.
Location (Dummy Variable)				
	1=Kansas City, 0 = otherwise	$LocKC_i$	+or –	
	1=Chicago, 0 = otherwise	$LocCH_i$	+or –	
	1=New York, 0 = otherwise	$LocNY_i$	+or –	The sign for each of these variables is to be determined empirically.
	Atlanta, 0 = Control	$LocAT_i$		
	1=Dallas, 0 = otherwise	$LocDA_i$	+or –	
	1=San Francisco,0 =otherwise	$LocSF_i$	+or –	

Capitalization risk (Cap Risk) is a measure of the probability of banking institution failing to maintain adequate capital to cover potential losses in cases of urgent demands (Raghavan, 2003). A banks' capital is usually measured in terms of its Capital Adequacy Ratio (CAR[4]) and is commonly used as an indicator of a bank's ability meet its capital needs to funds expansions or to accept losses. In this sense, capital could be regarded as a Measure of liquidity under stressed market conditions - greater capitalization means greater ability to offset risky conditions and enhance consumer confidence (Berger and Bauwman, 2011, Holmstrom and Tirole, 1997). In this analysis, CapRisk is computed as Equity/Total Asset. As in Safaeiet. al. (2014) and Zribi and Boujelbène (2011), because a bank with higher equity capital has a greater financial leverage, CapRisk is expected to be negatively correlated with credit risk (Loan Loss Allowance/ Total Deposit or Loan Loss Allowance/Total Loan).

2.3 Bank Market Related Variables

In this group, three variables are examined and these reflect the bank's business strategies. Specifically, two variables are used to measure how competitive a bank is in marketing its loans. The other variable is used to determine whether banks diversifying into nonbanking markets, such as investments, real estate and/or insurance markets have a significant impact on credit risk.

Loan Market Competition: Competition tends to erode profit margins and forces banks towards greater efficiency and lower default rates (Das and Ghosh, 2007).

However, the opposite may occur if banks lose sight of lending standards and become less prudent in order to increase loan sales (Honohan, 1997, Shaffer, 1998; Boot and Thakor, 2000). Banking market competition is analyzed through examining banking market structure, banking industry organization (Berger and Hannan, 1989; Berger, 1995), banking market restrictions and regulations, or other barriers to full competition (Besanko and Thakor, 1992; Boone, Van Ours, Van der Wiel, 2007; Boone, 2008). This analysis looks at the rate at which banks create loans as a measure of market competition. To estimate loan market competition, Mkt1, constructed following Gul, Irshad and Zaman (2011) as Net Loan/Total Asset, and Mkt2, constructed following the suggestion of the Federal Reserve Bank of Chicago (2011) and Dexheimer (2013), as Net Loans/Total Deposit are used. With regards to the expected correlation between the market competition variables (Mkt1, Mkt2),and the credit risk(CRisk1, Crisk2), this depends on whether the bank followed a prudent procedure or not – the relationship could be positive suggesting imprudent lending and increased credit risk, or negative indicating prudent lending and decreased credit risk. Consequently, a priory determination of the expected correlation between credit risk and Mkt1 and Mkt2 cannot be ascertained.

Diversification: Diversification of assets reduces the chances of financial distress (Boot and Schmeits, 2000, Acharya et. al., 2002)). In order to estimate the effect of diversification, the variable, Non-Interest Income/Total Income (Dvr) is used. This variable reflects the effect of non-banking activities rather than banking activities on credit risk. As is the case with some other variables studied, there is no clear cut relationship between the diversification variable (Dvr) and the credit risk variables (CRisk1 and CRisk2). RBI (2001) and Das and Ghosh (2007) observed that in bigger banks, increased diversity may lead to inadequate prudence and skills needed to manage increased diversification. Afzal and Mirza (2012) failed to support any significant relation between diversification and credit risk (nonperforming loans). Consequently, the exact correlation between Dvr and the Credit risk measures could not be determined a priori.

2.4 Macro/Location Related Variables

Eleven variables in three groups are examined in this category and these reflect the relationship between credit risk and factors that are external or more of a macroeconomic nature to the banks. The three groups of variables are per capita income, bank size and bank location.

Macroeconomic Conditions: Macroeconomic indicators, such as inflation, rate of growth GDP, and

[4] In estimating CAR, two types of capital are measured: 1) tier one capital, which can absorb losses without a bank being required to cease trading, 2) and tier two capital, which can absorb losses in the event of a winding-up and so provides a lesser degree of protection to depositors (Estrella et.al.,2000).

exchange rate tend to affect credit risk (Pesaran et. al., 2005). Improvements in macroeconomic conditions tend to increased borrowers' net worth and repayment capability, which suggests a negative correlation between credit risk and macroeconomic variables. Zribi and Boujelbène (2011), in a cross country analysis, found inflation rate and exchange rate to be negatively correlated with credit risk. Das and Ghosh (2007) found GDP to be negatively correlated with credit risk. In this study, the per capita GDP, calculated as GDP/population (INC), is used as an indicator of macroeconomic activities. In a general sense, the variable, INC, is expected to reflect prevailing macroeconomic upswings and downswings. Assuming ceteris paribus conditions, the correlation between the variable, INC, and the credit risk variables (CRisk1 and CRisk2) is expected to be negative, indicating that as per capita income increases, default rates should decrease.

Bank Size: For this analysis, banks are classified into standardized size groups (Size1 to Size4) based on their asset values (following FDIC, 2012) and then placed into the Small Bank group (Size1, Size2)or the Large Bank group (Size3, Size4) based on their sizes. The objective is to determine whether there is a difference in credit risk response between banks within each group. Dummy variables (Table 1) are used to proxy for each bank size, with Size 1 and Size 3 being the control in the Small Bank and Large Bank groups, respectively.

In terms of the expected correlation between bank size and credit risk, many researchers believe that larger banks have better diversification opportunities and are more skilled in risk management, suggesting a positive correlation. On the other hand, other studies (Das and Ghosh, 2007; FDIC, 2014) have observed that bigger banks tend to have higher problem loans, which suggests a negative correlation between bank size and credit risk.

Likewise, Chen et al. (1998) and Cebenoyan et al. (1999) observed negative relationships between bank risk and bank size. In this analysis, an a priori determination of the expected correlation between bank size and credit risk within each banks group cannot be ascertained.

Bank Location: During the 2007-2013 financial crises, the distribution of failed banks across the FDIC banking regions was fairly even, with the exception being the Atlantic region (Aubuchon and Wheelock, 2010). The other FDIC regions are as follows: 1. Kansas, 2. Chicago, 3. New York, 4. Dallas and 5. San Francisco (FDIC 2012). The states included in each region are shown below[5]. The objective here is to determine whether credit risk dependent on banking regions. To do this, dummy variables, as in Dietrick and Wanzenried (2009), are used.

The assignment of the dummy variables are as shown in Table 1, with the Atlantic region (LocAT) being the control. The dummy variables are expected to reflect regional characteristics such as banking risks, governance, politics and banking regulations. Because the impact of each region on credit risk cannot be determined a priory, there is no a priori expectation regarding the signs of the dummy variables.

3. THE DEPENDENT VARIABLES AND MODEL

3.1 Dependent Variables

In this paper, credit risk is measured in terms of loan loss provisions, which is an amount put aside as a reserve against uncollectible loans. Two measures are constructed from this variable: 1) CRisk, formulated as Loan Loss Allowance/Total Deposit (as in Samad, 2012). 2) CRisk2, modeled after Dietrich, and Wanzenried (2009) and Samad (2012) as Loan Loss Allowance/Total Loan.

3.2 The Model

The economic models used are as shown in Equations (1) and (2) in which the variables are as described in Table 1. The models for small banks are as follows:

$$CRisk1_{small} = f(ROE, ROA, IRisk, LRisk, CAPRisk1, Mkt1, Mkt2, DVR, SIZE1, SIZE2, SIZE3, SIZE4, INC, LocKC, LocCH, LocNY, LocDA, LocSF, LocAT)$$

Model 1 (1)

$$Crisk2_{small} = f(ROE, ROA, IRisk, LRisk, CAPRisk Mkt1, Mkt2, DVR, SIZE1, SIZE2, SIZE3, SIZE4, INC, LocKC, LocCH, LocNY, LocDA, LocSF. LocAT)$$

Model 2 (2)

The models were repeated for large banks. The econometric model is as shown in Equation (3)

$$Y_{ij} = \alpha_1 X_{ij} + e_{ij} \quad (3)$$

where i and j represent Bank i and Year j respectively; Y_{ij} is the dependent variable representing the credit risk measures (i.e. CRisk1, CRisk2) of Bank i in Year j; the other variables, $X_{ij,}$ are the independent variables as

[5] 1. Kansas City – Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota. 2. Chicago – Illinois, Indiana, Michigan, Ohio, Wisconsin. 3. New York- Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont , Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, Puerto Rico, U.S. Virgin Islands . 4. Atlantic - Alabama, Florida, Georgia, North Carolina, South Carolina, Virginia, West Virginia .5. Dallas - Arkansas, Kentucky, Louisiana, Mississippi, Tennessee, Colorado, New Mexico, Oklahoma, Texas. 6. San Francisco- Alaska, American Samoa, Arizona, California, Guam, Hawaii, Idaho, Montana, Nevada, Oregon, States of Micronesia, Utah, Washington, Wyoming (FDIC, 2012).

defined above and in Table 1 for Bank i in Year j; and e_{ij} represents unexplained random errors for Bank i in Year j.

4. THE DATA AND ANALYSIS

The data used in this study were obtained from the Quarterly Call Report, Federal Reserve Bank of Chicago [6] , and were annualized. The final data set consisted of 4832 non-failing commercial banks over the period, 2007-2013. For the year, 2007, 3000 banks (out of about 7,200 banks) were randomly selected and filtered for failed banks, banks that were difficult to track because of mergers, name changing, etc., and banks with inconsistencies in their records resulting from non-submission, omission, recording errors, etc. The final data set consisted of observations for 726 banks. This procedure was repeated for each of the years, 2008-2013.

The data for annual GDP per capita by state were obtained from the U.S. Dept. of Commerce, Bureau of Economic Analysis, Federal Reserve Banks of St, Louis.

The means and standard deviations for Small Banks and Large Banks variables used are as shown in Table 2.

From Table 2, important points to note regarding the data are i) at least 10.0% (or 483 observations) were taken from each of six geographic regions. ii) Small banks made up 88 % of the observations. The highest percentage of small banks was from the Kansas City region (24%).

The highest percent of large banks was from the New York region (24%) ii) of the small banks, 53% were bank of asset size $100M –$1B. Of the large banks, 80% were in the $1B-$10B asset size group. iii) The means for CRisk1 and CRisk2 for small banks were lower than those of large banks (0.1048 vs. 0.1116) and (0.0179 vs. 0.0240). Other important points to note are the means of the profitability and risk variables and the marketing variables.

Heteroscedasticity is a common problem encountered when dealing with cross-sectional data. To correct for unobservable heteroscedasticity, the generalized least square regression procedure was used to estimate coefficients. (This method also accommodates for any possible negative values in the dependent variables, which is not likely in this case). For each of the dependent variables (CRisk1and Crisk2), two regression models were estimated; one for Small Banks and the other for Large Banks, and the RSquared for each was noted as shown in Tables 3 and 4

5. RESULTS AND DISCUSSION

The results are as shown in Tables 3 and 4. Each table shows the responsiveness of variables associated with small and large banks. The asterisks ***, ** and * indicate significance at the 99 %, 95% and 90% levels, respectively. Each coefficient is interpreted as the number of units increase or decrease in the credit risk variable for a one unit increase in the associated variable (except for the dummy variables). The coefficient of determination (R-Squared) for each regression is shown below.

For CRisk1 (Table 3), the R-squared for small banks shows that the variables studied explained about 35 % of the variability of CRisk1 and for large banks, the variables explained about 75 % of the variability of CRisk1. For CRisk2 (Table4), the R-squared for small banks is about31 % and that for large banks is 76 %. In terms of significant variables, in the small-banks regression (Table 3), the profitability (ROA), interest rate risk (IRisk), capitalization risk (CapRisk), diversification (Dvr) and GDP/Capita are all significant and each has its expected sign. In Table 4, ROE and the market competition variable (Mkt1) are significant and each has the expected sign.

[6] The Quarterly Call Reports maintains quarterly data from call reports submitted by Federal Reserve banks (2013).

Table 2: Mean and standard deviation of variables

			Small Banks (<1 B Dollars)			Large Banks (≥1B Dollars)	
			Mean	**Standard Deviation**		**Mean**	**Standard Deviation**
Dependent (Credit Risk) Variables							
Credit Risk	Loan Loss Allowance/Total Deposit	CRisk1	0.1048	0.0688		0.1116	0.0277
	Loan Loss Allowance/Total Loan	CRisk2	0.0179	0.0113		0.0240	0.0134
Independent Variable							
Profitability Variables							
Return to Equity	**Net profit/Equity**	ROE	0.1086	0.1146		0.1201	0.0651
Return to Asset	New profit/Total Asset	ROA	0.0117	0.0131		0.0114	0.0069
Independent Variable							
Bank Risk Related Variables							
Interest Rate Risk	Net Interest Income/ Total Income	Irisk	0.5171	0.1804		0.5922	0.1733
Liquidity Risk	Total Deposit/Total Asset	Lrisk	0.7180	0.1233		0.6810	0.0681
Capitalization Risk	Equity/Total Asset	CapRisk	0.1161	0.0390		0.0963	0.0180
Market Related Variables							
Loan Market	Net Loan/Total Asset	Mkt1	0.6345	0.1114		0.4906	0.1358
Competition	Net Loan/Total Deposit	Mkt2	0.9082	0.2815		0.7202	0.1737
Diversification	Non-InterestIncome/Total Income	Dvr	0.0091	0.0085		0.0116	0.0039
Macroeconomic/Location Related Variables							
Bank Size	<$100Million, Small Bank Control	Size1	0.3722	0.4725			
Dummy Variables	1=$100-<1Billion, 0 =otherwise,	Size2	0.5344	0.4501			
	$1B-10Billion, LargeBank Control	Size3				0.8028	0.3314
	1 =$10Billion, 0=otherwise	Size4				0.1912	0.2423
National Income	Income/Capita	Gdp/Capita	43342.3	10148.4		40348.7	2244.7
Bank Location	1=Kansas City, 0 = otherwise	Kansas City	0.2450	0.2358		0.1363	0.2877
(Dummy Variables)	1=Chicago, 0 = otherwise	Chicago	0.2201	0.3820		0.1110	0.4469
	1=New York, 0 = otherwise	New York	0.1171	0.4911		0.2139	0.4469
Atlanta,Control	1=New York, 0 = otherwise	Atlanta	0.1277	0.3114		0.1584	0.1873
	1=Dallas, 0 = otherwise	Dallas	0.1949	0.3972		0.1753	0.3337
	1=San Francisco,0 =otherwise	San Francisco	0.0952	0.2314		0.2047	0.4140

In the large-banks regression, in Table 3,ROA, interest rate risk (IRisk), the diversification (Dvr), and the dummy variables for the Chicago and San Francisco regions are significant. And, in Table 4, LRisk, capitalization risk (CapRisk), market competition (Mkt1, Mkt2), and GDP/Capita are also significant and each has its expected sign.

With regards to the coefficients, for small banks, (Table 3, CRisk1), the coefficient for the profitability variable, ROA, is -0.05 and in Table 4, the coefficients for ROE and ROA are-0.06 and -0.99, indicating that credit risk is likely to decrease by the value of the coefficients for a 1 unit increase in the respective profitability measure (ROE, ROA). With regards to large banks, Table3, the coefficients for ROE is -0.46, and in Table 4, the coefficient is -0.15, showing that CRisk2 (Loan Loss Allowance/ Loan) is likely to decrease by the amount of the coefficient for each unit increase in ROE. These results suggest, as was the case in Louzis et al. (2010) and Manab et. al (2015), that credit risk is likely to decrease as profitability increases, possibly as a result of banks increasing their efficiencies. Overall, credit risk in large banks appears to be more responsive to changes in profitability measures compared with small banks.

With regards to the bank risk related variables, in Table 3, for small banks, the coefficient for interest rate risk (IRisk) was0.05. That for large banks was0.09 indicating that credit risk is likely to increase by these amounts for a one unit increase in IRisk. In other words, as Net Interest Income/ Total Income increases by one unit, the Loan Loss Allowance/Total Deposit increases by the respective coefficient. In Table 4, the coefficients were similar, but less significant in small banks. What these correlations imply is that as interest rate risk increases, credit risk is likely to increases as well. Interest rate risk appears to have a large impact in large banks compared with small banks.

Table 3: Coefficients for credit risk (Crisk1)

		Small			Large		
		Coefficient	**t Statistics**		**Coefficient**	**t Statistics**	
Intercept	Int	0.1904	4.1413	***	0.2623	3.8250	***
Profitability Variables							
Return to Equity	ROE	-0.0945	-1.1735		-0.4590	-2.3550	***
Return to Asset	ROA	-0.0449	-5.0194	***	-0.9652	-0.5802	
Bank Risk Related Variables							
Interest Rate Risk	IRisk	0.0480	2.2229	**	0.0964	2.6134	***
Liquidity Risk	LRisk	0.0584	1.3203		0.0541	1.0088	
Capitalization Risk	CAPRisk	-0.6949	-6.2861	***	-0.3100	-1.6908	*
Market Related Variables							
Market	Mkt1	-0.0469	-1.0180		-0.0919	-1.6748	
	Mkt2	-0.0249	-0.9268		-0.0482	-1.8303	*
Diversification	Dvr	-1.0027	-2.2040	**	-1.9300	-4.1729	***
Macroeconomic/Location Related Variables							
National Income	INC	0.0000	-6.6114	***	0.0000	-1.7168	*
Bank Location	Kansas City	0.0145	0.7382		-0.0020	-0.3100	
	Chicago	0.0202	1.2588		0.0106	2.2080	**
Atlanta (Control)	NewYork	-0.0024	-0.1625		0.0068	1.3761	
	Dallas	-0.0148	-0.8576		-0.0001	-0.0079	
	San Francisco	-0.0071	-0.4482		0.0141	2.4336	***
BankSize Size1 (Control-Small Bank)	Size2	0.0107	1.4617				
Size3 (Control-LargeBank)	Size4				-0.0035	-0.9358	
	Rsquared	0.3520			0.7474		

The Liquidity risk variable (LRisk) is not significant, for either small or large bank in Table 3, but is significant and positive for large banks (0.03) in Table 4, suggesting, as observed by Safari et. al. (2014) that increases in liquidity risk is correlated with an increase in credit risk. While causation was not implied, Ötker-Robe and Podpiera (2010), suggest that this relationship, with liquidity risk as an explanatory variable for credit risk, might be due to the link between fund used to maintaining adequate liquidity and creating new loans, especially under conditions of high market demands for loans and high cost of obtaining funds. Capitalization risk was significant for both large and small banks, with coefficients of -0.69 and -0.31respectively in Table 3, but was only significant, with a coefficient of -0.16,for large

banks in Table 4. These results are supported by Safari et. al. (2014) and Zribi and Boujelbène (2011), and suggest, in general, that credit risk is likely to decrease as Equity/Total Asset ratio increases. Unlike the case with interest rate risk and liquidity risk, credit risk appears to be more responsive to changes in the capitalization risk variables in small banks compared with large banks.

Regarding the market related variables, neither Mkt1 (Net Loan/Total Asset) nor Mkt2(Net Loan/Total Deposit) is significant for either large or small banks in Table 3, but in Table 4, Mkt1 is significant for both small and large banks, with coefficients of -0.03 and -0.12. Mkt2 is significant for large banks with a coefficient of -0.02. These results indicate that credit risks in large and small banks are likely to decrease by the value of the coefficients indicated for each unit increase in the market competitions variables. In this sense, these results agree with Das and Ghosh, (2007) and suggests that banks become more efficient with increased loan market competition. Credit risk appears to be more responsive to the market variables in small banks compared with large banks.

The diversification variable, Dvr, measured as Non-Interest Income/Total Income, is significant for both small banks and large banks in Table 3, with coefficients of -1.00 and -4.93, but is significant for only large banks in Table 4, with a coefficient of -1.49, indicating that credit risk is likely to decrease by the amount indicated by the coefficients for a one unit increase in Dvr. These results contradicts RBI (2001) and Das and Ghosh (2007) and suggest that credits risk, in this case, is likely to decrease as banks become more diversified. Between large and small banks, changes in the diversification variable appear to have a greater impact on credit risk in large banks compared with small banks.

Within the macroeconomic/locational group of variables, GDP/Capita is significant for both small banks and large banks in both Table 3 and Table 4, with coefficients bearing negative signs, indicating, as in Zribi and Boujelbène (2011) and Das and Ghosh (2007), that with an increase in the GDP/Capita, and, in general, an improvement in macroeconomic conditions, credit risk is likely to decrease.

With regards to location variables, in both Table 3 and Table 4, in the small bank group, there is no significant difference between any region compared with the control group. However, for large banks, the Chicago and San Francisco regions are significant with coefficients of 0.01 and 0.01, indicating that credit risk was greater in these regions compared with the control (The Atlantic Region). The others were not significantly different from the control. With regards to the bank size variables within the small banks group and the large banks group, no group was significantly different from the control, indicating that there was no significant difference in credit risk between banks in their respective groups.

Table 4: Coefficients for credit risk (Crisk2)

		Small			Large		
		Coefficient	t Statistics.		Coefficient	t Statistics	
Intercept	Int	0.0348	4.5084	***	0.0425	2.3779	**
Profitability Variables							
Return to Equity	ROE	-0.0610	-4.5142	***	-0.1466	2.8884	***
Return to Asset	ROA	-0.0998	8.6588	***	-0.1008	0.0248	
Bank Risk Related Variables							
Interest Rate Risk	IRisk	0.0061	1.6816	*	0.0226	2.3530	**
Liquidity Risk	LRisk	0.0107	1.4487		0.0353	2.5278	**
Capitalization Risk	CAPrisk	-0.0166	-1.8971	**	-0.1577	-3.3022	***
Market Related Variables							
Market	Mkt1	-0.0251	-3.2540	***	-0.1179	-8.2463	***
	Mkt2	-0.0060	-1.3260		-0.0298	-4.3535	***
Diversification	Dvr	-0.0896	-1.1739		-1.4952	-4.8597	***
Macroeconomic/Location Related Variables							
National Income	INC	0.0000	-5.4932	***	0.0000	-1.9931	**
Bank Location	Kansas City	-0.0007	-0.2116		0.0113	0.4647	
	Chicago	-0.0004	-0.1348		0.0350	1.9678	***
Atlanta	NewYork	-0.0002	-0.0794		0.0251	1.3736	
(Control)	Dallas	-0.0030	-1.0471		-0.0003	-0.0086	
	San Francisco	-0.0004	-0.1604		0.0675	3.1287	***
BankSize Size1 (Control-Small Bank)	Size2	0.0002	0.1819				

Size3(Control-LargeBank)	Size4				-0.0074	-0.5311	
	Rsquared	0.3150			0.7642		

6. CONCLUSION

Credit risk is the dominant source of bank risk in the U.S. Understanding how credit risk responds to bank specific, market related and macroeconomic/location related variables in small and large banks in the U.S can help formulate strategies to improve the relationships between credit risk and these variables. Using the generalized least square, the impacts of these variables on credit risk were examined. Results indicate that in both large and small banks:

a) Credit risk had a negative correlation with the profitability measures (ROA, ROE), suggesting that as banks improve their performance, credit risk decreases.
b) Credit risk had a positive correlation with Net Interest Income/ Total Income, which indicates a positive relationship between credit risk and interest rate risk.
c) Credit risk had a positive correlation with the liquidity risk variable (Total Deposit/Total Asset).
d) Credit risk had a negative correlation with the capitalization risk variable (Equity/Total Asset).
e) Credit risk had a negative correlation with the Market competition variables (Mkt1) and the diversification variable (Dvr).
f) Credit risk had a negative correlation with the measure of macroeconomic condition, GDP/Capita.

The correlation coefficient for each variable, except for capitalization risk, appeared to be stronger in favor of large banks than in small banks suggesting that, at the industry level, strategies aimed at improving profitability, banks risk situations and market competition could have a stronger impact in large banks compared with small banks. Strategies to improve capitalization risk in small banks are likely to have a greater impact on credit risk in small banks than in large banks. Credit risk appeared to be greater in the Chicago and San Francisco regions compared with other regions.

The coefficient of determination (R-squared) was less in small banks compared with large banks (about 35% vs 75 %), suggesting that additional factors need to be considered in order to more fully explain credit risk in small banks.

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