

## Predicting US Bank Failures during 2009

James Murtagh\*

### ABSTRACT

The purpose of this study is to compare the financial characteristics of failed to surviving banks. We use one-tailed t-tests in examining bank financial ratios to determine if there are significant differences between banks that survived The Great Recession versus those that failed during 2009. The results indicate significant differences between surviving and failing banks, implying that it may be possible to detect banks likely to fail before they collapse. This study evaluates the influence of these variables using regression, logit and probit analysts. Preliminary results suggest early warning measures that would allow regulators to intervene sooner to avert bank failures.

### INTRODUCTION

The Great Recession plunged the global financial system into disarray. Small banks, which lacked the capital to withstand severe shocks, were harmed, and some of the oldest financial firms disappeared into bankruptcy or acquisition. In the United States, the Federal Reserve took unprecedented steps to contain the damage and stabilize the financial system. Even with these extraordinary measures, 423 commercial banks failed from 2008 through 2012. The greatest number of failures occurred during 2009, when 126 commercial banks failed.

The Federal Deposit Insurance Corporation also acted, closing many failing banks, and providing insurance payouts to the banks' depositors. Given the size and cost of these actions, any metrics that can detect banks headed for insolvency before it happens would be valuable. This preliminary study evaluates several performance measures performing one-tailed t-tests on a set of 116 banks that failed during 2009, and a set of peer surviving banks of similar asset size and geographic location. Further, this paper aims to understand how the level of these characteristics two and four quarters prior to failure may have contributed to the eventual bank failure.

### LITERATURE REVIEW

In examining bank failures during The Great Recession, many factors have been suggested as causes, or at least as indicators, that a depository institution may be headed for trouble. Among the determinants, ratio analysis, as noted below, has been shown to be a promising indicator of troubled banks. The research in this field is currently somewhat limited, however, insofar as we are only just coming out of the financial crisis, and so studies of it are ongoing.

---

\* Department of Finance, Siena College, 515 Old Loudon Road, Loudonville NY 12211.

Cole and White (2012) found that one of the most significant influences on a bank's failure is the asset types the bank held. Banks with higher concentrations in real estate construction and development loans, multi-family mortgages, and commercial mortgages consistently had a higher likelihood of failure in the future as compared to banks with larger holdings of residential, single-family mortgage loans or consumer loans. Cole and White also found that failed banks often had lower capital ratios, particularly referring to the ratio of equity to assets. Lower liquidity, measured by cash and due to assets, investment securities to assets, and brokered deposits to assets, also contributed to bank failures. Lastly, Cole and White found that lower earnings, as measured by return on assets, indicated banks that were more likely to have failed. Samad (2011) identified four specific capital adequacy ratios that were significantly different between banks that survived the financial crisis and those that failed, with the failed banks having lower ratios in all four cases.

In a 2011 study, the Office of the Inspector General (OIG) (2011) found that management can be complicit in an institution's failure, particularly due to strategic decisions made to grow the firm's asset base, the bank's compensation structure, or funding choices. Some management teams' compensation structures helped encourage the offering of additional loans and loosening of underwriting standards, as some firms tied compensation to increases in the bank's loan portfolio. When compensation is tied strictly to the size of the loan portfolio, rather than the quality of the loans therein, management works its way down the credit quality ladder, loaning to less creditworthy parties, and thereby increasing the bank's risk level. The OIG study also found that additional efforts to increase a bank's business, such as expanding into new activities or markets or performing mergers and acquisitions, sometimes conducted without due diligence, also led to bank failures. Similarly to Cole and White, the OIG's study found that asset type is a significant influence on the likelihood of bank failure. Specifically, construction, land, and land development, or CLD, loans and commercial real estate, or CRE loans, were contributors to bank failures. The OIG study, however, specifically found that the cause of bank failures was not so much the exposure to commercial mortgages, but the real estate construction and development loans. Banks that failed also often had higher ratios of non-performing assets (NPAs), and hence lower asset quality overall.

The OIG study also had similar findings to Samad, where a bank's failure to maintain sufficient capital to protect against potential losses was found to be a critical determinant of banks that survived versus those that failed. The level of capital adequacy is particularly important insofar as many of those that failed, since they were making riskier CRE and CLD loans, as noted above, should have had even more capital set aside for potential losses than a bank might "normally" have.

DeYoung and Torna (2013) evaluate whether income from nontraditional banking activities contributed to bank failures during the crisis. They apply a multi-period logit model and find that the probability of distressed bank failure declined with fee-based activities like securities brokerage and insurance sales. In

contrast, they find that venture capital activities, investment banking and asset securitization increased the probability of failure.

## **METHODOLOGY**

The data in this study consists of 116 commercial banks that failed during 2009 and a paired set of surviving banks. The complete list of banks and financial statement values is available from the author upon request. The survivors were based on assets and geographic location. The data was obtained from the Federal Financial Institutions Examination Council website. Reported data is analyzed 2 and 4 quarters prior to the bank failure date. Financial ratios, loan portfolio ratios and capital adequacy measures were calculated for each of the 332 banks in the sample. We examined commonly used performance measures including: the loan loss allowance as a percentage of Total Assets, Capital Adequacy, the rate spread, several measures of the real estate portfolio as a percent of total assets and Tier 1 capital. A one-tailed t-test was performed on these variables, with a general null hypothesis that for each variable, there is no significant difference between the mean ratios for surviving versus failing banks. If the null hypothesis is rejected, the values for these failed bank performance ratios are expected to be consistently less than those of the survivor banks.

Consistent with Cole and White, we evaluate the portion of total loans and leases represented by real estate loans, construction and development loans, commercial mortgages, and multifamily mortgages. The null-hypothesis for each variable is that there is no significant difference between the mean ratios for surviving versus failing banks. If the null hypothesis fails, we expect that the failed banks will have a greater exposure to these types of loans than the survivor banks.

As mentioned above, Samad analyzed capital adequacy as a potential cause of bank failures within the U.S. He evaluated four ratios, including the total equity capital as a percent of total assets (EQCTA), Tier One capital as a percentage of average total assets minus intangible assets (T1RBCATA), Tier One capital as a percentage of risk-weighted assets as defined by the appropriate federal regulator for prompt corrective measure (T1RWB), and total risk-based capital as a percentage of risk-weighted assets as defined by the appropriate federal regulator for prompt corrective measure (TRBCRWA). We examined two of these ratios in this study, with a general null-hypothesis that for each variable, there is no significant difference between the mean ratios for surviving versus failing banks. If the null hypothesis fails, we expected that the failing banks will have lower capital ratios.

## **BANK PERFORMANCE RATIOS**

The descriptive statistics, differences between means, and significance are shown in the table below. Panel A presents the results for two quarters before failure. The results for four quarters before failure are shown in Panel B. In both periods, failing banks exhibit larger loan loss allowances per dollar of Total

Assets. The capital adequacy and spread measures are both lower for failing banks. In addition, Model 2 shows that the real estate construction and land development loans as a percent of Total Assets (RECONTA) and multifamily (5 or more) residential property loans as a percent of Total Assets (REMULTA) description) are larger for failing banks. Loans on 1-4 family residential property (RER14TA) and Tier 1 capital are both lower for the failing set. Both these variables are divided by the Total Assets of the bank.

**Table 1: Descriptive Statistics, Differences Between Means, and Significance**

**Panel A: Two Quarters before Failure (Q=2).**

Model 1	N	Failed		Survived		Difference	signif
		Mean	StdDev	Mean	StdDev		
LLAllowTA	114	0.0240	0.0169	0.0117	0.0084	0.0123	***
CapAdeqHN	114	0.0641	0.0241	0.1044	0.0296	-0.0403	***
Spread	114	0.0178	0.0121	0.0213	0.0111	-0.0035	**
<b>Model 2</b>							
RECONTA	114	0.2375	0.1392	0.1154	0.0898	0.1221	***
REMULTA	114	0.0367	0.0587	0.0203	0.0237	0.0164	***
RER14TA	114	0.1233	0.1055	0.1547	0.1290	-0.0314	**
T1CapTA	114	0.0623	0.0212	0.0983	0.0288	-0.0359	***

**Panel B: Four Quarters before Failure (Q=4).**

<b>Model 1</b>							
LLAllowTA	95	0.0182	0.0227	0.0103	0.0049	0.0079	***
CapAdeqHN	95	0.0854	0.0294	0.1064	0.0399	-0.0210	***
Spread	95	0.0168	0.0082	0.0195	0.0113	-0.0028	*
<b>Model 2</b>							
RECONTA	95	0.2582	0.1515	0.1166	0.0999	0.1416	***
REMULTA	95	0.0389	0.0669	0.0180	0.0225	0.0209	***
RER14TA	95	0.1184	0.1021	0.1561	0.1357	-0.0377	**
T1CapTA	95	0.0811	0.0206	0.1017	0.0396	-0.0206	***

\*\*\* significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level

## BANK FAILURE MODELS

The results of bank failures models two and four quarters prior to failure are shown in Table 2, Panel A. Panel B: Four Quarters before Failure (Q=4) is available from the author upon request. The results of two different models are presented. Model 1 evaluates the influence of the Allowance for Loan Losses as a percent of total assets (LLAllowTA), capital adequacy and the rate spread between interest income and interest expenses. In this model, regression results indicate that bank failure is positively related to the Loan Loss Allowance and negatively related to capital adequacy. The Spread variable is not significant two quarters before failure, but is negative and significant four quarters before failure. Logit and Probit models show that the loan loss allowance positively affects the probability of failure while the capital adequacy and spread have a negative effect. The sign and magnitude of the marginal effects indicate that increasing the loan loss allowance two quarters before failure increases the probability of failure by 14.6%. The marginal

effect is even more apparent four quarters before failure. At that time, an increase in the loan loss allowance increased the probability of failure by 39%. Two quarters before failure, increasing capital adequacy and the spread decrease the probability of failure by 9.7% and 4.7% respectively. Four quarters from failure, the magnitude of the influence reverses. Increased capital adequacy reduced the probability of failure by 5.4% and increased spread dropped the chance of failure by 10%.

Model 2 analyzes the influence of Tier 1 capital as a percent of total assets and evaluates specific real estate assets as a percent of total assets. The regression model finds that the coefficients construction and land development loans and multifamily (5+) real estate loans are positive, 1-4 family residential loans and Tier 1 capital are negative. The coefficient of the 1-4 family residential loans is not significant four quarters before failure. Logit and Probit models find similar results. The marginal effects indicate that increases in Tier 1 capital reduce the probability of failure by 8-10% while increase in the concentration of real estate construction loans and multifamily real estate loans consistently increase the probability of failure by less than 2%.

**Table 2: Failure Models**

**Panel A: Two Quarters before Failure (Q=2).**

<b>A1: Regression Models</b>		<b>Model 1</b>	<b>signif</b>	<b>Model 2</b>	<b>signif</b>	
F value		62.25	***	51.37	***	
Adj. R <sup>2</sup>		0.4473		0.4702		
	Intercept	1.020	***	0.957	***	
	LLAllowTA	10.572	***			
	CapAdeqHN	-7.837	***			
	Spread	-2.465				
				RECONTA	1.221	***
				REMULTA	1.392	**
				RER14TA	-0.367	*
				T1CAPTA	-8.240	***
<b>A2: Logistic Procedure</b>		<b>Model 1</b>	<b>signif</b>	<b>Model 2</b>	<b>signif</b>	
Intercept and Covariates						
	AIC	151.233		143.374		
	SIC	164.951		160.521		
Testing Global Null (Beta = 0)			***		***	
	Intercept	6.933	***	7.174	***	
	LLAllowTA	146.200	***			
	CapAdeqHN	-97.495	***			
	Spread	-46.867	**			
				RECONTA	11.583	***
				REMULTA	18.146	***
				RER14TA	-3.863	
				T1CAPTA	-115.400	***
	<b>Correct</b>	<b>Incorrect</b>		<b>Correct</b>	<b>Incorrect</b>	
Fail	94	12		96	12	
Survive	102	20		102	18	

**Table 2: Failure Models****Panel A: Two Quarters before Failure (Q=2).**

% correct	86.0	86.8
Sensitivity	82.5	84.2
Specificity	89.5	89.5
False Positive	11.3	11.1
False Negative	16.4	15.0

**A3: QLIM Procedure**

Model Fit	Model 1	signif	Model 2	signif	
AIC	151.233		143.370		
Schwarz	164.951		160.520		
Intercept	6.933	***	7.174	***	
LLAllowTA	146.247	***			
CapAdeqHN	-97.496	***			
Spread	-46.867	**			
			RECONTA	11.583	***
			REMULTA	18.146	***
			RER14TA	-3.863	
			T1CAPTA	-115.404	***
Marginal Effects					
	LLAllowTA	14.607			
	CapAdeqHN	-9.738			
	Spread	-4.681			
			RECONTA	1.057	
			REMULTA	1.656	
			RER14TA	-0.353	
			T1CAPTA	-10.535	

\*\*\* significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level

Panel B: Four Quarters before Failure (Q=4) is available from the author upon request.

**CONCLUSIONS**

Our analyses show statistically-significant differences between the performance ratios, loan concentration measures, and capital adequacy of banks that failed during 2009 compared to peers that survived. With sample financial data up to 4 quarters prior to failure, there seems to be a period of time where regulators could have noted the soon-to-be-failed banks entering the “danger zone,” and stepped in to prevent their collapse. One possible use of this study is to identify possible warning signs that a bank is in trouble. These warning signals may be used to establish more prompt corrective action to possibly save banks from failing. The encouraging statistical results in this preliminary study provide support for undertaking a long-term term study of the nearly 500 banks that failed during The Great Recession.

**REFERENCES**

Cole, Rebel A. and Lawrence J. White. “Déjà Vu All Over Again: The Causes of U.S. Commercial Bank Failures *This Time Around*.” *Journal of Financial Services Research* 42 (2012).

- DeYoung, Robert and Gokhan Torna. "Nontraditional banking activities and bank failures during the banking crisis." *Journal of Financial Intermediation* 22 (2013).
- Kyle, Albert S. "A commentary on 'Déjà Vu All Over Again: The Causes of U.S. Commercial Bank Failures This Time Around.'" *Journal of Financial Services Research* 42 (2012).
- Board of Governors of the Federal Reserve System: Office of Inspector General. *Summary Analysis of Failed Bank Reviews*. Washington, DC: 2011.
- Samad, Abdus. "Is Capital Inadequacy a Factor for Bank Failure? Evidence from US Banking." *Journal of Accounting and Finance* 11, no. 4 (2011): 105-110.
- Wheelock, David and Paul Wilson. "Why do banks disappear? The determinants of US Bank failures and acquisitions." *The Review of Economics and Statistics* 82, no. 1 (2000): 127-138.