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U.S. SMALL BANK FAILURES AND THE FINANCIAL CRISIS OF 2007–2009

Abstract

This study utilizes logistic regression to identify annual financial statement and performance ratio factors that influenced the failure rate of U.S. small banks before and after the Financial Crisis identified during December 2007 through June, 2009. The study includes rates of small bank failure before and Financial Crisis spanning the years 2001 through 2014. The aim of the paper is to describe in large increase in U.S. small bank failure after the Financial Crisis. The Financial Crisis created drastic sustained changes of the financial system that were designed for large financial institutions. These changes may have created undue hardship for small banks and elevated the rate of small bank failures in the post-Financial Crisis period. Post-Financial Crisis bank failures had lower capital ratios and increased loan portfolio risk relative to the prior period. The combined effect of expansionist monetary policy, increased regulatory costs, and possession of illiquid real estate assets contributed to the higher rate of failure. The identification of factors that contribute to the increase in small bank failures after the Financial Crisis should assist bank managers, policy analysts, and scholars in developing alternative solutions for the future.

Keywords

bank regulation, liquidity, monetary policy, net interest margin, real estate

JEL Classification

G20, G21, G33

INTRODUCTION

Small banks in the United States are defined as commercial banks with total assets under USD 1.2 billion (FDIC, 2019). Their failure is defined as firm insolvency that required the appointment of the FDIC Receivership to dispose of assets and recover depositors' claims before the closure or merger with another financial institution (FDIC, 2019). The Financial Crisis of 2007–2009 had a devastating effect on the small banking industry as the Federal Deposit Insurance Corporation (FDIC) was forced to close more small commercial banks than any other period since the Great Depression. The speed and intensity of the crisis exposed the systemic risk of a globally integrated financial system for small bank operations. The crisis simultaneously created a reinforcing effect that devalued the assets of small bank balance sheets that was not able to be offset by new profitable loan growth. This resulted in a higher rate of insolvency for small banks that were unable to overcome their depressed asset values relative to their liabilities (Mankiw, 1996).

Prior studies in the literature seem to mainly focus on the performance and efficiency of larger banks, leaving much of the subject regarding the failures of small banks relatively unstudied. Bank regulations subject its financial institutions to many requirements, restrictions, and guidelines. Any major changes in regulation will tend to alter the small banks' operating paradigm potentially and affect its

operations, profitability, and hence even its solvency. A study on the effectiveness of bank regulations on small bank failures could shed light on the impact of bank regulations.

This study is focused on annual financial statement and performance ratio factors that contributed to the changes in small bank failure rate before and after the Financial Crisis of December, 2008 through June, 2009. There were 560 cases of small bank failures from 2001–2014. The cases were divided into two seven-year periods to demonstrate the different operating environments created during the Financial Crisis. During the pre-crisis period, the banking industry witnessed 28 small bank failures for the years 2001 through the start of the Financial Crisis that began in December of 2007. This is a stark contrast to the post-crisis period beginning in 2008 and continuing through 2014 during which the industry experienced 532 small bank failures. The contextual change not identified in the statistics is the radical transformation of monetary and fiscal policies in response to the Financial Crisis. Since the regulatory changes implemented to contend with the financial crisis only affected banks during the second half of the study period, a contrast between the two halves of the overall study period arguably could help understand the role played by those bank regulations in reducing risk, increasing efficiency, and enhancing performance.

This study focuses on annual financial statement categories that will be proxies for the three small bank comparative disadvantages vis-à-vis their larger competitors. This method differs from many previous studies that focus on analyzing the small bank failure problem from an aggregate perspective rather than using bank-specific data. The study is important due to the increased systemic risk derived from the globally integrated financial system that disproportionately increases the risk of failure among small banks.

1. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Previous literature has explained the causes of small bank failure as an extension of general bank failure theory due to their business model's reliance on traditional banking. Two main causes of bank failure include insolvency and illiquidity. Both increase the probability of default, but the interaction between both of these factors significantly increases the risk of failure (Imbierowicz & Rauch, 2014).

The primary risk of bank insolvency is non-performing loans, as borrowers are negatively affected by unfavorable changes to the economic cycle. Macroeconomic changes, including changes in the pattern of real GDP growth, share prices, and interest rates, are known to influence the frequency of failure (Beck et al., 2013). These factors are often historically linked to banking crises that show higher rates of bank failure due to the volatility of non-payment, which leaves banks without sufficient income to repay their debts (Ari et al., 2019).

Liquidity is also a major concern as banks are vulnerable to bank runs (Diamond & Dybvig, 2000). Bank runs occur due to the perceived threat of limited access to capital because of endogenous bank mismanagement or exogenous factors related to significant changes in economic conditions. The presence of depositor cash reduces the moral hazard and incentivizes efficient risk management by allowing bank management to cover depositor withdrawals without the high liquidation cost of investment or loan portfolios during economic downturns (Calomiris et al., 2015).

Historically, governments have attempted to address these issues through cumbersome regulations designed to stabilize the banking system. The most well-known is capital requirements. These are risk-weighted ratios designed to promote banking stability through the regulation of large financial conglomerates that have increased systemic risk. Their use is a byproduct of Basel I, which attempted to promote global financial stability by requiring international banking operations to sufficient maintain minimum capital to safeguard short-term liquidity and long-term solvency (Hellmann et al., 2000).

Their primary use is in objectively evaluating the level of bank capitalization through the Capital Adequacy Ratio (CAR).

However, capital requirements are expensive for banks because they create firm inefficiency by restricting the amount of the bank capital that can be used in funding new loan growth to improve its franchise value and positively affect cash flow (Hellmann et al., 2000). They also raise the cost of capital, resulting in banks paying more to service their debts and lowering the return to their equity holders (Thankor, 1996). Their effectiveness as a bank safety measure is also questionable as risk-weighted ratios have not been proven to predict the risk of bank failure more effectively than simple ratios (Estrella et al., 2000). This is especially evident in Tier 2 capital, which departs from accounting and economic principles by allowing loan loss reserves to be added back as capital after their loss has already been accrued (Ng et al., 2014).

The limitations of capital requirements result from the equal application of standards that cover the wide variety of financial institutional assets that exist within the banking system. Smaller financial intermediaries do not have the benefits of economies of scale and pledge a disproportionate amount of their assets to cover regulatory and compliance requirements. As a result, the compliance burden for small banks is a major source of relative disparity when compared to larger commercial banks that benefit from economies of scale.

During their initial formation, small commercial banks have the choice between operating under either a national charter or a state charter. Most startup or *de novo* small banks choose to form under a state charter because they are incentivized to do this by a streamlined application process, lower supervisory fees, and reduced regulatory examination standards (Agarwal et al., 2014; Blair & Kushmeider, 2006). State and federal banking regulations are very similar, but not the same. In fact, the standards of both regulators are so close that they utilize each other's examination results as a proxy for compliance during alternating annual examinations. However, state examiners are not as strict

about enforcing the mutually-agreed-upon standards as federal regulators. Naturally, leaving the banks at a higher risk of insolvency on alternating years increases their risk of failure (Agarwal et al., 2014).

State-chartered banks are still subject to some federal regulation. The FDIC's primary role is to determine the eligibility of banks and the receipt of their Federal Deposit Insurance (FDI) program (Diamond & Dybvig, 2000). The FDI insures most, but not all, of the nations' deposits in order to promote confidence in the banking system and act as deterrent against bank runs (Demirguc-Kunt & Detragiache, 2002). It also assumes an auxiliary role as the primary federal regulator in enforcing the compliance of small, state-chartered banks. Like all federal banking agencies, the FDIC conducts individual examinations in accordance with the Uniform Financial Institutions Ratings system (UFIRS). These standards ensure federal bank examinations are applied to banks objectively, regardless of the federal agency supervising the examination. Most of the variables in the examinations are within the control of bank management and do deliver an objective measure of bank performance (Hays et al., 2009).

Regulatory compliance costs are high because they create an inefficiency, which limits the ability of small banks to improve their franchise value and positively affect their operating income (Van den Heuvel, 2008). Their smaller size means that they utilize a higher percentage of non-interest income expense as compared to their competition, resulting from hiring new personnel and consultants, and data processing to comply with the dual regulatory requirements (Hogan & Burns, 2019). These costs were significantly increased after the Financial Crisis as the Basel Committee on Banking Supervision (BCBS) developed Basel III and the United States Congress enacted the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (Dodd-Frank) in an effort to stabilize the banking system. However, the increased stability of the system resulted in increased costs that have not impacted all the banking participants proportionately (Lindblom & Willeson, 2013).

Following the implementation of the increased capital requirements, the average compliance costs of non-interest expense at small banks increased to 10%, relative to 5% at financial institutions with assets over USD 1 billion (Dahl et al., 2018). The increases in costs were the result of reactionary regulatory design that focused on creating banking stability by enacting measures that targeted the largest financial institutions, without regard for the smaller entities (Huff, 2013).

The discrepancy in scale for small banks results from a limited total amount of assets available to fund new loan growth. This is due to a smaller total amount of deposits from its customers in one geographic area. This limitation means they are unable to compete for extremely large-scale projects with higher net interest margins and must target second-tier customers as a primary source of revenue (Davila & Walther, 2018). This reliance on one geographic area limits possible branch expansion and leaves it susceptible to both microeconomic and macroeconomic shocks that can destabilize revenue streams (Wheelock & Wilson, 2000). These factors force small banks depend on a small pool of strong, long-term bank-depositor relationships as a competitive advantage. This strategy lessens the probability the depositor will transfer assets to another bank in a fiercely competitive industry (Iyer & Puri, 2012).

Since 2002 (until 2022), the Federal Reserve had extensively pursued a policy of consistent lower interest rates to increase market competition. The result has been a negative impact on net interest margins throughout the banking industry (Claessens et al., 2018). Significant changes in bank competition have only a limited impact on the largest institutions due to their access to commercial paper, corporate bond, and equity markets (Cetorelli & Strahan, 2006). Larger financial institutions have adapted to the low-interest-rate environment by increasing non-interest income to offset reduced net interest margins, resulting in an increased market share of potential customers in national and local markets (Abedifar et al., 2018). However, vigorous competition in banking markets has forced a reduction in size on intermediate and small banks

due to reduced potential net interest margins for generating earnings, sustaining bank operations, increasing franchise values, or funding new loan growth (Cetorelli & Strahan, 2006).

The commercial profitability of small banks is driven by the gap between the cost of sourcing funds and the interest rate charged to their borrowers. The interest rate is driven in large part by the federal funds rate along with open market operations, which are managed by the Federal Reserve based on their decision to expand or contract the money supply to their annual targets (Adrian & Shin, 2010). Any change in the federal funds rate will directly impact the credit risk-taking of banks by forcing an adjustment to short-term interest rates that quickly snowball and affect interest rate on term loans, security assets, yield spreads, and risk measures for all types of credit around the world (Miranda-Agrippino & Rey, 2015). This is significant for small commercial banks because they are price-takers that must accept the current market-driven interest rate and adjust their spread to create new loan growth to sustain its operations, regardless of the economic environment (Boyd & De Nicolo, 2005).

The literature explores many factors that impact potential small bank failures. However, many studies have adopted linear regression methods to verify the impact of key variables on the failure of commercial banks. The situational contexts of small financial institutions are often ignored. The known factors of general bank failure theory also apply to small bank failure, but the effects of minor changes in the bank's operating environment are magnified by their lack of size and have the potential to increase the chance of bank failure. The magnification and confluence of factors that contribute to small bank failure highlight the fact that linear regression is not the optimal choice for determining the causation of small bank failure when comparing two economic periods.

This study utilizes Logit regression to model the causality of internal and external factors that may influence potential small bank failure. Internal analysis is focused on the bank's income generation, efficiency, and cost. External

analysis is focused on macroeconomic variables that impact their operations. Specifically, the study focuses on the following hypotheses:

- H_1 : Failed small banks in the post-Crisis period had lower profitability, compared to the pre-Crisis period.
- H_2 : Failed small banks in the post-Crisis period had a higher rate of loan default than in the previous period.
- H_3 : Failed small banks in the post-Crisis period demonstrate a higher compliance cost than those in the previous period.

The objective of the study is to identify factors that contribute to the rise in bank failures since the turn of the century. The anticipated findings state that the failed small banks in the post-Crisis period were less profitable and more costly to operate relative to their counterparts in the pre-Crisis period.

2. DATA AND THE METHODOLOGY

The study explored U.S. small bank annual financial statements and performance ratios to identify factors that impacted U.S. small bank failure rates before and after the Financial Crisis. The data consist of 560 bank failure observations collected from the FDIC's website. All data gathered from the sample required the individual extraction of annual financial statements by firm from the FDIC Institutional Directory. Cases that exceeded the FDIC's small bank definition of having 1.2 billion dollars in total assets were excluded. Distressed mergers and cases where most of their financials in the year of their failure were not published were also excluded. The final dataset has 22 observations in the Pre-Crisis Group and 449 in the Post-Crisis Group.

The methodology of the study focused on comparing failed small banks in the two consecutive periods that have been divided into pre-Crisis and post-Crisis groups. The boundaries of the groups were selected based on the data limitations of small bank failure frequency that were

characterized by paradigm shifts in regulatory and macroeconomic policy. The best method to analyze the data is through the adoption of the Logit model to compare the annual time series data of 22 observations in the Pre-Crisis Group with the 449 observations in the Post-Crisis Group.

The study includes variables from the bank failure literature that focus on four categories that target banking operations, including: efficiency, profits, diversification, costs, and risk (Cebula et al., 2016; Hays et al., 2009). Specifically, the efficiency ratio was chosen to measure a firm's ability to use assets to generate income. Return on equity (ROE), net interest margin (NIM), real estate, and non-interest income represented profit and diversification. The capital ratio, provision for loan lease and losses, and the cost of funding assets-earning assets measured risk and cost. Variables offered in a non-ratio format were all scaled in accordance with each firm's total assets to permit interbank comparability and to account for outliers. Macroeconomic conditions were controlled by including the annual growth rate of the money supply (M2) and the GDP growth rate (GDP) that were collected from the Federal Reserve Bank of St. Louis website.

The model is as follows:

$$\begin{aligned} \text{Prob}(\text{banks failed in the post crisis era}) = & \\ = \alpha + \beta_1 \cdot \text{NIM} + \beta_2 \cdot \text{Non_interest_income} + & \\ \beta_3 \cdot \text{Real_estate} + \beta_4 \cdot \text{Efficiency_ratio} + & \quad (1) \\ + \beta_5 \cdot \text{ROE} + \beta_6 \cdot \text{Loan_loss_Provision} + & \\ \beta_7 \cdot \text{Cost_assets} + \beta_8 \cdot \text{Capital_ratio} + & \\ + \beta_9 \cdot \text{Capital_ratio} \cdot \text{Total_assets} + & \\ + \beta_{10} \cdot \text{M2_growth} + \beta_{11} \cdot \text{GDP_growth}. & \end{aligned}$$

where y is the dependent variable is a dummy variable that takes a value of 1 if the bank failure occurred during the 2008–2014 period, and 0 otherwise. The main variables were chosen based on categories identified in the literature review. The detailed descriptions of each variable is in Table 1.

To select the most appropriate approach for Model 1, the Logit model is utilized as the main tool for testing and the Probit model is utilized for the robustness test.

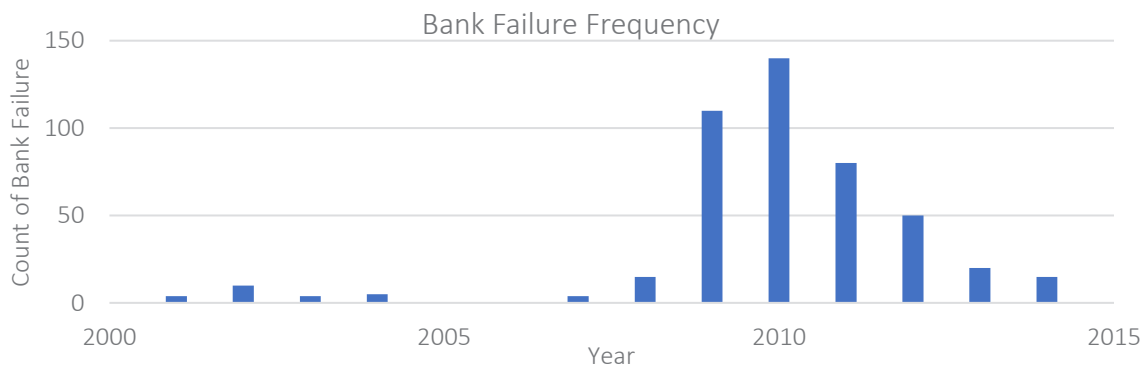


Figure 1. The distribution of the occurrence of bank failures from 2001 to 2014

Table 1. Definitions of variables

Main variables	Definition
Net Interest Margin (NIM)	The amount of money that a bank is earning in interest on loans compared to the amount it is paying in interest on deposits
Non-interest income to assets (non_interest_income)	Income from bank services and sources other from assets that bear interest as a percentage of the average total assets.
Real Estate Owned (Real_estate)	Total other real estate owned on a consolidated basis.
Efficiency ratio (Efficiency_ratio)	Non-interest expense less intangible asset amortization as a proportion of net interest income + non-interest income
Return on Equity (ROE)	Average total Equity divided by net income after taxes and unusual items
Loan and lease loss provision to assets (Loan_loss_provision)	The allowance for loan and lease losses expressed as a proportion of average total assets
Cost of funding earning assets (Cost_assets)	Total interest expenditure on deposits and other borrowings expressed as a proportion of average earning assets on a consolidated basis.
Core capital (leverage) ratio (Capital_ratio)	Tier 1 (core) capital is required as a proportion of average total assets minus disqualifying intangibles
Total assets (Total_assets)	The total value of all the institution's assets, including cash, loans, securities, bank property, and other assets
M2 Growth (M2_growth)	The M2 annual growth rate
GDP Growth rate (GDP_growth)	The GDP annual growth rate

Figure 1 shows the distribution of the occurrence of bank failures from 2001 to 2014.

3. RESULTS

The four variable groups: efficiency, profit and diversification, costs, and risk.

Table 2 provides descriptive statistics from 2001 to 2014.

The variables were initially tested with a two-sample t-test, and the results are reported in Table 3. NIM, ownership of real estate, equity ratio, ROE, cost funding earnings assets, capital ratio, and total assets show significant differences between the two periods.

The variables were also tested for multicollinearity. The results show that the VIF and tolerance values are in an acceptable range. Specifically, all the VIFs are less than 3, and the tolerances are greater than 0.4. Further, the total assets as a control variable were dropped due to multicollinearity.

In addition, as shown in Table 4, the correlation matrix did not indicate collinearity issues among the independent variables. Specifically, all the correlation coefficients of the independent variables fell into the range of -0.4 to 0.5 .

The Logit model is suitable for modelling binary data. Especially, for analyzing factors associated with small bank failures in two different periods. There were 22 failed banks in the pre-Crisis period and 449 in the post-Crisis period. The non-ratio

Table 2. Descriptive statistics 2001–2014

Variables	Mean	Median	Min	Max	SD
Net interest margin	0.0268	0.027	-0.024	0.1262	0.01285
Non-interest income	550.966	153	-16,357	62,612	4,200.192
Real estate owned	13,253.55	6,534.5	0	189,297	19,873.74
Efficiency ratio	2.2885	1.4851	-134.3333	201.50	13.9635
ROE	-2.5457	-1.5218	-110.9583	63.7535	10.7880
Loan loss provision	7,970.535	2,935	-1,538	155,665	14,919.66
Cost funding earning assets	0.0229	0.0216	0.0034	0.0666	0.0108
Total noninterest expense	6,965.32	4,009	146	148,024	10,525.46
Total risk weighted assets	207,999	134,266.5	0	2,144,067	224,812.9
Total equity capital	1,767.5	3,866.15	-47,041	65,445	9531.93
Capital ratio	0.0203	0.0179	-0.1895	0.6363	0.0567
Total assets	262,853.5	249,590.3	6,177	1,188,956	249,590.3
M2 increasing rate	0.06	0.06	0.02	0.010	0.03
GDP growth rate	0.63	1.71	-3.29	4.30	2.24

Table 3. Two-sample t-test results

Variable	Mean (pre-crisis)	Mean (post-crisis)	Difference	SE	t-statistic	P value
Net interest margin	0.05	0.03	0.02	0.00	4.64	0.0001
Non-interest income	2047.59	477.63	1569.96	1925.85	0.82	0.2120
Real estate owned	276.64	13887.98	-13611.34	956.36	-14.23	0.0000
Equity Ratio	1.31	2.34	-1.02	0.72	-1.43	0.0771
ROE	-0.86	-2.63	1.77	0.58	3.03	0.0013
Loan loss provision	6893.05	8023.33	-1130.28	4179.53	-0.27	0.3947
Cost funding earning assets	0.04	0.02	0.01	0.00	4.04	0.0003
Total noninterest expense	10588.82	6787.78	3801.04	6838.57	0.56	0.2921
Total risk weighted assets	166117.30	210046.50	-43929.20	100429.80	-0.44	0.3331
Total equity capital	8043.91	3661.90	4382.01	3374.57	1.30	0.1039
Capital ratio	0.10	0.02	0.08	0.02	3.68	0.0007
Total assets	126275.80	269530.70	143254.90	51367.52	-2.79	0.0052
M2 increasing rate	0.07516	0.06103	0.0141	0.0047	3.02	0.0027
GDP growth rate	2.0731	0.5640	1.5090	0.2631	5.73	0.0000

Table 4. Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Net Interest Margin	1.000	-	-	-	-	-	-	-	-	-
(2) Non-interest income	0.123 (0.008)	1.000	-	-	-	-	-	-	-	-
(3) Real estate owned	-0.247 (0.000)	-0.156 (0.001)	1.000	-	-	-	-	-	-	-
(4) Efficiency ratio	-0.053 (0.250)	-0.021 (0.654)	0.004 (0.929)	1.000	-	-	-	-	-	-
(5) Loan loss provision	-0.005 (0.913)	-0.075 (0.102)	-0.085 (0.064)	0.009 (0.851)	1.000	-	-	-	-	-
(6) Cost funding assets	-0.356 (0.000)	-0.061 (0.188)	-0.027 (0.563)	-0.010 (0.835)	0.247 (0.000)	1.000	-	-	-	-
(7) Total noninterest expense	0.329 (0.000)	0.477 (0.000)	-0.031 (0.505)	-0.028 (0.545)	0.176 (0.000)	0.014 (0.754)	1.000	-	-	-
(8) Total risk weighted assets	0.201 (0.000)	0.052 (0.260)	0.005 (0.920)	0.014 (0.754)	0.187 (0.000)	0.197 (0.000)	0.107 (0.020)	1.000	-	-
(9) Total equity capital	0.215 (0.000)	0.188 (0.000)	-0.149 (0.001)	-0.034 (0.460)	-0.351 (0.000)	0.123 (0.008)	-0.105 (0.022)	0.038 (0.407)	1.000	-
(10) ROE	0.049 (0.291)	0.032 (0.489)	0.005 (0.916)	-0.006 (0.891)	-0.103 (0.025)	0.042 (0.361)	0.147 (0.001)	-0.039 (0.395)	0.096 (0.037)	1.000

Table 5. Logit model regression results

Variables	Coefficient	SE	Coefficient	SE	Coefficient	SE
Net interest margin	-125.3***	34.15	-118.0***	38.6	-120.4***	32.8
Non-interest income	37.91	25.52	42.73*	21.86	37.1	29.34
Real estate owned	35.03*	19.92	51.14*	28.28	26.64	19.7
Efficiency ratio	0.014	0.0862	0.0228	0.087	0.0186	0.0844
ROE	0.0418	0.028	0.0454*	0.0257	0.0503	0.0333
Loan loss provision	5.363	11.63	-4.109	13.66	-2.354	12.3
Cost funding earning assets	-220.7***	52.69	-201.0***	56.57	-214.3***	53.69
Total noninterest expense	-22.79*	13.02	-36.69**	14.58	-25.08*	13.35
Capital ratio	-15.55***	4.875	-185.6***	65.02	-	-
Capital ratio · Total asset_log	-	-	14.67***	5.538	-	-
Total risk weighted assets	-	-	-	-	5.575***	2.13
Total equity capital	-	-	-	-	-32.12***	12.09
M2 annual growth rate	-9.711	18.6	-29.83	23.22	-8.546	19.18
Real GDP growth rate	-2.264***	0.746	-2.333***	0.728	-1.856***	0.665
Constant	19.40***	4.308	21.15***	4.956	14.99***	3.704
Observations	470		470		470	
LR chi2(12)	131.8		140.66		134.65	
Prob > chi2	0.00		0.00		0.00	
Pseudo R2	0.7418		0.7917		0.7575	
AIC	0.149		0.134		0.147	
BIC	-2,772.084		-2,774.787		-2,775.81	

Note: ***, **, and * denote statistical significance at the level of 1%, 5%, and 10%, respectively.

variables are all scaled in accord with each firm's total assets to permit interbank comparability and to account for outliers.

The Logit estimation results are reported in Table 5.

The capital ratio is used as a measure for a bank's compliance with Basel II, which requires that the bank's total capital goes beyond 8% of its risk-adjusted assets. The results show that the capital ratio of failed banks in the post-Crisis period is significantly lower than those in the pre-Crisis period. This suggests that the deteriorated financial market tends to be more hostile against small banks looking to survive after the financial crisis. The introduction of the Dodd Frank Act was intended to improve individual bank resiliency to help improve the stability of the banking system. The unintended consequence of the legislation resulted in increased compliance cost that simultaneously reduced available capital for individual banks. Hogan and Burns (2019) show that total non-interest expenses in the banking system increased by an estimated USD 64.5 billion per year after 2010. Part of this increase comes from expenses for hiring lawyers and consultants to cope with the regulatory changes of the Dodd Frank Act. The increase in cost disproportionately affect-

ed small banks relative to their larger peers due to their limited available assets. In other words, the Dodd Frank Act may have created additional operational pressures on small banks that increased their probability of default. The interaction term between the capital ratio and the log of total assets is significantly positive, indicating that bigger banks are more likely to reach the capital requirements. Hence, this study provides evidence in support of the hypothesis regarding the increased compliance costs in the post-Financial Crisis period due to policy changes.

Further analysis shows that, in the post-Crisis period, failed banks have significantly higher total risk-weighted assets but significantly lower total capital, causing the capital ratio to be lower in the post-Crisis period. The findings also suggest that banks have been pursuing higher loan portfolio risks to offset the declining interest income due to low interest rates in the economy.

Regarding variables for costs and risks, the results show that the costs of funding earning assets and non-interest expenses are significantly lower in the post-Crisis period than during the prior period. The post-Crisis period's monetary policy is one of the contributors as extremely low interest rates reduced

the cost of interest paid on deposits and non-interest expenses. The low interest rates also stifled available NIM throughout the industry by creating severe competition that eroded profit potential for new loans. The combination of lower NIM and increased compliance costs reinforced each other to create an environment that left small banks less profitable in the post-Financial Crisis period.

Meanwhile, the estimated coefficient on the loan-loss provision is negative but statistically insignificant. Hence, this study does not find any evidence to support the hypothesis regarding an increased loan default rate after the Financial Crisis. A further study shows that the loan default rate is much higher than it had been in the years when the Financial Crisis hit the hardest, but that the rate

decreased quickly afterwards. Furthermore, loan losses were very high in 2002, mainly due to the loans given to faltering telecommunication and cable companies.

Regarding the diversification measure of banks, the results demonstrate that failed banks' real-estate-owned holdings in the post-Crisis period are significantly higher than they had been in the previous period. The possible cause could be the underwater mortgages that were foreclosed and not resold due to high unemployment and economic uncertainty. It should be noted that the robustness of the results has been confirmed by utilizing the Probit model. The findings based on the *de facto* robustness test are consistent with those based on the Logit model.

CONCLUSION

This study analyzes the determinants of failed small banks in the pre- and post-Financial Crisis periods from 2001–2014. The main finding of the study is that failed banks in the post-Crisis period were distinct from those before the Crisis in several ways. Post-Crisis failed banks had lower capital ratios due to bank managers' excessive leverage in risk-weighted assets and real estate. Overextended banks with large amounts of illiquid assets and liabilities emerged in the post-Crisis period to combined unfavorable economic environment, expansionist monetary policy, and increased regulation. The combination of these factors reduced overleveraged banks' ability to capture increased net interest margin to offset the possession of illiquid real estate and higher costs of new regulations.

The main lesson for policy makers is that the implementation of new bank regulations requires exemptions depending on circumstances. Rulemaking based on the assumption that all bank operations are equal does not result in parity. Smaller banks are disproportionately affected by macroeconomic trends and regulation due to their smaller amount of available liquid assets. This is especially important for the health of the overall economy because small banks offer a variety of essential financial services in areas not occupied by the largest financial institutions. As a result, policymakers should carefully consider the impact of new regulation on the small banks to avoid potentially devastating consequences to the industry.

This study suggests that, in the aftermath of the Financial Crisis, expansionist monetary policies, increased real estate default rates, and increased regulatory requirements all contributed to the rise in the failure of small banks. These were all external forces that negatively impacted the small banking industry in the U.S. These results suggest that the small banking industry needs additional measures or exclusions to ensure that their failure rate is comparable to the rest of the banking industry.

AUTHOR CONTRIBUTIONS

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