ASSESSING THE PROBABILITY OF BANK FAILURE: A SNAPSHOT OF BANKS REGULATED BY THE FEDERAL DEPOSIT INSURANCE CORPORATION FROM 1998 – 1999 AND 2001 – 2002

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ASSESSING THE PROBABILITY OF BANK FAILURE: A SNAPSHOT OF BANKS REGULATED BY THE FEDERAL DEPOSIT INSURANCE CORPORATION FROM 1998 – 1999 AND 2001 – 2002

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Abstract

The Federal Deposit Insurance Corporation (FDIC) was created in 1933. Today, the FDIC's presence and monitoring ensures that banks are and remain solvent. Although the FDIC does everything in its power to prevent a bank from failing, bank failure can still occur, even in times of relative economic stability. Using a Probit regression analysis, this study assesses the probability of bank failure by looking at 102 different banks, eight different financial variables, and six geographic region variables during the time periods of 1998 – 1999 and 2001 – 2002. The geographic location variable is used to investigate if failures occur more often in certain regions of the country or in more urban or rural areas. In the end, none of the financial variables were statistically significant, whereas the regional geographic variables were. This suggests that during a period of relative economic stability, regional economic conditions affect bank failures more so than financial variables.

KEYWORDS: (Federal Deposit Insurance Corporation, Bank Failure, Regulation)

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ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED
UNAUTHORIZED AID ON THIS THESIS

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Signature

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CHAPTER 1

INTRODUCTION

Created in 1933 in response to thousands of bank failures in the 1920s and 1930s, the Federal Deposit Insurance Corporation (FDIC) is an independent agency of the federal government. Its purpose is to:

> Preserve and promote public confidence in the U.S. financial system by insuring deposits in banks and thrift institutions for at least $250,000; by identifying, monitoring and addressing risks to the deposit insurance funds; and by limiting the effect on the economy and the financial system when a bank or thrift institution fails ("Who is the FDIC?," 2013).

Since the start of FDIC insurance on January 1, 1934, no depositor of an FDIC-insured bank has lost a penny of insured funds as a result of a failure ("History of the FDIC," 2013).

The FDIC monitors banks in the United States based on many components. The Uniform Financial Institutions Rating System (UFIRS) was adopted by the Federal Financial Institutions Examination Council (FFIEC) in 1979. The purpose of the UFIRS is to provide "effective internal supervisory tool for evaluating the soundness of financial institutions on a uniform basis and for identifying those institutions requiring special attention or concern." ("FDIC Law," 1996). It is under the UFIRS that the acronym CAMELS rating system was created to promote efficient and thorough examination processes for the FDIC. The CAMELS categories include, but are not limited to: Capital Adequacy, Asset Quality, Management, Earnings, Liquidity, and Sensitivity to Market

Risk. Composite and component ratings are assigned based on a '1' to '5' numerical scale. A '1' indicates the highest rating, meaning the institution is not a high supervisory concern for the FDIC. This means the financial institution has a strong performance and practices safe risk management. On the other end of the scale, a '5' indicates the lowest rating an institution can score. This means the institution has the weakest performance, practices inadequate risk management, and therefore, presents the highest degree of supervisory concern ("Composite Ratings," 2012).

The FDIC's presence and monitoring was designed to ensure that banks are solvent. Although the FDIC does everything in its power to prevent a bank from failing, bank failure can still occur, even in times of economic stability. Extensive research has been done on why banks fail and the causes and consequences of these failures. While there are many factors that can contribute to a failure of a bank, in general, banks that have failed shared a common pattern. These elements included: (1) aggressive growth objectives on the bank's management's side and poor strategic decisions, (2) rapid loan portfolio growth which exceeded the bank's risk management capabilities and/or internal controls, (3) commercial real estate loans made which increased the bank's vulnerability to changes in the marketplace and lastly, (4) a failure on behalf of management to raise enough capital for the bank (Fuchs, 2009).

This study focuses on financial issues and the geographic location of the banks affecting 49 bank failures in 1998 – 1999 and again in 2001 – 2002. By looking at these two periods of relative economic stability in the United States with all other variables held constant, this study gains insight to a better understanding of the bank dynamics. In addition, this study will take into account a random sample of 53 banks that have not

failed from 1998 –1999 and 2001 – 2002. By comparing banks that have failed with those that have not failed during the same periods, the key factors contributing to bank failure will emerge.

The outline of this study is as follows. Chapter 2 provides an overview of existent literature as it relates to this topic. In Chapter 3, the theory and models are outlined. Chapter 4 is dedicated to data, while Chapter 5 discusses the methodology and results of the study. Finally, the paper ends with Chapter 6, which consists of conclusions, model limitations, and directions for future research.

CHAPTER 2

LITERATURE REVIEW

In 2009, The Federal Reserve Bank of St. Louis studied failed banks. The Fed argues "during strong economic times, the pricing of balance sheet assets is frequently misaligned with the inherent risk acceptance in lending. The result is felt when economic tides turn and losses are experienced" (Fuchs, 2009). The Fed concludes, that in general, banks fail for four general reasons: 1) the imbalance of risk versus return, 2) failure to diversify, 3) failure to understand products and services, and 4) poor (or no) risk management.

This study assesses a sample of 102 randomly chosen banks. It focuses on both financial issues and the geographic location of the banks affecting 50 bank failures in 1998 – 1999 and again in 2001 – 2002. In addition, this study also examines a random sample of banks that have not failed from 1998 –1999 and 2001 – 2002. Focusing on both failed and not failed banks begs the question: are there other exogenous factors besides financials that increase the probability of a bank failing? The next section of this chapter discusses the financial reasons why banks fail. The subsequent section discusses key variables that should be examined when looking into bank failures and the significance of their coefficients. The last section introduces the idea of exogenous

factors that could contribute to a bank failure, which is what this study focuses on in the upcoming chapters.

Why Banks Fail

According to Cebula, in *Determinants of Bank Failures in the US Revisited*, a bank failure occurs when a bank is forced by regulators to close or merge with another institution. Cebula assesses the impact of the Federal Deposit Insurance Corporation Improvement act (FDICIA) and also the impact of two other major banking statues, the Riegle-Neal Interstate Banking Act (1994) and the Gramm-Leach-Bliley Act (1999). His study follows other studies in the field, by including many economic and/or financial variables. These include: the unemployment rate, the cost of funds for banks, and the financial market volatility. The study adopts the variance in each year of the monthly averages of the S&P 500 Stock Index, charge offs to outstanding loans at a commercial bank, and interest rate yield on new 30-year fixed-rate home mortgages, to run an Ordinary Least Squares (OLS) regression. Bank failure rate over the study period was an increasing function of these variables, which in the end, could contribute to a bank failure (Cebula, 2010).

According to the Federal Reserve Bank of St. Louis, banks also fail because they do not diversify, which can occur on the asset and the liability side of the balance sheet. "Choosing not to diversify intensifies the need for higher capital ratios. Diversification needs to occur on the liability side of the balance sheet as well" (Fuchs, 2009). If there is a concentration of assets by loan category, industry, or geography, the bank creates the potential for material losses in times of economic stress or recessions.

Many banks do not understand the products and services they have set in place. This lack of knowledge also leads to bank failure. For example, many community banks purchased structured products, like mortgage-backed securities, probably to decrease balance sheet risk. However, many banks purchasing this product did not understand the composition and the risk these products placed on underlying assets.

Lastly, poor or no risk management can lead to a bank failure. A risk management system is:

> … An exposure-accounting system and a control system. An exposure-accounting system is a dynamic system that gives managers an opportunity to assess the effects of changes in economic factors such as interest-rate movements, yield-curve shifts and reshaping, currency and commodity price moves, and stock price movements, on the economic profit and loss of the entity. It determines the firm's need for capital to support its positions (Scholes, 2000, 18).

Risk management is often times a difficult topic for community banks that do not have a sophisticated system in place. However, good risk management usually goes hand in hand with good overall management. According to the Federal Reserve Bank, good management stems from a culture of understanding risks in the institution's operations and how those risks change as product structures evolve, business operations transform, or economic conditions remain. Good management also involves strong internal controls and high ethical standards on the part of every person employed at the institution. In addition, it requires an effort to properly align incentives with performance and to develop appropriate checks and balances through internal audit and board of directors' oversight.

Wheelock and Wilson (2000) acknowledge other factors that contribute to bank failure in their article *Why Do Banks Disappear? The Determinants of U.S. Bank Failures and Acquisitions*. Legal impediments to branch banking tied the fortunes of

banks to geographically limited markets. Also, sectoral shocks, like a decline in agriculture or energy prices contributed to banks failing. Furthermore, little capital, illiquid or low-quality assets and bad management, all were huge contributors to banks failing. Wheelock and Wilson assessed capital adequacy, asset quality, earnings, liquidity, and other miscellaneous factors in order to observe the key factors of bank failure (Wheelock, 2000).

Looking through a more quantitative lens, Li, Sanning, and Shaffer, in *Forecasting Bank Failures: Timeliness Versus Number of Failures* assessed banks failures though a Logit regression. By creating a Logit regression using "financial data from year "t" to predict the probability of failure in years "t + 1" through "t+2", they measured the ability of the fitted model to predict failures on a subsequent holdout sample" (Li, 2011, 1549).

Li, Sanning, and Shaffer assessed many different variables. In addition, they anticipated whether the coefficients of those variables should be positive or negative. Those variables included: assets (negative), equity/assets (negative), nonperforming loans (positive), expenses (positive), net income (negative), jumbo CDs (positive), and loans (positive).

Their results suggest, "sparse failures can impede both regulatory supervision and effective market discipline of banks due to informational imprecision. Regulators may do better to re-estimate their models only in years of high failure rates, rather than every feasible quarter." Moreover, if "exogenous factors shift the relationship between observable variables and bank risk, quantifying this shift may require a new wave of failures. Thus, periodic banking crises may be an unavoidable price of having very low

failure rates during normal times" (Li, 2011, 1550). Li, Sanning, and Shaffer, looked at banks failures through a model using Logit regression. This study, like their model, uses similar financial variables and a Probit regression due to the fact that a smaller dataset is used.

Exogenous Factors

As evidenced through many scholars and as seen above, the finances behind a bank failure are significant. Whether or not a bank has sound financials partially determines the success or failure of a bank, and there is a great amount of literature to support that. However, there has yet to be a recent or updated study on whether exogenous factors, such as timing and geographic location have played a role in the bank failures since 2000.

The most recent seminal work on geography and location relating to economics are written by Krugman in *Increasing Returns and Economic Geography* (1990) and *What's New About the New Economic Geography*? (1998). Before Krugman's work, there has not been much literature on the study of spatial economics. From a time span ranging from 1826 – 1974, Von Thünen, Weber, Christaller, Lösch, Isard and Henderson analyzed land rent and use around an isolated city location analysis, and the urban systems theory (Krugman, 1998).

According to Krugman (1990), the study of economic geography is not prominent in standard economic analysis. This neglect is surprising because "one of the most remarkable things about the United States is that in a generally sparsely populated country, much of whose land is fertile, the bulk of the population resides in a few clusters of metropolitan areas; forty percent are crowded into a not especially inviting section of

the East Coast" (Krugman, 1990, 1). It is due to the fact that economic geography is not prominent in many studies that it is an included variable in this study.

Krugman, in *What's New About the New Economic Geography?* (1998) provides the theory that there are centripetal and centrifugal forces that tend to promote geographical concentration and those that oppose it. Centripetal forces that affect geographical concentration are market-size effects, thick labor markets and pure external economies. On the other hand, the centrifugal forces affecting geographical concentration are immobile factors, land rents, and pure external diseconomies.

Clark, Gertler, and Feldmen in *The Oxford Handbook of Economic Geography* (2003), also touch on the topic of location and economic activity. For new companies, choosing the location is a crucial part of the startup process. The location selection that a company makes could contribute to the company's access to resources that could enable them to innovate, develop and grow (Clark, 2003). Like Krugman (1990), Clark, Gertler, and Feldman agree that eventually, clusters form in certain geographic regions and this formation of geographic clusters offers its own set of advantages. For example, clusters enable benefits in transaction costs over other forms in addition to improving many incentive problems. Location can play a large role in success of a company or institution because being clustered in a certain area can foster open communication, a sense of community, and trust between clients and business owners.

This chapter has reviewed the current literature on bank failure and the relation between geography and economics. While there is ample literature on bank failure and the financial variables that contribute to bank failure, there is very little literature regarding geography as it relates to bank failures. As stated above, geographic location is

often a critical part of starting a business, however, banks were not mentioned in that literature. Using "Geographic location for banks" as a variable in this study enables me to investigate if more failures occur in certain regions of the country or in more urban or rural areas. Further research will outline the necessary theory to build a foundation and model for this study.

CHAPTER 3

THEORY

According to Fama, in *Banking in the Theory of Finance*, banks serve two functions. "They provide transactions services, allowing depositors to carry out exchanges of wealth through their accounts, and they provide portfolio management services" (Fama, 1980, 44). Without financial accounting, banks would not be able to perform either of those two functions. Financial accounting consists of three main financial statements: the balance sheet, the income statement, and the statement of cash flows. It is from these principal financial statements of accounting, information from the FDIC, and the seminal work by Martin (1977) and Collins (1982), that the financial variables were chosen for this study.

The balance sheet consists of a list of the assets, liabilities, and owner's equity as of a specific date. It provides an institution with the statement of their financial position. Assets are the resources owned by a business. Common assets listed on the balance sheet are cash, accounts receivable, cash and due from depository institutions, securities, loans and leases, inventory, and buildings. Liabilities are the rights of creditors that represent debts of the business. Some common liabilities include accounts payable (deposits), taxes payable, mortgage payable, and unearned revenue. Owner's equity equals the net assets.

Some common sources of owner's equity include capital stock and retained earnings (Warren, 2014).

The income statement is a summary of the revenue and expenses for a specific period of time. Revenue is defined as the amount of assets created though the sale of goods and services. Additionally, expenses are the amounts of assets consumed through business operations to gain revenues. Thus, net income equals revenue minus expense (Warren, 2014).

The statement of cash flows is a summary of the cash receipts and cash payments for a specific period of time, which includes operating, investing, and financing activities (Warren, 2014). Operating activities is the selling of goods or services. Investing activities is the buying or selling of long-term assets. Financing activities is the cash repaid/obtained from owners and creditors (Warren, 2014).

Along with basic accounting theory for direction on which financial variables to include, this study also looked at what the FDIC considers important in banking for financial variable ideas. As discussed in Chapter 1, the FDIC uses what is known as the CAMELS rating system when examining the safety and soundness of banks. The CAMELS acronym stands for: Capital Adequacy (capital), Asset Quality (assets, loans, securities, cash and due from banks), Management, Earnings (earnings), Liquidity, and Sensitivity to Market Risk ("FDIC Law," 1996). All the financial variables that were chosen for the sample of the 102 banks were chosen because it is public and available information. Aspects that the FDIC monitors, such as management, cannot be assessed in this study because the FDIC assesses those based on subjective (not financial) information.

The last place information was gathered to see what financial variables should be used in this study was in *Early Warning of Bank Failure* by Martin (1977). In that study, the objective is to express:

> …the probability of future failure as a function of variables obtained from the current period's balance sheet and income statement. Typically, the model is estimated on past financial data; depending on the particular approach used, the past record of bank failures and/or bank examiner's ratings of banks may also be an input to the model" (Martin, 1977, 249).

In his study, the independent financial variables used were drawn from a set of 25 financial ratios from the Federal Reserve Bank of New York's research, which is a nationwide database. The ratios that the Federal Reserve Bank of New York uses come from the Report of Condition and the Report of Income from different banks. From that list of 25, eight were chosen for the purposes of this study. Of the list of 25 financial variables, the variables can be categorized into four main groups: 1) asset risk, 2) liquidity, 3) capital adequacy, and 4) earnings (Martin, 1977). The four main groups are important, and are included in this study, because each of these groups, in theory, could affect a bank's success or failure. According to Martin:

> Banks typically are threatened with failure because of losses on assets; and the other three characteristics measure the ability of a bank to remain open in spite of these losses. Liquid assets and/or access to short-term borrowings allow the bank to maintain cash flow if expected loan repayments fail to materialize and depositors make larger than normal withdrawals. Capital adequacy and earnings allow losses to be offset by current or past income (Martin, 1977, 263).

This is a well-known and accepted theory of causes of bank failure; it has been the basis of bank supervision for decades.

This thesis poses the question: does geographic location of a bank also play into the probability of a bank failure? The years of 1998 – 1999 and 2001 – 2002 were economically sound times, as the United States was coming off a period of sustained

growth. In 1997, the Real Gross Domestic Product (GDP) rose at an annual rate of 3.8% marking the sixth consecutive annual increase. Real GDP per capita also increased in 1997 to $26,835. Furthermore, between 1993 and 1996, the number of persons in poverty fell 2.7 million to 36.5 million. Lastly, the median net worth of families was $56,400 in 1995, up slightly from 1992 in real terms, but unchanged from 1989 (U.S. Census Bureau, 1998). Please see Figures 3.1 and 3.2 for more data regarding the economy at this time. In choosing an economically sound time in the United States, this study hopes to hold all other economic factors constant, and isolate the financial and geographic location variables chosen for this study.

FIGURE 3.1

GROSS PRIVATE SAVING AND GROSS INVESTMENT: 1960 TO 1997

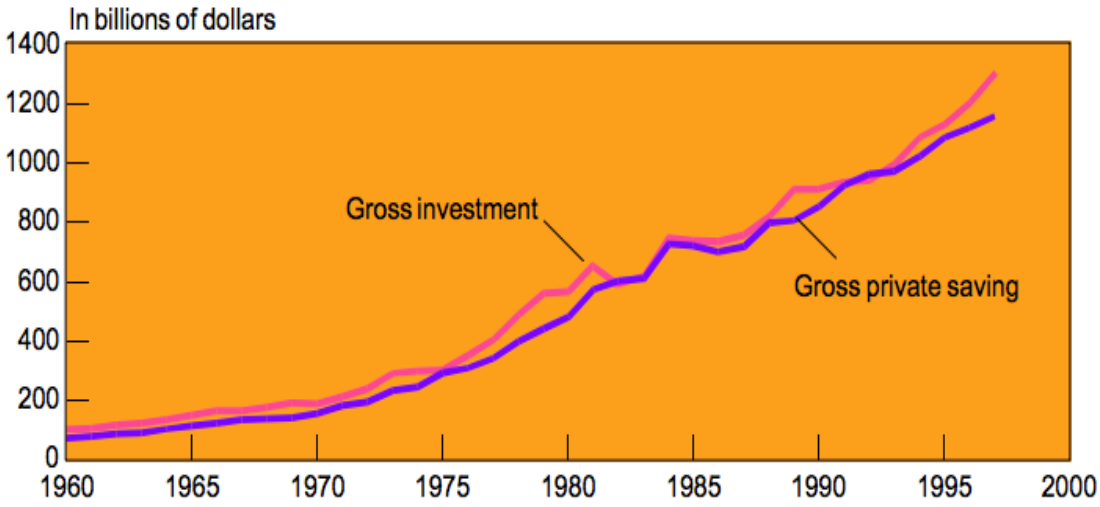
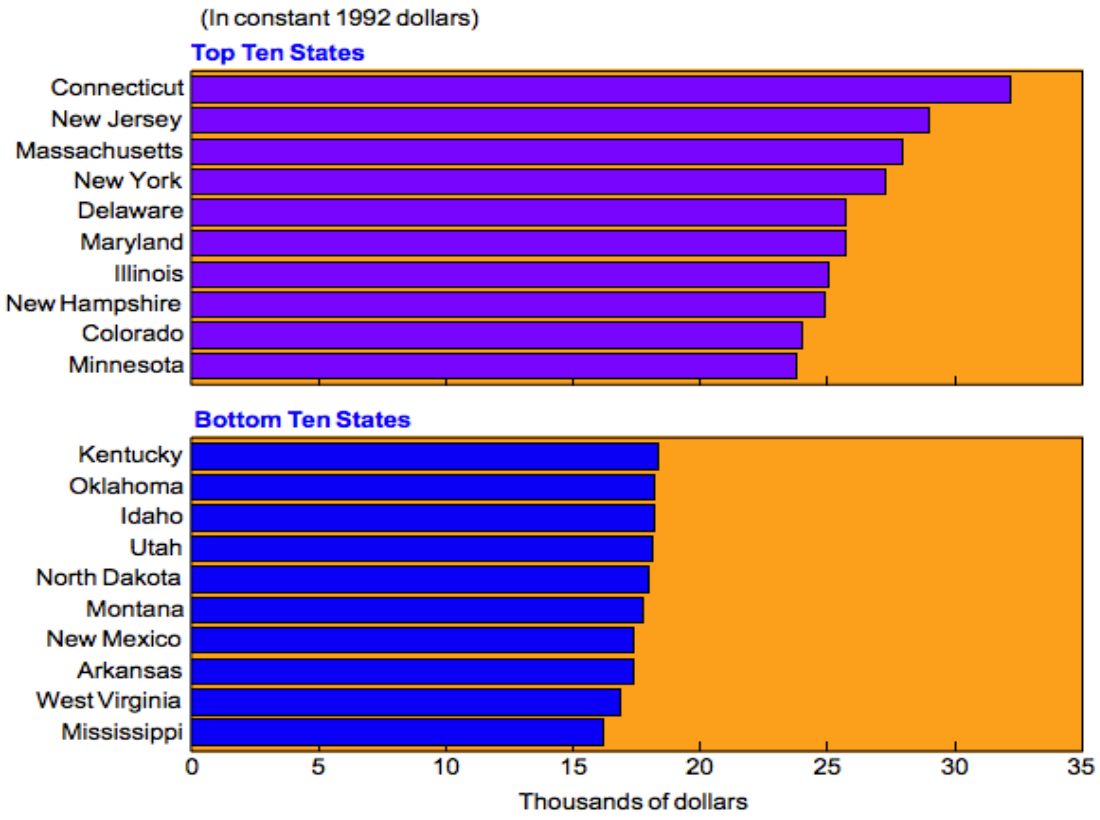


FIGURE 3.2

PERSONAL INCOME PER CAPITA, BY STATE: 1997



This research looks at 102 different banks at two different time periods: 1998 – 1999 and again in 2001 – 2002. As discussed above, these periods occurred during economically stable times. Fifty banks analyzed are banks that have failed, and the other 50 banks are ones that have been successful and are still active ("Find an Institution," 2013). An analysis of the financials of 102 banks from both time periods will help determine if a bank failure is solely dependent on the financials of the institution.

This study deliberately uses a Probit regression analysis for assessing the probability of bank failure. Often times for studies like this, a Logit regression is used. Both are very similar, however, a Probit regression is chosen for this study because it gives probabilities, whereas a Logit regression gives odds ratios. Collins and Green in *Statistical Methods for Bankruptcy Forecasting,* (1982) state that there are three statistical models often used for bankruptcy forecasting. These three models are multiple discriminant analysis, the linear probability model, and logistic regression. Their paper compares and contrasts these three models and assesses their effectiveness. In the end, they conclude that a Logit regression (and for purposes of this study, a Probit regression) is more appropriate for forecasting bankruptcy for three primary reasons: 1) "The logistic discrimination has much more theoretical appeal and much better statistical properties. The logistic cumulative distribution function is a sigmoid curve that asymptotically approaches zero and one. This functional form has the 'threshold' property that the bankruptcy forecasting problem logically requires" (Collins, 1982, 351). 2) the Logit formation is more robust to distributional assumptions, and, 3) a Logit model reduces type I errors, providing a modest increase in the overall classification rate.

Using a Probit model, this thesis will investigate the probability of a bank failure, by using the model: $p_i = F(x_i'*beta)$ while looking at the variables: total deposits, total assets, total cash and due from depository institutions, total securities, total net loans and leases, total liabilities, total equity capital, total net income, and the geographic regions of Atlanta, Chicago, Dallas, Kansas City, and New York.

In the Probit model, the dependent variable, fail or not fail, is a categorical variable and is coded either as 0 (failure) and 1 (active). Similarly, location is coded on a 1 to 6 scale, as the FDIC has six geographic regions that it divides the United States. By isolating each geographic region with a dummy variable, it will become more obvious if one geographic region is more prone to bank failure than another.

The geographic regions of Atlanta, Chicago, Dallas, Kansas City, and New York were picked for this study for three primary reasons. First off, this study wants to investigate if there is more than just financial activity that contributes to bank failure. Second, geographic regions were picked to see if location is a proxy for regional instability. Lastly, geographic regions were picked as variables to see if perhaps FDIC banking regulation is not as stringent in some geographic regions than in others. In support of geographic regions contributing to bank failure, Meyer and Pifer, in *Prediction of Bank Failures* conclude that the factors contributing to bank failures can be divided into four groups: "1) local economic conditions, 2) general economic conditions, 3) quality of management, and 4) integrity of employees." Additionally, they believe that banks that are geographically located in high income and growth rate areas are more likely to see success (Meyer, 1970, 854).

In *Early Warning of Bank Failure*, a bank fails "if its net worth becomes negative, or if it is unable to continue its operations without incurring losses that would immediately result in negative net worth" (Martin, 1977, 249). The FDIC defines an insured bank failure as the "closing of a bank by a federal or state banking regulatory agency" ("When a Bank Fails," 2010). Usually a bank closes when it fails to meet its financial obligations to depositors and others. A failed bank on the FDIC's list could also be a bank that was acquired by another institution. In that case, the acquiring institution is not responsible for any remaining assessments due from the failed institution.

When a FDIC insured institution fails, the FDIC is responsible for acting in two primary ways. First, the FDIC pays insurance to the depositors. Second, since the FDIC is the receiver of the failed bank, it is responsible for selling and/or collecting the assets of the failed institution and the FDIC settles all debts that the failed bank acquired. ("When a Bank Fails," 2010).

This chapter has outlined the economic theory regarding the assessment of bank failure. By building on the models described by Martin (1977) and Collins (1982), this study adds value by taking the geographic region variables into account while simultaneously assessing important financial variables that contribute to bank failure. The next chapter describes the dataset used in this study.

CHAPTER 4

DATA

This chapter will describe the method of collection and describe the dataset used for this study. As mentioned in Chapter 3, the variables used in this study are: total deposits, total assets, total cash and due from depository institutions, total securities, total net loans and leases, total liabilities, total equity capital, total net income, and the geographic regions of Atlanta, Chicago, Dallas, Kansas City, and New York.[1] These variables are explicitly defined in the rest of this chapter. The data came from one source and contains geographic and financial information from a random stratified sample 102 banks. The information was collected in October of 2013.

Financial Data

The FDIC offers an "Industry Analysis" section under Institution Directory (ID). Using this tool, users can analyze individual institutions and create custom reports. This Institution Directory provides financial and demographic data for every single FDIC-insured institution. For this study, using the Institution Directory, institution status, information as of, federal regulator, and FDIC geographic region were selected. The

[1] The FDIC divides its regions into six geographic regions. San Francisco, the sixth region, is not listed due to that fact that it was picked at random and used as the base line for the rest of the study. Therefore, all coefficients for the financial and geographic variables are all relative to San Francisco.

directory then provided lists of banks that have failed and are still active in 2002. Through that list, a stratified random sample of 53 failed banks and 49 active banks were selected at random from each FDIC geographic region. Their financial information was collected and then compared to their financials from the year of 1998 – 1999.

Financial Variables

There were eight financial variables used in this study: total deposits, total assets, total cash and due from depository institutions, total securities, total net loans and leases, total liabilities, total equity capital, and total net income. For each bank, information was provided for each of these variables in 1998 – 1999 and again in 2001 – 2002. For purposes of the regression, the change in each variable was used. So the difference in the years of 1998 – 1999 and 2001 – 2002 for each variable was used.

The FDIC defines all other financial variables used in this study. According to the FDIC, total deposits is all deposits, some of which include savings deposits, time deposits, and money market deposits. Total assets is the sum of all assets owned by the specific bank, which include, but are not limited to, loans, cash, securities, and bank premises. However, this summation does not include off-balance-sheet accounts. Cash and due from depository institutions is the total cash and balances which are due from depository institutions. These include interest-bearing and noninterest-bearing balances. Securities, according to the FDIC, is the sum of all investment securities. Furthermore, net loans and leases are the "total loans and lease financing receivables minus unearned income and loan loss allowances" ("Bank Data Guide," 2013). Similarly, total liabilities are deposits and other borrowings, along with subordinated notes and debentures, limited-life preferred stock and related surplus, trading account liabilities and mortgage

indebtedness. Total equity capital is the total capital on a consolidated basis. Finally, net income is interest income plus total noninterest income plus losses on securities, minus total noninterest expense, loan loss provisions, and income taxes.

Geographic Data

The FDIC divides the United States into six geographic regions to divide which FDIC offices are responsible for which states ("FDIC Geographic Region," 2011). These regions are responsible for different states and are: Atlanta (Alabama, Florida, Georgia, North Carolina, South Carolina, Virginia, West Virginia), Chicago (Illinois, Indiana, Kentucky, Michigan, Ohio, Wisconsin), Dallas (Colorado, New Mexico, Oklahoma, Texas, Arkansas, Louisiana, Mississippi, Tennessee), Kansas City (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota), New York (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, Puerto Rico, Virgin Islands), and San Francisco (Alaska, Arizona, California, Guam, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming).

For this study, in the Probit model, the six FDIC geographic regions were categorized on a 1 to 6 scale in Stata. Atlanta '1', Chicago '2', Dallas '3', Kansas City '4', New York '5', and San Francisco '6'. Once the first Probit regression was run using 'geographic region' as a variable, another regression was run, isolating each geographic region individually to see if there was a problem region. This was done by creating a separate dummy variable for each of the five of the six regions.

Observation Periods

For this study, 102 banks are used in two time periods: 1998 – 1999 and 2001 – 2002. Eight financial variables are observed for each bank. The years of 1998 – 1999 and 2001 – 2002 were selected because they were years of relative economic stability in the United States, as discussed in Chapter 2.

CHAPTER 5

METHODOLGY AND RESULTS

For this study, the regression is set up with a Probit model. This econometric model fits a maximum-likelihood model, and is used to model binary outcome variables. In this Probit model, the inverse standard normal distribution of the probability is modeled as a linear combination of the predictors ("Stata Data Analysis," 2013). In this case, the dependent variable, fail or not fail, can only be a '0' or '1.' For this Probit model, '0' is a failure and '1' is an active and successful bank. Equation 5.1 is the regression model used to determine the variables that impact the probability of a bank failure.

$$P(\text{success}) = \text{FailureActive} + \beta_0\text{totaldeposits} + \beta_1\text{totalassets} + \beta_2\text{totalcashanddue} + \beta_3\text{totalsecurities} + \beta_4\text{totalnetloansleases} + \beta_5\text{totalliabilities} + \beta_6\text{totalequitycapital} + \beta_7\text{totalnetincome} + \beta_8\text{Atlanta} + \beta_9\text{Chicago} + \beta_{10}\text{Dallas} + \beta_{11}\text{KansasCity} + \beta_{12}\text{NewYork} \quad (5.1)$$

As defined in Chapter 4, the variables used in this study are: total deposits, total assets, total cash and due from depository institutions, total securities, total net loans and leases, total liabilities, total equity capital, total net income, and the FDIC geographic regions of Atlanta, Chicago, Dallas, Kansas City, and New York. The definitions of each variable are listed below ("Bank Data Guide," 2013):

P(success): Probability of success

FailureActive: If the institution is failed or active

β_0*totaldeposits:* all deposits, some of which include savings deposits, time deposits, and money market deposits

β_1*totalassets*: the sum of all assets owned by the specific bank, which include, but are not limited to, loans, cash, securities, and bank premises

β_2*totalcashanddue*: the total cash and balances which are due from depository institutions. These include interest-bearing and noninterest-bearing balances.

β_3*totalsecurities:* the sum of all investment securities

β_4*totalnetloansleases:* the "total loans and lease financing receivables minus unearned income and loan loss allowances" ("Bank Data Guide," 2013)

β_5*totalliabilities:* deposits and other borrowings, along with subordinated notes and debentures, limited-life preferred stock and related surplus, trading account liabilities and mortgage indebtedness

β_6*totalequitycapital:* the total capital on a consolidated basis

β_7*totalnetincome:* interest income plus total noninterest income plus losses on securities, minus total noninterest expense, loan loss provisions, and income taxes

β_8*Atlanta:* Responsible for the states of Alabama, Florida, Georgia, North Carolina, South Carolina, Virginia, West Virginia

β_9*Chicago:* Responsible for the states of Illinois, Indiana, Kentucky, Michigan, Ohio, Wisconsin

β_{10}*Dallas:* Responsible for the states of Colorado, New Mexico, Oklahoma, Texas, Arkansas, Louisiana, Mississippi, Tennessee

β_{11}*KansasCity:* Responsible for the states of Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota

β_{12}*NewYork:* Responsible for the states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, Puerto Rico, Virgin Islands

In order to further investigate these results, Equation 5.2[2] was derived. Please note Equation 5.2 tests for heteroscedasticity, using the "robust" command in Stata. Testing for heteroscedasticity using the "robust" command checks and corrects for any non-normal error terms in the results of the Probit regression.[3]

$$P(\text{success}) = \text{FailureActive} + \beta_0\text{totaldeposits}/100{,}000 + \beta_1\text{totalassets}/100{,}000 + \beta_2\text{totalemployees}/100 + \beta_3\text{totalcashanddue}/100{,}000 + \beta_4\text{totalsecurities}/100{,}000 + \beta_5\text{totalequitycapital}/100{,}000 + \beta_6\text{totalnetincome}/100 + \beta_7\text{Atlanta} + \beta_8\text{Chicago} + \beta_9\text{Dallas} + \beta_{10}\text{KansasCity} + \beta_{11}\text{NewYork, robust} \quad (5.2)$$

The variables, as described in Chapters 2 through 4, which were chosen for this study come from a combination of previous literature from *Forecasting Bank Failures: Timeliness Versus Number of Failures* by Guo Li, Lee W. Sanning and Sherrill Shaffer and from The Federal Reserve Bank of St. Louis' research on why banks fail. Geographic location for the different institutions was added as proxy to see if there were any indicators of regional economic instability that could contribute to certain bank failures. The results of the Probit regression appear in Table 5.1 and 5.2 on the following pages.

[2] To allow the effects of each variable to be more visible, each variable was magnified and divided by either 100,000 or 100.

[3] For this regression, I am assuming errors are normally distributed due to the fact that there are a large number of observations.

TABLE 5.1

PROBIT REGRESSION RESULTS I

Number of obs	101
Wald chi2 (13)	34.81
Prob > chi2	0.0009
Pseudo R2	0.4124

TABLE 5.2

PROBIT REGRESSION RESULTS II

CHANGE IN	dy/dx	Std.Err.	Z	P>z
Total Deposits	0.0045687	0.0141473	0.32	0.747
Total Assets	0.1278097	0.0914618	1.40	0.162
Total Cash and Due from Depository Institutions	-0.1688697	0.2274076	-0.74	0.458
Total Securities	0.0025798	0.0529041	0.05	0.961
Total Net Loans & Leases	0.0000612	0.0000819	0.75	0.455
Total Liabilities	-0.0416795	0.0910738	-0.46	0.647
Total Equity Capital	-0.5866908	0.3312605	-1.77	0.077
Total Net Income	-0.9838967	0.8108343	-1.21	0.225
Atlanta	0.0580755	0.2223903	0.26	0.794
Chicago	0.3691183	0.2090959	1.77	0.078
Dallas	0.4525996	0.2091651	2.16	0.030
Kansas City	0.6153088	0.1983997	3.10	0.002
New York	0.5102732	0.2393018	2.13	0.033

For this study, in the Probit model, the six FDIC geographic regions are categorized on a 1 to 6 scale in Stata. Atlanta '1', Chicago '2', Dallas '3', Kansas City '4', New York '5', and San Francisco '6'. Once the first Probit regression was run using 'geographic region' as a variable, another regression was run, isolating each geographic region individually to see if there was a problem region. This was done by creating a dummy variable for five of the six regions. By omitting San Francisco, this Probit regression compares the probability of failure in the other five regions to San Francisco. In doing so, it is evident that Atlanta is really no different than San Francisco, and a bank being in the FDIC geographic region of Atlanta, with a Z-score of 0.26, does not change the probability of bank failure, based off San Francisco.

The FDIC geographic regions of Dallas, Kansas City, and New York are statistically significant, with Z-scores of 2.16, 3.10, and 2.13, respectively. A bank being in the geographic locations of Dallas, Kansas City, and New York means that the bank in these regions are 45.2, 61.5, and 51.0 percent more likely to see bank success, compared to the region of San Francisco. The statistical significance of these three geographic regions begs the question: why are there three distinct geographic regions that are more likely to succeed in bank activity than others?

Dallas and Kansas City have historically seen conservative banking practices during sound economic times. Likewise, New York is more likely to see bank success in their region because New York City is home to large capital markets, many banks are too big to fail, and there is a lot of money in circulation in New York.[4] On September 11,

[4] This commentary on the regional banking practices of Dallas, Kansas City, and New York is based on speculation.

2001, Manhattan saw great tragedy with the terrorist attacks on the World Trade Center. This act of terror "caused a breakdown in the usual means of communication between banks, and resulted in the temporary shutdown of the interbank market. Some banks found themselves with high liquidity needs, while others had large excess of liquidity" (Martin, 2008, 5). However, because the market was not functioning normally, these banks were not able to lend to one another. In order to ease and reduce the effects of the liquidity shortage, the Federal Reserve provided large amounts of reserves at a low cost (Martin, 2008).

This increase in probability of bank success in these regions could have occurred for multiple reasons, as there were many different economic factors coming into play during the time period of 1998 – 2002. While there were different regional economic factors, which will be discussed in the following pages, it is evident that bankers and regulators during this time were doing a good job, as there were fewer bank failures during this time period compared with other time periods of economic instability.

The Pseudo R-Squared is the proportion of variance in the dependent variable, which can be explained by the independent variables, is statistically significant for this Probit model, at 0.4124. There is a very low statistic, a 0.0009 percent chance that the Pseudo R2 could be a better fit, meaning the model is a good fit for the data.

Of the financial variables used in this Probit regression, there is not one financial variable that is statistically significant in this study. As these are measured, none of these are at the root of determining the success or failure of a bank. As discussed above, it is the regional dummy variables that are capturing some aspect of regional economies. The lack of statistical significance for all of the financial variables chosen is shocking; the

financial variables that were chosen, as discussed in Chapter 3, were chosen for specific reasons, with important aspects of financial accounting taken into consideration. On the other hand, the lack of statistical significance for these financial variables also suggests that FDIC bank examiners were doing their job well, and that banks during this time were behaving and complying with safe banking practices.

While the United States of America would like to maintain that it is one country, not divided economically by different geographic regions, this study suggests that regional sectoral shocks primarily contribute to the failure or success of a bank.

In the FDIC geographic region of Chicago, which includes the states of Ohio and Michigan, during 1998 – 2002, experienced major cutbacks from the 'Big Three' automakers in the United States: General Motors, Ford, and DaimlerChrysler. In December of 2000, these companies let off 85,231 employees. This is significant because the Unites States' auto production accounts for four percent of the nation's economic output. In addition to layoffs, automakers decided to make production cuts for 2001, including a 26 percent reduction for Chrysler, 17 percent for Ford and 21 percent for General Motors. Consequently, auto suppliers and other related industries, like steel companies, were affected by these decreases as well, which can be seen in the announcement of bankruptcy by LTV Steel (Roberts, 2011).

During the same time in the FDIC geographic region of Dallas, weakening energy prices, layoffs at computer manufacturers and airlines, the bankruptcy of Enron, and the most costly tropical storm in U.S. history all are factors that affected the regional economy during this time. In Texas, by February of 2002, the Baker-Hughes domestic drilling rig count fell 35 percent from July of 2001. As a result of warmer weather and

sluggish United States global economic growth at this time, there was a weakened demand for petroleum and natural gas-related products, leading to constrained energy prices and cutbacks were made in capital expenditures and exploration (Sanchez, 2002). Stemming from the decline in the energy sector, construction, retailing and business services also took a toll at this time. Compaq Computer Corporation laid off 3,000 workers in the metro area as a result of slow computer sales. Similarly, as a result of September 11, 2001, there was a decrease in air travel that caused Continental Airlines to cut 3,000 jobs. Lastly, the financial difficulties that Enron Corp., led to the layoffs of two-thirds of its 7,500 Houston-based employees (Sanchez, 2002).

Another FDIC geographic region included in this study is Kansas City. From 1998 – 2002, Kansas City was very vulnerable to overbuilding within the property sector. In 1997, the Kansas City region had 1.7 million square feet of retail completions which exceeded the demand of 513,000 square feet by 3.3 times. During 1998, construction activity in the Kansas City region was at 12 percent of existing space, which was the third highest rate of retail development. Although authorities did not see a "boom-bust" scenario for Kansas City at this time, there was a heightened degree of concern over the rapid development and related growth in construction loan concentrations occurring within this market (“Bank Trends,” 1999).

Lastly, while the events of September 11, 2001 did not affect the bank failures at the time, the event did impact the regional economy. Although the New York region was in good shape and outperforming the nation, due to the robust financial sector in Manhattan, by September 11, 2001, its economy contracted drastically. By third quarter of 2001, the gross metro product of Manhattan decreased at an annual rate of 15 percent.

This is in comparison with a 1.3 percent annual rate of decline in the nation's GDP ("New York City Economy," 2002).

The attack hit Downtown Manhattan the hardest. As a result of the attacks, the stock market closed for four days, business confidence declined, tourism, travel, and retail all were shattered. Similar to the Dallas region, airline traffic came to a standstill. Consequently, the hotels in Manhattan saw major declines in revenues, which declined 34 percent from fourth quarter of 2000 to fourth quarter 2001. Local income and business tax collections were disrupted. As a result of all this, the local government of New York City saw the largest budget deficits it had seen in years ("New York City Economy," 2002).

It should be noted that for this study, a very small sample group was used, a sample of 102 FDIC insured banks. Therefore, it is a very sensitive dataset. While a random sample was sought after, there is a chance that it is not truly random, therefore the region effects might have inadvertently caused a non-random data set.

This section has discussed the methodology and results of this study. The final chapter ends with conclusions, challenges and limitations, and opportunities for future research.

CHAPTER 6

CONCLUSIONS

By examining financial and geographical variables to analyze the probability of bank failure, this study shows that of the financial variables used in this Probit regression, there is not one financial variable that is statistically significant in this study. As these are measured, none of these are at the root of determining the success or failure of a bank. It is the regional dummy variables of Atlanta, Chicago, Dallas, Kansas City and New York that are capturing some aspect of different regional economies. The lack of statistical significance for all of the financial variables chosen is surprising; the financial variables that were chosen, as discussed in Chapter 3, were chosen for specific reasons, with important aspects of financial accounting taken into consideration. For example, the lack of statistical significance for Total Equity Capital, with a Z-score of -1.77 does not make sense, based on accounting theory. However, Martin (1977), would argue that:

> The policy implications of these findings are not surprising: the relevance of conventional bank soundness criteria will vary over the business cycle. In periods when bank failures are extremely rare, the empirical link between capital adequacy (and other measures of bank safety) and the actual occurrence of failure will be weak. In periods of stress due to increased loan losses, when a larger number of banks fail, the conventional supervisory wisdom reasserts itself; 'weakness' as measured by earnings, capital and asset composition is an indicator of risk, although the link with failure is still far short of perfect prediction (Martin, 1977, 272).

On the other hand, the lack of statistical significance for these financial variables also suggests that FDIC bank examiners were doing their job well, and that banks during this time were behaving and complying with safe banking practices.

Of the five geographic region variables used in this study, Dallas, Kansas City, and New York are statistically significant, with Z-scores of 2.16, 3.10, and 2.13, respectively. A bank being in the geographic locations of Dallas, Kansas City, and New York means that the bank in these regions are 45.2, 61.5, and 51.0 percent more likely to see bank success, compared to the region of San Francisco.

Many challenges arose throughout this research, primarily stemming from gathering a dataset. While the FDIC provides ready and ample information, the information took longer than expected to gather due to the fact that this study examines time-specific years: 1998 – 1999 and 2001 – 2002. Once lists of either active or failed banks were gathered for each year, a random sample was then needed. In addition, it needed to be truly random for both the banks that were selected and for the geographic regions in which they were located, in order to get statistically significant information on the location variable.

A limitation in this study worth noting is that a very small sample group was used, a sample of 102 FDIC insured banks. Therefore, it is a very sensitive dataset. While a random sample was sought after, there is a chance that it is not truly random, therefore the region effects might have inadvertently caused through a non-random data set.

For future research, a larger dataset could be evaluated, which would make the variables examined more statistically significant. In addition, another study could look at banks regulated by other federal regulators, such as Comptroller of the Currency, the

Federal Reserve Board, or the Office of Thrift Supervision. The study could take into account the nonpublic CAMELS ratings of each bank, and see how those ratings correlate with the financials of each bank. Lastly, another study could examine other years in United States history, perhaps a larger timeframe rather than a snapshot, of 1998 – 2002, which is what this study used.

Through quantitative evaluation, this study attempts to understand and explain the financial and geographic factors that impact the probability of a bank failure. Ultimately, this study shows that while at first glance, one would think many financial variables play into bank failure like total assets, total net income, and total equity capital, none turn out statistically significant. It is the FDIC geographic regions of Dallas, Kansas City, and New York that see an increase in probability of bank success. This data tells a good story for the United States and for its federal regulators: during the time frame of 1998 – 1999 and 2001 – 2002, FDIC bank examiners were doing their job well, and banks were behaving and complying with safe banking practices.

CHAPTER 7

APPENDIX

TABLE 7.1

CORRELATION MATRIX I

	Chicago	Dallas	KansasCity	NewYork
Chicago	1.0000			
Dallas	-0.1593	1.0000		
KansasCity	-0.2088	-0.1768	1.0000	
NewYork	-0.1357	-0.1148	-0.1506	1.0000

TABLE 7.2

CORRELATION MATRIX II

	Total deposits	Total assets	Total cash anddue	Total securities	Total netloans leases	Total liabilities	Total equity	Total net income	Atlanta
Total deposits	1								
Total assets	0.5556	1							
Total Cash anddue	0.9011	0.6244	1						
Total securities	0.6287	0.8105	0.5501	1					
Total Netloans leases	0.5694	-0.221	0.3249	0.0355	1				
Total liabilities	0.3736	0.936	0.3902	0.8633	-0.3408	1			
Total equity	0.0626	0.8314	0.1752	0.5769	-0.6031	0.9004	1		
Total Net income	0.0048	0.6328	-0.0381	0.7158	-0.4678	0.8537	0.8118	1	
Atlanta	0.1079	0.2551	0.1326	0.2124	-0.0781	0.235	0.1927	0.1524	1
Chicago	0.0341	-0.079	0.0234	-0.0668	0.1031	-0.086	-0.107	-0.1054	-0.316
Dallas	0.0215	-0.092	0.0064	-0.0555	0.1029	-0.0933	-0.094	-0.0732	-0.267
KansasCity	0.0385	-0.102	0.016	-0.0567	0.1387	-0.1112	-0.116	-0.0888	-0.351
NewYork	-0.38	-0.125	-0.3019	-0.1099	-0.3718	-0.027	0.086	0.1496	-0.228

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