CARLETON UNIVERSITY

THE CHOICE BETWEEN FOCUS AND DIVERSIFICATION STRATEGIES IN BANKING AND ITS RELATIONSHIP TO RISK AND RETURN OUTCOMES

by

MITCHELL STAN

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

DEGREE OF Ph.D. IN MANAGEMENT

SPROTT SCHOOL OF BUSINESS

OTTAWA, CANADA

February 4, 2009

Your file Votre référence
ISBN: 978-0-494-52087-1
Our file Notre référence
ISBN: 978-0-494-52087-1

Abstract

This research examines whether the risk of financial institutions in six different focused peer groups is higher than that of banks in more diversified peer groups. It investigates whether the risk-reducing benefits of diversification outweigh the benefits of specialization. Each focused group includes banks with a large proportion of assets in a narrow industry segment such as agricultural loans, credit cards, commercial lending, mortgage lending, consumer lending and other focused loans.

This thesis differs from much of the research in this area in taking a regulator-focused approach rather than the perspective of a shareholder. Regulators differ from shareholders because they cannot diversify themselves to improve their risks. A better understanding of the relative levels of risks of different types of strategies and industry focuses could contribute to a better allocation of regulatory resources, and to more effective supervisory interventions.

This study differs from similar work in the past because it controls for the size and tax-status of the banks in the sample, and compares focused banks to a sample including only diversified banks. Other studies, in contrast, compared one focused peer group to a comparator group of all banks but for the one focused group. Thus, the comparator group included both diversified and focused banks. Further, this study includes six different focused groups of banks whereas most previous studies considered only one focused group. This study also considers banks that switch between focus and diversification strategies as a distinct class of banks and is therefore unique in this regard.

The data in this study confirm the major hypothesis that banks following a diversified strategy are less risky than banks following an industry-focused approach. It

provides limited support for the hypothesis that diversified banks will generate lower returns on assets than focused banks, although this finding seems to be size-dependent and to apply only to certain focused groups. The third major hypothesis, that diversified banks will have lower standard deviations of returns on assets, is also supported. The results for the hypothesis that diversified banks will hold less capital relative to assets than focused banks, is largely contradicted.

Table of Contents

List of Tables

Chapter One: **Introduction**

1.1 Preamble

This thesis examines the following question in banking: Do the benefits of diversification, with its attendant requirement to be good at many things but perhaps not expert at all of them, outweigh the benefits to specialization where one ostensibly becomes very good at a narrower range of activities, but loses the benefits of diversification?

The motivation of this research is to determine which banker a regulator should believe when deciding how to allocate scarce regulatory resources: – the banker who argues that he or she is protecting the bank's interests by diversifying across a broad range of risks or the banker who argues that he or she is protecting the bank's interests by becoming expert at a relatively narrow range of activities. If regulators can answer this question, they can then determine which banking group – the diversifiers or the focused – they ought to watch more closely.

This exploratory study investigates the relationship between diversification and risk of banks by comparing banks following a focused strategy with ones pursuing a diversification strategy. There are two competing theories about the relationship for banks between risk and diversification. One, based on portfolio theory, predicts that diversified banks will be less risky than focused banks in the same manner that the overall risk of a diversified portfolio of less than perfectly correlated assets will be lower than that of a focused portfolio. The second theory holds that banks focusing on specific market segments will be better at monitoring and screening borrowers and will therefore

be less risky. While the literature on this question includes studies comparing one focused strategy, such as credit cards, with a mixture of other banks, this dissertation examines the relative risk of six different focused strategies. It also compares those six focused groups to a comparator group that includes only diversified banks. This is in contrast to previous studies where the comparator group included both diversified and focused banks.

The findings will primarily be of interest to regulators and central banks since they can potentially contribute to better allocation of supervisory resources and more appropriate intervention strategies such as requiring riskier banks to hold higher levels of capital. As the Chairman of the Federal Deposit Insurance Corporation recently stated her agency "takes a risk focused approach to bank supervision and we are actively concentrating our attention and resources on the areas of greatest risks for the institutions we supervise" (FDIC, 2008). This research could support that type of regulatory strategy since it provides information on the relative risk of different types of strategies.

With this regulator-focused approach this research differs from most in the literature which typically look at diversification from the point of view of the shareholders or, less frequently, management or bondholders. Regulators and central banks are different from shareholders and bondholders because they cannot easily diversify themselves to improve their risks and returns. A better understanding of the risk and return characteristics of banks would be beneficial for regulators and central banks interested in the stability of the banking system due to costs involved with bank failures, the possibility of systemic risk and potential disruptions in the availability of credit.

Deposit insurers concerned with minimizing their losses and assessing premiums according to risk could also benefit.

The relatively low number of failures in recent years has been cited as evidence of declining risk levels in the sector, perhaps driven by better risk management techniques. There were over one hundred bank failures in the US annually during the late 1980's and early 1990's but fewer than ten per year in most recent years (Berger and Mester, 2003). However there are indications that risks facing banks may be increasing again as there were three failures in 2007 and twenty-four in 2008 after two years without a single bank failure. The number of problem banks identified by the FDIC has also increased to 171 at the end of September 2008, from 117 one quarter earlier and as low as 50 in 2006 (Holzer, 2008). Another indication of increasing risk in the banking sector is that the cost of credit default insurance on bank debt has risen substantially, in some cases to as much as twenty times higher than in the summer of 2007 (Rappaport et al, 2008). Research based on stock market volatility also points to increasing levels of risk for commercial banks during the period 1975 to 2005 (Houston and Stiroh, 2006). Further, equity volatility may not capture all relevant types of risks, especially high-severity, low-probability tail events. This means actual risk may be even higher than has been found in the stock market-based literature. The increasing level of bank risk means renewed research on this topic, which has waned in recent years, is becoming more important. The recent upheavals in credit markets and their substantial negative impact on numerous major financial institutions underscore this point.

In recent years the environment facing banks has been transformed. New financial instruments, new participants in the financial sector like hedge funds and innovative technologies including electronic trading have changed the risks facing banks. There has also been a trend away from traditional intermediation towards an "origination and distribution" model. King et al (2006) of the Federal Reserve Bank have stated that "Since 1990 banks have faced significant legislative, financial and technological innovations" yet "research has slowed considerably on the characteristics of banks headed for trouble". One researcher noted that since 1980 "Congress has passed five acts which may be expected to have a significant impact upon the behavior and, hence, the risk and returns of U.S. deposit taking institutions" (Brooks et al, 2000, p 19). The five acts are: the 1980 Depository Institutions Deregulation and Monetary Control Act; the 1982 Garn-St. Germain Depository Institutions Act; the 1987 Competitive Equality in Banking Act; the 1989 Financial Institutions Reform, Recovery and Enforcement Act; and, most recently, the 1991 Federal Deposit Insurance Corporation Improvement Act.

In addition to regulatory changes, other trends point to a continuing evolution in the banking sector, driven by such factors as the introduction of the Basel II capital accord, the growth of the sub-prime mortgage sector, increasing consumer debt levels, greater optionality risks now embedded in mortgage products, the move by banks into different and unfamiliar lines of business, the declining importance of retail deposits (replaced by more brokered and jumbo certificates of deposit), trends towards disintermediation and securitization, the introduction of electronic payments, on-line banking and computer credit-scoring, the growth of mono-line banks in areas like credit cards and the explosive increase in the use of derivatives (King, Nuxoll and Yeager,

2006). The changing environment reinforces the need for an up to date understanding of the risk levels of banks.

There is also evidence that many characteristics of risky banks have changed in recent years (King et al, 2006). For example fee income as percentage of assets in the period 1984 to 1994 was the same for both failing and non-failing institutions while in the 1995 to 2003 period it was much higher at failing banks. In contrast, commercial real estate lending as a percentage of assets was significantly higher at failing institutions in the earlier period but in the later one was essentially the same. This may be an indication that the risk facing banks focusing on this type of loan has decreased. Given the changes in the financial services environment in recent years combined with an apparent increase in bank risk, research on the relationship between banking strategies, risk and returns based on more recent data may be timely.

This is amplified by the fact that bank failures can have substantial societal costs as the financial system safety net, and in particular deposit insurance, makes the government and therefore taxpayers in almost all developed countries the largest creditor of most banks. In an international context, failing banks have been common. Between 1971 and 1997 estimates of the number of countries facing banking crises ranged from sixteen to thirty-six depending on the definition used (Bell and Pain, 2000). The cost of resolving a banking crisis has on average been about 13% of gross domestic product (Beck and Laeven, 2006) but has ranged from 3% of GDP in the US to as high as 50% of GDP in Chile and Indonesia (Chan-Lau and Sy, 2006).

As a result of the substantial size of these costs many countries, including Japan, the United Kingdom and the United States, have adopted laws requiring prompt corrective action by regulators even if the banks are still solvent with assets exceeding their liabilities. Under these laws regulators are required to take timely action against problem banks as experience has shown that regulatory forbearance results in increasing the level of the ultimate loss to the financial system. It has been said that it "is easy to identify a problem bank at the time of its failure. The challenge is to identify a problem bank in time to prevent its failure or at least in time to alter its behaviour in order to limit the losses to the deposit insurance fund" (Shibut et al, 2003). A better understanding of the risk and return characteristics of various bank strategies would assist in this process.

1.2 Research Objective

Specifically I will look at whether the risk of diversified financial institutions with significant lending activity but low levels of asset concentration is lower than that of banks in six different focused peer groups with a large proportion of assets in narrow industry segments including agricultural loans, credit cards, commercial lending, mortgage lending, consumer lending and miscellaneous focused loans. I will also investigate the link, if any, between membership in the different peer groups and risk. In order to better understand the underlying drivers of the level of risk I also examine relative returns, variance of returns and capital levels of the various bank strategies. Finally, I will also investigate the relative risk of banks that switch between the two strategies of focus and diversification.

1.3 Research Format

The primary risk measure in this study will be what is known as the risk index which has been commonly used in the literature (e.g. Hannan and Hanweck (1988), Sinkey and Nash (1993), Boyd et al (1993), Laderman and Kwan, (1999) and Beck and Laeven, (2006)). It is defined as:

$$\text{Risk Index} = [(\Pi / A) + (K / A)] / \sigma_{\Pi / A}$$

where Π is net income, A is total assets and K is total regulatory capital held by the bank. I have chosen this accounting measure rather than a market-based measure because only a very small minority of banks in the United States are publicly-traded[1]. Given the regulatory focus of this study using a measure which is available for all banks has obvious benefits. Further, since certain of the literature indicates that bank size is correlated with risk being available for all banks is an important attribute since smaller banks tend to be privately owned rather than publicly traded. While accounting data may not exactly match economic reality research has shown that accounting earnings and stock market data are statistically positively related (Rivard and Thomas, 1997). Accounting data for banks also have the advantage of being more uniform than that of other industries due to the presence of regulator-mandated reporting requirements.

Returns in this study will be measured relative to total assets rather than relative to equity to eliminate the impact of leverage which for banks can be very substantial. Further, they are a direct measure of management's ability to generate returns on a

---

[1] It is acknowledged that accounting measures may be subject to income smoothing strategies adopted by management. For a discussion, see Rivard (2003), Anandarajan (2007) and Zoubi (2007).

portfolio of assets (Rivard and Thomas, 1997). There is a debate in the literature concerning which accounting based return measure best captures the phenomenon of interest: return on assets or return on equity. In this case, return on assets is a component of the risk index, and we therefore examine it separately. In choosing this approach I am also following Rivard and Thomas (1997) as well as many others. An advantage of the return on asset measure that it avoids the extreme return on equity values that can arise when a bank is very highly levered.

I also control for size and tax status of the banks in the study which almost all of the research in this area does not. The literature review indicates these are important intervening variables which should be taken into account. Finally, my asset measure will include both on and off-balance sheet assets unlike the other papers reviewed which included only on-balance sheet assets. Because off-balance sheet assets have increased substantially in size this is a valuable contribution. In this paper the term bank will be used to refer to any deposit-taking institution. Certain of these, such as savings and loan associations and thrifts, are not legally banks but carry out essentially the same functions of taking deposits and giving out loans and therefore will be included.

The remainder of this research study is presented in the next six chapters. Chapter Two comprises the literature review. The theoretical framework is then discussed in Chapter Three, followed by a description of the research methodology. Chapter Five presents the results both for the aggregate sample, for quintiles based on size and for the focused peer groups. The following chapter discusses those results and this thesis then concludes with a discussion of practitioner applications and areas for future research.

Chapter Two: **Literature Review**

The purpose of this literature review is to consider various approaches to bank risk that have been taken in previous research so that we can: a) appropriately ground this research in precedent, and b) identify clear points of differentiation between this research and earlier research. As a result, this review summarizes the various ways in which the risk index and other accounting- and market-based proxy measures of risk in banks have been utilized by earlier researchers, the relevant literature on the relationship between bank risk and diversification and that covering size and its relationship with bank risk. It also looks at the use of accounting ratios to predict corporate and bank failure.

2.1 Risk Index as a Proxy for the Actual Unobservable Risk of a Bank

The risk index has been widely and regularly used as a proxy for risk in the financial and non-financial literature since Roy (1952). It has commonly also been referred to as the distance-to-default and the z-score but differs from Altman's (1968, 2000) z-score which is a predictor of corporate financial distress based on accounting ratios.

The relationship between levels of the risk index and the degree of involvement in non-bank activities by banks was examined by Boyd and Graham (1986) for the period 1971 to 1983. They found no statistically significant link between the two factors indicating that this type of diversification was not negatively related to risk and in fact during the sub-period of 1971 to 1977 was positively related. Involvement in non-banking activities was measured as the amount of non-bank assets relative to total assets.

Hannan and Hanweck (1988) used the risk index to investigate whether there was, as they expected, a positive relationship between bank risk-taking and the spreads over the default free rate that banks were required to pay to raise large and therefore uninsured deposits. They found that return on assets and the asset to capital ratio have a negative relationship with deposit account spreads while variability in returns was positively related. This conclusion lends credibility to the index as a proxy measure of actual risk since the component ratios seem to be priced as such by market participants.

Eisenbeis and Kwast (1991) used two different measures of risk, the risk index and standard deviation of return on assets, in their comparison of banks focusing on real estate with their more broadly diversified counterparts. They found little difference in results between the two but their sample did indicate that real estate banks, defined as those having more than 40% of their assets in that type of loan, had higher returns with less risk.

In contrast to that study Liang and Savage (1990) found that focused companies had higher risk levels than their diversified control group. Kimball (1997) explained this apparent contradiction by pointing out that Eisenbeis and Kwast (1991) included low risk residential real estate categories that Liang and Savage (1990) did not. Kimball's (1997) study used the risk index and other accounting measures to compare a small sample of banks specializing in small business micro-loans with a diversified peer group matched by size and location and found that the focused group was riskier than the diversified group.

The risk index has been used to compare the risk of banks focusing on credit cards with those pursuing a diversified strategy (Sinkey and Nash, 1993). Credit card banks were defined as those with 75% or more of their assets in these types of loans. They found that the credit card banks were riskier but did generate higher returns than their more diversified counterparts.

Boyd et al (1993) used two different versions of the risk index along with the median standard deviation of return on equity to evaluate whether one thousand simulated mergers in the period 1971 to 1987 between banks and six different types of non-bank financial firms such as life insurance companies would have resulted in riskier combined entities. One of the their risk indices was based on accounting data while the second used stock market data to determine profits, assets and equity levels. They found that mergers with life insurance and property and casualty companies was linked to lower risk but mergers with securities or real estate firms was related to higher levels of risk. Both the accounting and market based measures provided similar results giving credence to the use of accounting ratios as measures of risk.

A similar study using the risk index but covering a later period 1984-98 found simulated mergers of banks with life insurers linked to lower risk levels while those with securities or property and casualty insurers showed slightly higher levels of risk. Similar results were found when the standard deviation of returns on equity was used as the risk measure (Lown et al, 2000).

Another study of mergers (Craig and Santos, 1997) found that the risk index of merged banks was higher than that of the individual merger partners prior to their

amalgamation. They concluded that mergers therefore are on average related to lower levels of risk, possibly reflecting diversification benefits.

Whalen used the risk index in a series of papers (1998, 1999a, 1999b) examining whether the existence of foreign subsidiaries engaged in the securities and insurances businesses was related to the risk of their domestic parents. In the first of these, which looked at securities firms between 1987 and 1996, he found that the overseas subsidiaries were riskier than their domestic bank parents but that a combination of the two exhibited lower levels of overall risk. In the second of the series he reported similar findings for insurance subsidiaries although these were less risky than the securities entities. In the most recent of these studies he again focused on foreign securities subsidiaries but examined the relationship between risk and organizational structure. He found, based on a sample containing 108 different foreign subsidiaries from twelve different countries during the 1987 to 1997 period, that bank-owned subsidiaries were not riskier than those owned by holding companies.

Emmons et al (2004) used the risk index along with the Federal Reserve Bank's risk rank model in their study based on simulated mergers of small community banks. They found that the strongest relationship between risk and type of merger was related to increases in the size of the merged banks rather than from geographic diversification. They attributed this finding to the pooling of idiosyncratic risk being more important than local market risk. Findings for both risk measures were similar. Other observers have commented that this study may not be representative as it was based on a period of time, 1989-1993, when the level of risk facing banks was very high whether measured by the

number of bank failures, the amount of problem loans or standard deviation of returns on equity (Furlong, 2004).

The risk index was used by De Nicolo et al, (2004) in their study of the relationships between bank consolidation, internationalization, conglomeration and financial risk. Based on data from more than one hundred countries, both developing and developed, they found that large conglomerate banks exhibited higher levels of risk in 2000 than smaller and more focused firms. In contrast risk levels were equal five years earlier. Conglomerates were defined as firms operating in two or more business lines such as banking, securities and insurance. Countries where the banking sector was highly concentrated measured by market share held by the five largest banks in each country in the study were also riskier than in less concentrated ones. This trend was evident in 1993 to 2000 but accelerated during 1997 to 2000.

Demirgüc-Kunt et al (2006) used Moody's financial strength rating along with the risk index to measure bank soundness and assess whether it was related to compliance with the Basel Banking Committees Core Principles for Effective Banking Supervision. They found that there was a positive and statistically significant correlation between it and Moody's Financial Strength Ratings giving additional support to the use of the risk index as a proxy for risk.

The risk index was also used by Beck and Laeven (2006) in their study which examined the link between measures of deposit insurance and the institution responsible for bank failure resolution and bank fragility during the period 1997-2003. They found that in countries where the deposit insurer, rather than another body such as the central

bank, had the responsibility of intervening and resolving failures banks tended to be less risky. Their study looked at over 1,700 banks in 57 countries and found a wide variety of risk in banks. Return on assets would have had to fall about fifty times below the average level of profits in the United States to wipe out regulatory capital compared to only two times in South Korea.

Laeven and Levine (2008) used the risk index along with the volatility of equity returns and the volatility of earnings as measures of bank risk in their assessment of the relationship among risk taking by banks, their ownership structure and national bank regulations. They found that regulation has different effects on bank risk taking depending on the bank's corporate governance structure.

De Nicolo and Loukoianova (2007) used the risk index in various panel regressions on a large sample of banks in 133 non-industrialized countries between 1993 and 2004 and showed that there was a positive and significant relationship between it and measures of bank concentration. Further they found this relationship was stronger when type of ownership was considered. They divided their sample into three types of owners: private domestic, state-owned, and foreign and also found that foreign banks were riskier than both private domestic and state-owned institutions. They attributed the higher risk levels of the private domestic banks to the larger market shares of the other two types.

Another study used a slightly different form of the risk index to examine the relationship between ownership and bank risk-taking and performance for 181 large banks from fifteen European countries (Iannotta et al, 2007). Here the capital ratio in the numerator of the index was calculated using the stock market value of equity rather than

the accounting value that has been typically used in other studies and that I use. The ownership types serving as the independent variables included public sector banks, mutual banks and privately-owned banks. The researchers found that public sector banks had higher levels of default risk and mutual banks had lower levels of risk as measured by this variation on the z-score.

While the risk index has its advantages, shortcomings must also be noted. First, it measures risk in a single period of time and therefore does not take into account that higher levels of risk resulting from a sequence of losses over more than one period. It also relies on the accuracy of accounting data which may not be a well-founded assumption since the literature indicates that banks tend to smooth earnings (Beck and Laeven, 2006). Notwithstanding these concerns, the risk index still can be a useful measure of relative risk between groups of banks at a point in time unless there is reason to believe that errors are not uniform across types of firms. There does not seem to be any strong reasons to believe this is the case in our data.

2.2 Alternative Measures of Bank Risk

Both accounting and market-based measures of risk commonly appear in the literature. Accounting-based risk proxies can be divided into two major categories. One is based on earnings or cash flow volatility measures, typically standard deviations of returns on equity or on assets, while the second is based on asset quality. Certain of the studies use accounting ratios drawn from both. It has been said that "Among practitioners risk in banking is typically defined in terms of earnings volatility" (Rajan 2005) and this may be why this is the most common type of accounting risk measure used. The risk index is an example of this type but has the advantages of also

incorporating the level of returns and amount of capital held. The latter serves as a buffer against failure and regulatory takeover.

Wall (1987) used a measure quite similar to the risk index in his investigation of the effect of non-bank subsidiaries on the risk of banking organizations. His dependent variable was identical to the risk index except it used return on equity rather than return on assets in the numerator. This change was made due to difficulty in obtaining data on the amount of assets held by the non-banking subsidiaries. He found that this form of diversification was risk-moderating in the sense that it tended to increase the risk of less risky banks but decrease it for riskier ones.

Liang (1989) used standard deviation of net income relative to assets as her measure of risk. She found that the effects of market concentration on firm profits becomes larger when risk is controlled for and that market concentration for banks and firm risk are positively related which she attributed to local market uncertainty leading to higher concentration and risk levels. The study was based on small banks during 1976 to 1985.

The question of whether corporate structure was linked to higher levels of risk in the savings and loan industry during 1982 to 1988 was examined by Esty (1997). His risk measures were the standard deviation of the time series quarterly return on assets and of the cross-sectional cumulative return on assets. One advantage of this study is it corrected for survivorship bias something not always done in the literature but which was particularly important for the savings and loan industry of this time when failure rates were almost 15%.

Reichert and Wall (2000) used the coefficient of variations of return on equity and assets calculated as the standard deviations of the two measures divided by their mean as their risk measures. They described it as analogous to the inverse of the Sharp ratio except that it does not measure returns relative to the risk-free rate. DeYoung et al (2004) used a different variant of the Sharpe ratio calculating the excess of the return on equity over the risk-free rate divided by the standard deviation of the return on equity. They compared six different groups of banks categorized on the basis of their size and found that medium-sized community banks exhibited higher levels of risk than their larger counterparts.

Berger and Mester (2003) used standard deviations of returns on gross total assets as a measure of risk and found that they have decreased during the 1986 to 1997 time period while returns increased substantially. Gross total assets were calculated as total assets plus loan and lease reserves and reserves for certain foreign loans. The authors believe this to be a superior measure of bank size since, unlike return on net assets, it does not depend on management's evaluation of whether or not loans are performing.

Nichols et al (2005) used earnings volatility relative to both total assets and common equity as their measures of risk in comparing publicly-traded and privately-held banks. Contrary to their thesis, they did not find that the two types of banks differed in terms of their risk measures. They did however find that public ones had lower capital ratios.

Kuritzkes and Schuermann (2006) used the standard deviation of pre-tax net income divided by risk-weighted assets as specified in the Basle I Capital Accord. They

hypothesized that bank risk arises from two major categories, financial and non-financial, further subdivided into five sub-groups: market, credit, structural asset/liability in the first and operational and business risk in the second. Their analysis was based on a sample of over 300 banks from 1986 to 2005 with assets more than $1 billion. They found that credit was linked to almost half of all risk with market sources relating to about 5%. The diversified banks' level of risk was about one-third lower than their focused counterparts.

In examining safety and soundness in US banking DeYoung (2007) used standard deviations of returns on equity. He found that small banks engaged in traditional bank lending with high levels of core deposits exhibited the lowest risk profile while large transaction-oriented banks had the highest. This latter group also engaged in substantial loan securitization and had a high degree of non-interest income.

The second major type of accounting risk proxy is derived from asset quality ratios such as the amount of loan losses or proportion of riskier assets held. Dick (2006) examined the link between charged-off losses and loan loss provisions relative to total loans and deregulation in the form of liberalized interstate banking. As measured by both ratios the level of risk increased. Two different explanations for this finding were put forward. It could have been due to the increased diversification opportunities presented by the deregulation allowing banks to take higher levels of credit risk. Alternatively the higher risk level may have been caused by the increased competition deregulation allowed. Whatever the explanation his findings were in contrast to Jayaratne and Strahan (1996) who found a decrease in risk followed a slightly earlier period of deregulation. They used loan losses as their measure of risk.

In one of the rare studies investigating the relationship between collateral and bank risk Berger and Udell (1990) found that banks with a higher proportion of secured lending also tended to display higher levels of risk. Risk here was measured by the risk premium and the net charge-off rates of loans relative to the total amount of commercial and industrial loans. The risk premium was defined as the annualized loan interest rate minus the rate for a treasury security of equal duration. Net charge-offs are an accounting expense measure reflecting total loans and leases removed from balance sheet because of uncollectability, minus amounts recovered on loans and leases previously charged-off.

Gorton and Rosen (1995) used non-performing loans as a percentage of total loans as their risk measure. Non-performing loans were defined as loans that were more than ninety days past due, non-accruing loans, and other real estate owned which mostly arises from foreclosures. Their study tested a model that explained excessive risk-taking by bank management as resulting from management entrenchment due to their ownership of shares in the bank and found support for their hypothesis.

The second type of asset quality measure uses the amount of riskier assets or liabilities rather than quality measures such as loan loss provisions. O'Hara (1981), for example, used two different ratios as proxies for risk in her comparison of the levels of risk at savings and loan banks organized as stock associations with those formed under mutual depositor ownership. The first of these was the percentage of real estate owned relative to average assets and the other was borrowed funds relative to average assets. Higher levels of bank-owned real estate correlate with risk because they typically arise

from the foreclosure of defaulted mortgages while reliance on borrowed funds is typically riskier than reliance on deposits because the latter are shorter in duration and usually higher cost. As she expected stock companies were riskier than mutual associations.

Fraser and Zardkoohi (1996) found evidence that the corporate structure was linked to higher levels of risk in the savings and loan industry of the 1976 to 1986 period using nine different accounting ratio risk proxies. These included investments in various types of risky real estate and loans along with measures of liquidity, leverage and profitability. Cordell et al (1993) looked at the same question but during the slightly later period of 1981 to 1989 and came to a similar conclusion. The authors used proportional holdings of higher risk real estate, above-average asset growth and low capital as the risk proxies. Size was controlled for through lagged total assets. In addition to holding riskier assets, the stock companies used more leverage and grew faster.

Another study, this time based on data from the United Kingdom, also found evidence that banks owned by stockholders were riskier (Valnek, 1999). This was true when risk was measured by loan loss provisions and reserves but when measured by standard deviation of return on assets there was no difference between corporate-form banks and the mutual building societies which served as the comparator group. The author concluded that while corporate-form banks do not take undue risk, they are not sufficiently compensated for the risks they do take. His conclusions were based on a very small sample of seven banks and seventeen building societies from 1983 to 1999.

Certain studies have used both earnings volatility and asset quality proxies for risk. In a comparison of the risk of publicly held versus privately owned banks Kwan

(2004) used three different accounting risk measures. The first was an asset quality measure, the ratio of past due and non-accrual loans to total loans while the second was an earnings volatility measure; the standard deviation of returns on assets. He also used the ratio of total capital including preferred and common stock and retained earnings to total assets. After controlling for firm size, risk was found to be essentially the same at the public and private banks but the public banks held significantly greater amounts of capital.

Rhodes and Rutz (1982) also used both types of accounting-based risk measures. The primary measure used in their study of the relationship between market power and bank risk was the coefficient of variation of profit rates which was calculated as the standard deviation of return on assets divided by the return on assets but supplementary risk measures included equity capital, total loans and net loan losses all measured relative to total assets. They found support for their "quiet life" hypothesis which held that banks with a high degree of market power measured by their market share pursued a lower risk strategy. The authors controlled for bank size because they postulated that larger banks given their assumed greater product and geographic diversification would tend to hold riskier assets. The study examined 6500 banks during the years 1969 to 1978.

In addition to the two main categories of earnings volatility and asset quality sporadic use has been made of other accounting ratios to proxy for risk. Hirtle (2003) used two different proxies for risk in her study which focused on market risk. The first was the standard deviation of the daily trading profits and losses and the second was the average of the three largest daily trading losses each quarter. She showed that the

regulatory capital required to be held against market risk was predictive of future levels of market risk as she defined it.

Rose (1987) used a variety of risk measures in his study looking at the relationship between mergers and risk where the latter was measured by net loan losses relative to equity capital, which he called loan portfolio risk exposure, total liquid assets to total assets or liquidity risk exposure and interest-sensitive liabilities to earning assets or interest-rate risk exposure. His sample of banks between 1970 and 1980 did not show a decrease in overall risk following the mergers and many of the more specific risk types actually increased. Further, banks which engaged in more than one merger during the period showed even higher levels of increased financial risk than those that participated in a single merger.

Stock and other market-based information have also been used to gauge bank risk. One study of this type showed that diversification into non-banking activities was negatively correlated with risk for bank holding companies (Brewer, 1989). The risk proxy was the volatility of 109 bank holding company stock market returns. His study covering the period 1978 to 1986 also used a variant of the risk index using return on equity rather than return on assets and both measures showed similar results.

Another stock market based study, Gallo et al (1996), demonstrated that diversification into mutual fund activities was linked to a decline in systemic risk after the mid-point of the 1987 to 1994 period. A two factor model including market risk and financial services industry risk variables was used to estimate systemic risk. The sample of 47 bank holding companies was divided into three categories: money centre, super-

regional and regional banks, with all three demonstrating the same shift but with the money centre banks demonstrating it one year earlier. Unsystematic risk did not decline.

Demsetz et al (1997) investigated the relationship between franchise value, ownership structure and risk using the annualized standard deviation of the weekly stock return as their measure of risk. They believed that this measure incorporated risks associated with all of the banks assets, liabilities and off-balance sheet positions, reflected diversification across those positions and also incorporated the impact of leverage. They found that higher franchise value, measured as the ratio of the sum of market value of equity plus book value of liabilities divided by the book value of tangible assets is correlated with lower levels of risk taking. Further, when franchise value is low ownership structure was related to risk but if it was high there was no link.

Keeley (1990) used the margin of the interest rate spread on uninsured deposits as his measure of bank risk. He found that banks with substantial market power, defined as those with higher market to book value ratios, held more capital and were less risky than their counterparts with low market power. This tendency was attributed to managements' reluctance to risk losing their valuable banking charter offsetting the attraction of the deposit insurance put option. He also concluded that increasing competition because of loosened bank regulation in the 1980's was diminishing the value of bank charters and may have been a contributing factor to the high failure rates of that period. While plausible at the time it is hard to reconcile his conclusions with the historically low failure rates of American banks in subsequent years.

In an international context Imai (2007) used the spread on subordinated debt for Japanese banks as his risk measure and found it was correlated, although not strongly, to four key accounting ratios. These ratios measured asset quality, liquidity, earnings and capital.

Certain studies have used both accounting and market based ratios. Acharya et al (2002), in their study of Italian banks during the period 1993 to 1999, used doubtful and non-performing loans relative to assets, the standard deviation of doubtful and non-performing loans relative to assets and the annualized stock return volatility for the publicly-traded banks in their sample. They found that greater loan diversification did not lead to an efficient risk-return trade-off.

The reasons for the higher risk at stock institutions compared to mutual associations were examined by Schrand and Unal (1998). They found that the stock companies engaged in higher levels of hedging to decrease interest rate risk but this was more than offset by higher credit risk. The authors found a link between higher credit risk and incentives such as stock options given to management after the demutualization. In this study total firm risk was measured by stock return volatility while credit risk was measured by the accounting ratio of commercial loans to total loans.

Information provided by stock or credit market prices has advantages because it is available more quickly than accounting data which take time to be produced and is often only available on a quarterly or even less frequent basis. Further, accounting measures are based on historical costs rather than market values and therefore may not reflect contemporaneous economic reality. For a regulatory-oriented study such as this one,

however, those disadvantages are outweighed by the universal availability of accounting-based measures. While various alternative accounting-based risk measures have appeared in the literature, the risk index has advantages in its mathematical link to the risk of failure and its integration of three different key risk ratios into one measure. For these reasons it has been chosen as the primary measure of risk used in this study. A second commonly-used measure, the standard deviation of net income, is also used.

2.3 Diversification and Bank Risk

Stiroh (2004, p. 135) pointed out that although "one might expect diversification to directly reduce risk, recent research for United States banks has been mixed". Overall though, it seems to lean towards the view that a negative correlation between diversification and bank risk exists. The relevant literature can be sub-divided into three types of studies. The first is based on portfolio theory and develops simulated models of what Stiroh (2004) called a "counterfactual exercise of bank combinations with non-banks" or of some other type of diversification-enabling combination. The second type is empirically-based but uses accounting results as the measures of risk while the third type uses market-based proxies for risk.

The earliest research of the first type used industry-level data from the 1950's to the 1970's obtained through the Internal Revenue Service to compare the volatilities and correlations of earnings of banks with other financial industries such as securities firms, insurance companies, real estate brokers, leasing companies and thrift institutions (DeYoung and Roland, 2001). Since the correlations were very low or sometimes even negative, diversification, defined as adding non-bank financial services to their existing banking business was assumed to lower risk.

Winton (1999) suggested that diversification is favoured by the financial intermediation literature while specialization is supported by the corporate finance literature which recommends that bank management focus on a single line of business so as to develop expertise and reduce agency problems leaving investors to diversify on their own. He used the simulated model form of analysis to compare banks' choices between the two strategies and found that diversification is no guarantee of reduced risk. While it reduced risk when loans had moderate exposure to the downside, it did not when exposures were either low or high. Further, his model indicated that since a bank's monitoring effectiveness was likely low when it entered a new area of business, diversification tended to increase risk. In his model bank risk was measured by the value of its debt which in turn was conditioned by its loan allocation between different types of loans.

Allen and Jagtiani (1999) used a similar type of modelling to create synthetic universal banks consisting of a bank, a securities firm and an insurance company to test the relationships with bank risk. They found that the resultant entity had lower levels of overall risk but higher systematic risk when compared to undiversified banks. Risk was estimated by the standard deviation of monthly stock market returns from 1986 to 1994. The securities firm exposed the merged entity to the additional risk while the insurance company had no significant effect. They pointed out that the higher systemic risk meant the diversified banks were more prone to a common economic shock which could impact the entire banking system.

Boyd and Graham (1988) simulated the results of merging bank holding companies with other financial firms including those in the life insurance, property and casualty insurance, insurance brokerage, securities, real estate development and other real estate businesses. Risk was measured by both the risk index and by the standard deviation of the return on equity. His data from 1971 to 1984 indicated that certain mergers were linked with reduced risk but others such as between banks and securities or real estate firms were not.

Laderman (2000) used a very similar methodology to Boyd and Graham (1988) but instead of limiting her sample to 100 possible combinations she used all possible combinations. She also controlled for size and type of business by dividing her sample into small and large banks and into those that are primarily securities brokers and those that provide investment advice. Her data indicated that substantial diversification into life insurance underwriting, casualty insurance underwriting and securities brokerage was related to reduced overall risk. In addition to variability of return on assets the risk index was used.

Smoluk et al (2003) also used this type of modelling with standard deviation of return in equity as their measure of risk and found that New England banks that expanded into various other regions of the US exhibited lower levels of risk. They used portfolio theory to estimate the optimal percentage of capital to be invested in the other regions based on the degree of correlations between the eight regions defined by the Bureau of Economic Analysis.

Simulated bank diversification by direct equity investment in real estate has been shown to have marginal benefits at low levels but result in higher levels of risk when the investment exceeded fairly low levels of concentration (Rosen et al, 1989). Using the standard deviation of return on assets as the measure of risk, the authors found that a trend toward higher risk emerged when the investment in real estate rose above 4% of total assets. Risk and return parameters for real estate were based on market returns for equity real estate investment trusts and from historic accounting returns on direct investment in real estate assets at thrift service corporations.

Portfolio theory has also been used to model potential diversification gains from adding dealing and underwriting of securities to traditional bank powers (Kwast, 1989). He found that some potential gains were possible but that these were limited in size. The measure of risk was the standard deviation of return on assets.

Another application of portfolio theory this time to the impact of diversification into non-interest based banking segments such as fees, fiduciary services and trading found that risk increased while average equity returns did not (Stiroh, 2006). This finding persisted even after controlling for bank size and equity ratios which the authors felt in turn controlled for management skills, internal diversification and leverage. Total risk was measured by the variance of the bank's stock returns and idiosyncratic risk was quantified by the variance of the residuals from a market model. Data was drawn from publicly traded bank holding companies between 1997 and 2004. He concluded that the largest US banks may have become overexposed to activities that generate non-interest

income possibly due to internal agency problems or managerial incentives to expand into newly allowed business segments.

Kwan (1997) used portfolio theory to evaluate the potential risk implications of the addition of securities activities to traditional banking organizations. Using standard deviations of returns on equity and assets as his measure of risk he found that securities subsidiaries were riskier but not necessarily more profitable than their banking parents. For securities firms that were primary dealers of government securities the higher risk levels were associated with higher leverage while for those that were not the higher risk was correlated with aggressive trading behaviour. The subsidiary securities firms appeared to provide possible diversification benefits overall because of low return correlations between them, regardless of primary dealer status, and the banks.

Another study (Reichart and Wall, 2000), also based on a portfolio approach, combined banking industry results with those of six other related industries such as insurance, real estate and securities. Industry data from the Internal Revenue Service was used to demonstrate that while diversification gains were possible, the amount possible varied over time. The authors tried to explain this variability by pointing to the influence of changes in the macroeconomic environment or technology. Risk was measured by the ratio of the standard deviation of return on assets to the mean return on assets for the same period.

In general the studies of diversification that are based on simulations of bank mergers with various types of related non-banking activities have shown mixed results. They indicate that securities activities and insurance agency, and insurance underwriting

are riskier than banking but still have the potential to provide diversification benefits to banking organizations because of low levels of correlation between the banking and non-banking businesses and because they are more profitable. While real estate agency, title abstract activities, and real estate operation are also more profitable than banking, real estate development may not be. Real estate activities are riskier than banking activities in general and the literature provides inconsistent evidence about their diversification benefits for banking organizations (Laderman and Kwan, 1999).

The second type of study on the relationship between diversification and bank risk is based on empirical accounting data. Using this type of information, in the form of overall earnings volatility, DeYoung and Roland (2001) found that increased levels of non-interest income, which can be considered a type of diversification, was linked with higher levels of risk. Their study, based on 472 US commercial banks between 1988 and 1995, found that the increase in risk was at least partially compensated for by increased levels of profits.

Sinkey and Nash (1993) compared credit card banks with their more diversified counterparts and found that credit card banks were riskier but also generated higher returns. This seems to indicate benefits from diversification.

Rivard and Thomas (1997) used a similar methodology to compare interstate banks with their less diversified counterparts operating in only one state and found that this type of geographic diversification was linked to higher profits and lower levels of both insolvency and volatility risk. Their study covered the four-year period 1988-1991 when multi-state banking was first allowed in the US after a long history of prohibition.

Risk measures were the standard deviation of return on assets and the reciprocal of the risk index.

An important area of diversification is the involvement of banks in non-traditional banking activities. Rogers and Sinkey (1999) studied bank involvement in non-traditional activities over the period 1986 to 1993. One of the motivations for their study was to determine whether banks were using non-traditional activities to take on more risk to exploit government guarantees. They find that larger banks tend to be relatively more involved in non-traditional activities and appear to be relatively less risky. Rather than use a direct measure of risk, they infer the banks' risk levels from capital ratios, levels of liquid assets, exposure to interest rate risk, and the levels of loan loss provisions. While Rogers and Sinkey (1999) make the case that banks don't seem to using non-traditional activities to take on more risk, they do not make a direct statement concerning the relative riskiness of non-traditional activities. DeYoung and Rice (2004a) examine data for U.S. banking companies in 1986, 1990, 1995, 2000, and 2003. They find that increased reliance on fee-based activities tends to increase the volatility of earnings and that banks with large fee-based net income appear to be more profitable on an ROA basis because of the lack of balance sheet effects associated with the activities. In a companion study, DeYoung and Rice (2004b) study various banking strategies using data from U.S. Banking companies for the period 1993 to 2003. They find the co-existence of high risk-high return and low risk-low return strategies and conclude that there is a range of financially viable business strategies. Interestingly, they find that very small banks operate at a financial disadvantage regardless of their competitive strategy.

In a more comprehensive study using 1989–2001 data on U.S. commercial banks, DeYoung and Rice (2004c) find that increases in non-interest income occur alongside higher profitability and higher variation in profits, and that his leads to a worsened risk-return trade-off. Similar to Rogers and Sinkey (19990, they find that large banks generate relatively more non-interest income.

More recently, Stiroh and Rumble (2006) study U.S. financial holding companies over the period 1997 to 2002 with a view to determining if their diversification leads them to outperform more concentrated financial institutions. While they find that non-traditional income makes financial holding companies relatively more diversified, the benefits to diversification are more than offset by the increased volatility of such income. In other words, financial holding companies are more diversified, but they are diversified in a relatively riskier source of income.

One of the implications of the articles that examine risk and diversification into non-traditional banking activities is that observed differences between the performance of large and small banks may be attributable to the differential exposure to non-traditional income sources for large and small banks.

Acharya et al, (2002) used both accounting and market based measures of risk to examine diversification and its relationship with bank risk and found that in certain cases there was a positive correlation. Their risk measures included both accounting measures related to bad and doubtful loans as well as annualized stock return volatility. The study was based on industrial, geographic and sectoral exposures of 105 Italian banks between 1993 and 1999. They concluded that there are diseconomies of scale of diversification

for certain banks. Both industrial and sectoral diversification caused increases in risk while geographic diversification caused decreases. There was no difference between moderately and highly risky banks.

Studies using stock market data have given evidence to support the idea that diversification is related to lower levels of risk. Baele et al (2006) used a panel data approach to model the risk-return trade-off of publicly-traded European banks during 1989 to 2004 and found that the markets favoured more diversified banks. Diversity of revenue streams was measured in terms of the ratio of non-interest income to total operating income and the loan to asset ratio. They concluded that "the stock market anticipates that functional diversification can improve future bank profits" (Baele et al, 2006 p. 2001).

Templeton and Severiens (1992) also found support for a link between diversification and lower risk levels although they noted that a small amount of diversification into non-bank activities provided most of the benefits with diminishing marginal benefits quickly becoming apparent. They used three different measures of risk: variance of shareholder returns, regression coefficient for the market factor in their two factor model and regression coefficient for the interest rate factor in their two factor model. The percentage of non-bank assets relative to the market value of total assets was used as the proxy for diversification. In order to answer the question as to the direction of causality or whether diversification leads to lower levels of risk or risk averse management choose to diversify the authors divided the sample into two halves, one with higher risk levels and one with lower. Regression equations were recalculated for both

groups with only the higher risk group reaching significant levels indicating that diversification decreases risk.

Event studies, while commonly used in the finance literature, have rarely been applied to the study of bank diversification. One notable exception examined the abnormal stock market returns around the time of an announcement by banks that they were adopting a legal structure known as a one bank holding company. During 1968 through 1974 in the US this structure was the only one which allowed banks to expand into various non-banking activities in any geographic location (Eisenbeis et al, 1984). The authors examined 78 banks and found that those announcing the adoption of this structure generated excess returns in the few weeks surrounding the announcement date. They attributed this finding to investors favouring the diversification it allowed, presumably because it enhanced the banks risk-return potential.

A second event study examined the impact of announcements that the Federal Reserve Bank would allow certain banks to diversify into investment banking through subsidiaries (Bhargava and Fraser, 1998). Since the literature indicates that securities underwriting, which is a key component of investment banking, is inherently riskier than traditional banking the authors hypothesized that an increase in risk as measured by stock market volatility would be observed following the banks expansion into these types of activities. Changes in total risk were examined by comparing the variance in total stock market returns for sixty days before and after the announcement date and was sub-divided into systematic and unsystematic components. Their data supported the hypothesis of increased risk following the announcement.

The following chart summarizes the research into the link between bank diversification and risk. While not unanimous, overall the conclusion seems to be that a negative correlation between the two exists:

Table 1

Findings in the Literature on the Direction of the Relationship Between Diversification and Risk

Type of Study	Positive Correlation	Negative Correlation	Mixed Results
Simulated Merger	Stiroh, (2006) DeYoung and Roland (2001)	Laderman (1999) Smoluk et al (2003) Kwast (1989) Kwan (1997) Reichart and Wall, 2000	Winton (1999) Allen and Jagtiani (1999) Boyd and Graham (1988) Rosen et al (1989)
Empirical with Accounting Risk Measure		Sinkey and Nash (1993) Rivard and Thomas (1997) Acharya et al, 2002	
Empirical with Market Risk Measure	Bhargava and Fraser (1998)	Baele et al (2006) Templeton and Severiens (1992) Eisenbeis et al (1984)	

2.4 Use of Accounting Ratios for Predicting Corporate Failure

A significant body of research has been carried out on the use of financial ratios for bankruptcy prediction. It largely concludes that a combination of a small number of financial ratios can successfully predict impending failure one or even two years prior to its occurrence. This has been demonstrated both for non-financial corporations and banks. My proposed study focuses on an earlier stage of decline where the bank is engaging in risky activities rather than failure but a review of the failure prediction

literature is valuable because it supports a link between accounting measures and eventual failure.

Beaver (1966), although specifically excluding financial institutions, used six ratios comprising cash flow to total debt, net income to total assets, total debt to total assets, working capital to total assets, current ratios, and the "no-credit interval" which was defined as defensive assets minus current liabilities to fund expenditures for operations. His univariate analysis was able to show predictive accuracy up to five years prior to failure for certain of the ratios examined.

Altman (1968) produced one of the earliest studies that used multiple discriminant analysis to combine accounting ratios to predict corporate bankruptcy and demonstrated that this technique was able to do so quite effectively. He used only five independent ratios representing corporate liquidity, profitability, leverage, solvency and capital turnover to calculate what he called the Z-Score and was able to correctly classify 94% of the original sample and 96% of a secondary sample. He, like Beaver (1966) restricted his sample data to manufacturing companies with financial institutions specifically excluded. Altman cited earlier univariate studies such as Beaver and Merwin which had demonstrated that firms exhibited failure characteristics as much as five years prior to failure but downplayed their results saying "little is mentioned of the true significance of these earlier year results". Supporting his assessment, the accuracy of Altman's multiple discriminant analysis approach diminished substantially for predictions made more than two years in advance.

Altman (2000) later updated and improved his original Z-Score model with the proprietary Zeta model which added cash flow measures to the original five independent variables. This model with seven independent variables is reportedly more effective than its predecessor but given its proprietary nature little supporting information is publicly available.

2.5 Use of Accounting Ratios for Predicting Bank Failure

In addition to predicting corporate failure, accounting ratios have also been shown to be linked to bank failure. Academic and practitioner interest in this area was very high in the 1980's and 1990's coincident with a wave of bank failures in the US but interest has declined in recent years. Techniques examined for combining the accounting ratios in question included discriminant analysis, proportional hazards models, factor analysis and logit regression, trait recognition and neural networks.

The "modus operandi employed in the studies are strikingly similar. A sample of distressed banks is compared with a paired or random sample of healthy banks. Data several years before some critical date (e.g. failure) are gathered and massaged. Financial characteristics are identified, the sample banks are reclassified, and predictions made using holdout samples." (Pettway and Sinkey, 1980). As with corporations, a common finding for banks was that a small number of consistently similar accounting ratios can successfully predict failure.

Altman (1977) used discriminant analysis to develop a model to predict failure for savings and loan associations which are a simple type of American bank concentrating on deposits and residential mortgage loans. He selected 12 of 42 potential accounting ratios;

seven were measures at a single point in time while five were trends comparing ratios at two different points in time. He pointed out that most of the earlier studies including Sinkey (1975) and Altman (1968) used linear discriminant analysis even though the key assumption of equality of group dispersions was not met. He defended the use of the linear method by pointing out that the bias produced is negligible if there is a large separation between the two groups. In contrast to those works however he used a quadratic method. He was able to show that a twelve variable model could predict failure of the savings and loan associations in his sample up to three semi-annual periods ahead of its occurrence.

Sinkey (1978) used discriminant analysis to study the link between the net capital ratio and failure. The net capital ratio consisted of total capital accounts plus the valuation reserve minus all low-quality loans, as classified by the bank examiner all relative to total assets. He found that although most banks with low net capital ratios do not fail, banks that did fail had low net capital ratios sixteen to twenty-two months before failure.

Pettway and Sinkey, Jr. (1980) found that a "dual-screen" early warning system using both accounting and stock market data was very effective in predicting bank failure. The accounting screen developed through multiple discriminant analysis used only two predictor variables:

1. Total operating expenses as a percentage of total operating income
2. Investments as a percentage of total assets where investments consist of all securities plus federal funds sold.

Selection of these two variables was based on the intuition that failed banks are less efficient than ones that don't fail and that they make more loans and accordingly hold fewer securities than their failing counterparts. The model developed was 100% effective in identifying failed banks an average of 66 weeks ahead of failure albeit the test sample was tiny with only six failed institutions. The accounting screen had a very high Type II error however as it identified four of six non-failed banks as failures in a holdout test.

Survival time models such as the Cox proportional hazards models produce estimates of the probability that an entity with a given set of characteristics will survive longer than some specified length of time into the future (Whalen, 1991). While originally developed for medical research, they have been used by various researchers to predict bank failure. This technique not only provides information about whether a bank will fail, but also about the timing of that failure. A further attribute of proportional hazards models is they avoid some of the strong distributional assumptions needed for certain of the other techniques such as discriminant analysis.

Lane Looney and Wansley, (1986) were some of the first to use the Cox proportional hazards model to predict bank failure. They used four accounting ratios from one year prior and were able to demonstrate that a proportional hazards model was as effective in predicting failure as a discriminant analysis procedure and had lower Type one error rates. The predictor variables used were the logs of total capital to total assets, commercial and industrial loans to total loans, total operating expense to total operating income and total loans to total deposits. Their analysis was based on matched samples

based on geographic location, charter status (state or national), size, holding company affiliation and age.

Whalen (1991) also used a Cox model but did not use a matched sample. He found that a Cox model could be built using a relatively small number of predictor variables that could effectively predict failure. Hunter, Verbrugge and Whidbee (1996) examined newly-established savings and loan institutions in the period 1980 to 1984, a time of very high failure rates for this type of institution. They found nine independent variables to be statistically significant precursors to failure.

Estrella, Park and Peristiani (2000) also used the Cox model and focused on the ability of three types of capital ratios to predict failure. They found that while the risk-weighted capital ratio was the most effective over longer time periods, the simpler ratios worked over shorter time frames and thus contain valuable and virtually costless information.

Cole and Gunther (1995) used a slightly different survival method known as split-population survival method. The split population model allows for the possibility that the bank population is divided into two groups which they call the failures and survivors. Using data from December 1985 to predict failure during the period from 1986 to the second quarter of 1992 they found fifteen accounting variables to be statistically significant relative to failure. Effectively, they used seven categories of bank loans to capture the effects of managerial decision-making on asset credit risk.

One of the few studies using non-American data used the Cox proportional hazards model to predict failure during the Columbian financial crisis of the late 1990s

and early 2000s when the number of financial institutions in the country declined from 110 to 57 and total assets in the financial sector went down by 20% (Gomez-Gonzalez and Kiefer, 2007). Two categories of financial institutions were included in this study: banks and finance companies. Using a rich data set with monthly data they found that capital ratios were the most significant predictors of failure while other important variables were bank size and profitability.

The first application of logit analysis to the bank failure prediction problem was carried out by Martin (1977). He examined bank failures from 1970 to 1976 and selected from twenty-five variables chosen for their usefulness as shown in earlier studies. These variables can be subdivided into four main categories; those measuring asset risk, liquidity, capital adequacy and earnings. The author stated that the first category is the reason why banks typically fail while the other three help them to survive those losses. He found that the classification accuracy of the logit and discriminant analysis models to be virtually the same.

Espahbodi (1991) compared the abilities of logit and discriminant analysis models to predict bank failure and, while both yielded good results, the former was better one year prior to failure while the latter was better two years prior. The independent variables differed from those used in most of the other studies. He looked at sources and uses of funds and deposit composition rather than the more common performance-based measures.

Kolari et al (1996) pointed out that potential problems stemming from unmet parameter assumptions for statistical models mean nonparametric classification

procedures are worth looking at. They therefore examined trait recognition which had been used with success in various other fields such as earthquake prediction and oil exploration but never tested prior to this to in a business application. They found that it produced a more stable model which outperformed logit analysis in the prediction of bank failure. The researchers looked at 145 banks that failed in 1986 and over 800 randomly selected non-failed banks. In all, 28 financial ratios were used and classification accuracy was very high at 98.6% two years prior, 99.2% one year prior on the holdout sample for trait recognition compared to 91.2% two years prior, 96.3% one year prior on the holdout sample for the logit model. The ratios found effective were in line with previous research.

The fact that accounting ratios have been consistently linked to bank failure supports their use as a measure of risk. In contrast to this literature on the prediction of bank failure I am proposing to use accounting measures as the dependent rather than the independent variables in order to identify risky banks at an earlier stage of their possible decline into failure.

2.6 Size and Bank Risk

There are theoretical reasons and empirical support for both positive and negative relationships between size and bank risk. On one hand increased size may mean banks can more readily benefit from diversification and from economies of scale for risk management and other areas that may be related to risk levels such as more sophisticated information systems and more advanced internal audit functions. Conversely, increasing size can lead to increased risk because of moral hazard incentives and agency problems associated with managing a larger and more complex organization (Elyasiani et al, 2007).

Large banks may also perceive themselves, and be perceived by others to be "too big to fail" because of their systemic importance and expect to be bailed out by governments if they run into trouble; therefore they may take on excessive levels of risk. The effect is amplified by the existence of deposit insurance if premium payments do not accurately reflect the underlying risk which is the case in the US and in most other countries due to the difficulties involved in pricing deposit insurance. This means that while gains from growth or pursuing risky strategies go to bank shareholders, losses are borne by the government through the deposit insurer. Boyd and Graham (1986) described the payoff facing shareholders of banks with deposit insurance as "Heads we win, tails, the FDIC loses".

Certain research has indicated that larger banks are less risky than smaller ones. Stiroh (2004) reported that for small community banks with less than $300 million in assets, increased size was positively associated with higher returns and lower standard deviation of those returns, which he attributed to benefits from economies of scale or geographic diversification. His findings may not reflect the entire universe of banks however as he looked at only a subset of very small banks.

Economies of scale have also been hypothesized as contributing to a negative correlation between size and risk. An international study on publicly traded banks in 21 industrialized countries for the period 1988-1998 provided support for that hypothesis when insolvency risk was measured with the risk index (De Nicolo, 2000). The only sub-sector where this finding did not apply was to the smallest category of US banks. Purnanandam (2005) also found that smaller banks are riskier. He used a logit model with

failure as the event to be predicted and various accounting ratios including the log of total assets as the independent variables. He also reported that large banks were much more active users of credit and interest rate derivatives than their smaller counterparts which may have reflected better hedging against credit and interest rate risk. The increased usage of these products may be contributed to by economies of scale since larger banks could have more sophisticated risk management functions and be better equipped to utilize and afford them.

Other but fewer researchers have reported some evidence that size and risk are positively related. De Nicolo et al, (2004) found that large financial conglomerates exhibited a higher level of risk in 2000 than their smaller counterparts; this trend was not apparent in 1995. They attributed the 2000 result to moral-hazard incentives outweighing the potential risk-reducing impacts of economies of scale and scope and through geographic and product diversification possibilities. In 2000 the larger financial firms had both higher levels of assets relative to capital and larger standard deviations of returns on assets. Results were the same for sub-samples of banks from the US, Japan and Western Europe. This signals a change from the observations of Berger and Mester (1997) who used data from 1990 to 1995. They concluded that larger banks can appear more profit efficient because of the large equity base they have accumulated relative to asset levels. These comments on size effects suggest it is important to control for size in studies of banks in which measures of profitability and leverage are important.

Boyd and Graham (1996) also found that larger banks are riskier than smaller ones. When failure was broadly defined as including those banks which are in receipt of government funds in any form of bailout the large American bank failure rate was much higher in both 1971 to 1978 and 1979 to 1986 while small banks failed more commonly

from 1987 to 1994. In the overall period of 1971 to 1994, though, the large bank cumulative failure rate was also higher at 17% compared to 12% for the smaller banks. The authors theorized that the too big to fail doctrine may play a role in explaining these findings.

Other studies contradict the importance of the too big to fail factor. Benston et al (1995) theorized that mergers may be driven by the desire to diversify earnings in an attempt to generate higher levels of cash flow relative to risk rather than trying to become too big to fail. Their study based on 302 mergers between December 1981 and July 1986 found support for this hypothesis in a negative relationship between the purchase premium and the target's contribution to the risk of the merged entity. This contradicted the alternative hypothesis of a positive relationship if the motivation was to increase risk and thus return to take advantage of the deposit insurance subsidy and/or to make the merged entity too big or important to fail. Risk in this study was operationalized as the variance of the target's return on assets and its covariance with the acquirer's return on assets, both measured prior to the merger.

Craig and dos Santos (1997) theorized that if the primary motive behind acquisitions was to reduce risk they would find lower levels following the acquisition. Using various measures of risk, including the risk index and the standard deviation and coefficient of variation of both returns on equity and returns on assets, they showed that the combined organizations that emerged after the acquisitions were finalized were less risky than before and that this trend improved over time. They concluded therefore, that risk reduction, rather than becoming too big to fail, was the primary motivator for the

acquisitions. Their other risk measures yielded conflicting conclusions which the authors attributed to statistical and methodological issues. The study was based on 256 acquisitions carried out by American banks between 1984 and 1993.

Ennis and Malek (2005) developed a simple model of the "too big to fail" effect and examined whether its implications were supported by empirical evidence. They hypothesized that "large banks that are riskier ex ante, are also more likely to perform poorly ex post" as these banks, encouraged to take risks, would have a larger variance of returns and thus be more likely to fail. Overall their findings were inconclusive with the data from certain time periods supporting their hypothesis while data from other periods contradicting it.

Contrary to the too big to fail hypothesis which implies that because of the implicit government subsidy large banks should be able to out-perform smaller ones, Boyd and Gertler (1994) found a robust negative correlation between size and performance in a panel of US banks in the period 1984-91. They concluded that "large banks were mainly responsible for the unusually poor performance of the overall industry".

Ennis and Malek (2005), however, looked at the period 1992 to 1993 and found opposite results. Return on assets was related positively to size, increasing reliably between each of their six size categories ranging from under $50 million in assets to over $10 billion. A further finding was that the variance of return on assets declined significantly after 1991 for all size categories. Before that time banks with more than $10 billion in assets had higher variance than those with between $1 billion and $10 billion.

Demsetz and Strahan (1997) found that larger bank holding companies were more diversified but this did not result in lower levels of risk as they also held lower levels of capital and higher levels of risky commercial and industrial loans than did their smaller competitors. They measured diversification by decomposing stock return variance into systematic and firm-specific risk and then assuming that diversification is negatively related to firm-specific risk. Boyd and Gertler (1994) looking at an earlier period, 1983 to 1991, reported similar findings with large banks, especially those with over $10 billion in assets, holding substantially lower levels of capital relative to the industry mean. They also found a u-shaped pattern in the loan loss provision ratio with the largest banks performing worst on this measure. Large banks were also riskier on the liability side of the balance sheet depending more heavily of volatile money market instruments rather than the more stable core deposits that smaller banks relied on.

It appears possible therefore that size is a confounding variable in the relationship between diversification and risk and may also be related to the other component ratios of the risk index. Overall the literature is not unanimous but leans towards larger banks being less risky because of higher profits and lower variability in those profits but holding lower capital levels. Accordingly size will be a control factor in this study.

Chapter Three: **Theoretical Framework and Research Hypotheses**

3.1 Theoretical Framework

The standard theoretical view is that diversification is negatively related to risk in banks. This is based on portfolio theory, which says that the variance of returns of a diversified portfolio of less than perfectly correlated financial assets is lower than that of a focused portfolio. For banks, it suggests that the expected level and variability of their return on assets is related to the mix of assets held, and that a portfolio of cash-flows from less than perfectly correlated sources should be more stable than its constituent parts (Baele et al, 2006). Cerasi and Daltung (1998) have pointed out that in credit markets where information is asymmetrically distributed, banks have two primary functions: to evaluate projects, and to monitor borrowers. As a consequence, bank assets are indivisible and illiquid. Diversification enables the bank to finance illiquid assets with liquid liabilities. Hence, through diversification, the bank can provide liquidity services to investors.

Other theorists have concurred. Boyd and Prescott (1986) stated that the optimal organization of a bank is one where it is as diversified as possible. Similarly Diamond (1984, p. 409-10) wrote that "the delegated monitoring model predicts well-diversified financial intermediaries with a capital structure that is mainly debt (deposits), with despite this high leverage, a low probability of default." This conclusion, again, was based on banks acting as delegated monitors of their borrowers utilizing both public, and unlike most other stakeholders, non-publicly available information. Bank monitoring includes estimating the borrower's potential cash flows, its balance sheet and the quality

of its management. This may require considerable expertise and experience although in practice it often devolves into verifying whether the borrower complies with loan covenants, which are typically accounting ratios such as solvency or cash balance tests (Holmstrom and Tirole, 1997). Diversification, according to Diamond, reduces the costs of providing a bank with incentives to monitor borrowers, as there are economies of scale in screening and monitoring costs allowed by diversification.

Cerasi and Daltung (1998) expanded on Diamond by theorizing diversification only improves the incentive of the banker to monitor if the bank is debt financed. If the liability structure is all equity, diversification fails to do so. Since almost all banks today are highly leveraged, this argument does not materially weaken Diamond's prediction of well-diversified financial intermediaries.

Their intuitive explanation is that with debt, an increase in returns generated by more diligent monitoring causes a larger share of the profit to accrue to the banker. In contrast, with all equity financing, the share of the profit accruing to the banker is invariant. Another way of saying this is if the banker has to share increased profits from monitoring with other equity holders, the banker will have less incentive to expend resources on monitoring. If he is the sole owner, in contrast, financing the lending with debt, diversification increases his incentive to monitor. Since diversification means financing a large number of projects, the Law of Large Numbers means the probability of a positive return on the portfolio is increased. Cerasi and Daltung (1998) only considered the possibility of taking on more projects as a way to increase diversification but did note

that an alternative way to reduce monitoring costs is to specialize, thus gaining efficiency.

Other theorists have put forward a more complex relationship between informational economies of scale, diversification, and risk (De Nicolo, 2000). Winton (1999) showed that diversification can be positively related with insolvency risk when certain structures of monitoring costs exist and there are skewed loan return distributions. The quality of monitoring and project evaluation play an important role in the theory supporting the view that a focused strategy rather than a diversified one is related to lower levels of risk. This arises from questions about how effectively banks can carry out these activities when they expand their lending portfolio into new and unfamiliar markets. While even the most effective monitoring cannot increase net income, since the amount of interest received on a loan is usually fixed, it can reduce the frequency and severity of the downside. It is likely that a bank entering a new market will be less skilled at monitoring and project evaluation than in more familiar industries. There are three reasons why this may be the case. First, bank personnel may lack an understanding of the risk drivers of the new sector. Second, if other banks are already effectively serving this market the new entrant may be exposed to the winner's curse. Finally, expansion into the new sector may mean the bank increases in size which could lead to scale inefficiencies. (Acharya et al, 2002).

The potential increase in risk relative to returns from diversification can also occur because certain sectors offer lower returns from monitoring due to factors such as low levels of collateral or the newly entered jurisdiction having fewer creditors' rights

(Winton, 1999). Although most of the theoretical literature focuses on monitoring, banks also screen borrowers and structure loans when underwriting, and most of the same arguments supporting the case for specialization, because it leads to better monitoring, can also be applied to these aspects of the lending process. Better screening means a superior ability to distinguish between higher and lower risk borrowers leading to lower credit write-offs and workout costs.

Overall therefore, the question of whether diversification is linked to higher or lower levels of risk is not totally clear. For the most part, however, the literature theorizes a negative relationship between the two although there may be structural reasons leading to a different result.

3.2 Research Hypotheses

In this study four different hypotheses will be tested. The first one is that diversified banks are less risky than banks in the focused peer groups with a large proportion of assets in six narrow industry segments (i.e. agriculture, credit cards, commercial lending, mortgage lending, consumer lending and miscellaneous focused). This definition of focus has been chosen because it aligns with the groups utilized by practitioners such as the FDIC. Further details on the definition of these groups are provided below.

The primary risk measure is the risk index. It is defined as:

$$Risk\ Index = \frac{[(\Pi/A) + (K/A)]}{\sigma_{\Pi/A}}$$

where Π is net income, A is risk-weighted assets which include all assets owned by the institution including cash, loans, securities, bank premises and other assets and also off-balance-sheet assets. Net income is net interest income plus total non-interest income plus realized gains or losses on securities and extraordinary items, less total non-interest expense, loan loss provisions and income taxes. Π / A, therefore, is referred to as return on assets in this paper and $\sigma_{\Pi / A}$ is the standard deviation of the return on assets. K represents total regulatory capital held by the bank which is the sum of Tier 1 and Tier 2 Capital. Tier 1, or core capital, includes common equity plus non-cumulative perpetual preferred stock plus minority interests in consolidated subsidiaries less goodwill and other ineligible intangible assets. The amount of eligible intangibles, such as mortgage servicing rights, that can be included in core capital is limited in accordance with supervisory capital regulations. Tier 2 capital includes less permanent forms of capital such as loan-loss reserves and subordinated debt. K / A is referred to commonly in the literature and by practitioners as the capital-asset ratio and that terminology will also be followed.

The higher the risk index the greater is the equity capital and average level of returns available to cushion against a loss relative to volatility of returns. This means the probability of failure is lower. The risk index has the advantage of combining in a single measure profitability, leverage, and return volatility. It increases when profitability and the capital held by the bank relative to assets go up and decreases when profit volatility increases. In this research, both the measure itself and its underlying components will be analyzed, and the impact of bank size and tax status will be controlled for.

Hannan and Hanweck (1988) explained their derivation of the risk index by pointing out that insolvency for banks occurs when current losses exhaust capital or, equivalently, when the return on assets is less than the negative capital-asset ratio. They go on to show that the probability of insolvency is:

$$p \leq (½)\, \sigma^2 / [\, E\,(\Pi / A\,) + \mathrm{K} / \mathrm{A}\,]^2$$

The ½ in this inequality accounts for the fact that failure occurs only in one tail of the distribution. Further details on the relationship between the risk index and the probability of bankruptcy are included in Appendix I. If profits follow a normal distribution then the risk index is the inverse of the probability of insolvency. It measures the number of standard deviations that a bank's return on assets has to drop before equity is wiped out (Beck and Laeven, 2006). Because of this relationship, the risk index has sometimes been referred to as the probability of failure (see, for example, Laderman and Kwan, 1999).

Even if returns on assets are not normally distributed, the risk index is still useful for relative comparisons (Boyd et al, 1993). It likely underestimates the true probability of bankruptcy since, by definition, it assumes failure only if one-period losses exceed a bank's total capital. Realistically though, banks experiencing losses of a much smaller scale could experience liquidity problems, creditor runs and regulatory interventions (Boyd and Graham, 1986).

The next three subsidiary hypotheses are based on the sub-components of the risk index- return on assets, standard deviation of return on assets and the capital to assets ratio- and are examined to better understand the underlying drivers of the aggregate risk

level. The second hypothesis is that the diversified peer groups will have lower returns on assets than the focused ones as was found by Sinkey and Nash (1993). I will also compare the focused and diversified peer groups in terms of the standard deviation of return on assets. The third hypothesis is that the diversified peer groups will have a lower standard deviation of returns on assets. Finally, a comparison of the capital-asset ratios of different groups will be made. Following Boyd and Gertler (1994), the fourth hypothesis to be tested is that the diversified group holds less capital relative to assets than the focused group. Banks that switch between strategies will be considered as a separate group and, as such, will also be compared with the diversified group. It is hypothesized that these banks will have the same position relative to the diversified banks as do the focused banks on all four comparisons since they pursue a focused strategy for at least part of the time during the period under study.

The four hypotheses therefore are:

> **H_1:** Total risk, as proxied for by the risk index, is lower for the diversified groups than for the focused groups and the switchers;
>
> **H_2:** Returns measured relative to risk-weighted assets are lower for the diversified groups than for the focused groups and the switchers;
>
> **H_3:** Volatility risk, as proxied for by the standard deviation of return on assets, is lower for the diversified groups than for the focused groups and the switchers;
>
> **H_4:** The capital-asset ratio is lower for the diversified groups than for the focused groups and the switchers.

Size will be controlled for since theory, and certain of the literature, indicate that size affects the components of the risk index. McAllister and McManus (1992), for example, support Boyd, Graham and Hewitt's 1993 finding that the risk index is

uncorrelated with bank size, but as size increases, return on assets and the capital ratio decrease, and the variance of return on assets declines. Demsetz and Strahan (1997) also found a relationship between size and capital ratios with larger banks operating with lower capital ratios. One of the contributions of this study is that size, measured by total assets, is taken into account. Another contribution is that banks organized as tax-free S-Corporations under the American tax code are not included in the study sample. This type of bank will show higher levels of returns and variances of returns on assets, ceteris paribus, since they do not pay income taxes. Thus the accounting data on which this analysis is based is not directly comparable between those banks and the majority of banks which do not qualify for this type of status. Further, the diversified group contains only diversified banks rather than banks carrying out different types of focused strategies as in Sinkey and Nash (1993) and Eisenbeis and Kwast (1991). This dissertation also looks at the switchers as a separate group, which has not been done in any of the previous research.

Chapter Four: **Research Methodology**

For each quarter-end for the period from December 31, 2001 to December 31, 2007 four different data values were obtained for each bank: net income for that quarter, average assets, average risk-weighted assets and the total risk-based capital ratio at the end of the quarter. Return on assets is defined as annualized net income after taxes and extraordinary items for the quarter as a percent of average total risk-weighted assets during the quarter. It includes extraordinary items and other adjustments, net of taxes. Risk-weighted assets are assets adjusted for risk-based capital definitions which include on-balance-sheet as well as off-balance-sheet items multiplied by risk-weights that range from zero to one hundred percent. A conversion factor is used to assign a balance sheet equivalent amount for selected off-balance-sheet accounts. The risk-weights and conversion factors are those stipulated by the Bank for International Settlements, and used by regulators in major industrialized countries. This study uses risk-weighted assets for a variety of reasons. First, modern banking involves a material amount of transactions that are entered into, and positions held that are recorded off-balance sheet. The Bank for International Settlements specifies a protocol for taking account of these positions in the determination of bank capitalization, and it seems sensible on the face of it to do so. Moreover, the risk measure used in this study is based on risk-weighted assets, and the approach follows the precedent of many researchers, including Kuritzkes and Schuermann (2006), and Estrella, Park and Peristiani (2000), with the latter finding that the risk-weighted capital ratio was the most effective measure for predicting bank failure over longer time periods. Finally, this study is intended to inform bank regulators, many

of whom use risk-weighted assets as their reference point. This study is therefore consistent with current practice in the regulatory community in the United States, and other jurisdictions. Quarterly returns on risk-weighted assets and the total risk-based capital ratios were calculated as the mean of the quarterly observations during the twenty-four quarter study period for each bank. Similarly the standard deviation of return on assets was based on the quarterly observations of returns during the twenty-four quarter study period for each bank and the mean of the observation as discussed above. The following table shows the identifiers used by the FDIC Statistics on Depository Institutions for each of the data points.

Table 2

FDIC Identifiers for Data Points

Data Point	**Statistics on Depository Institutions Identifier**
Quarterly Net income	NETINCQ
Total risk weighted assets	RWAJ
Average total assets	ASSET2
Total risk-based capital	RBCRWAJ

To control for bank size I have also compared matched quintile sub-samples based on average assets during the entire period and compared the full sample of diversified banks to sub-samples of size-matched focused banks and switchers. The banks in the latter two sub-samples consist of the one focused bank and one switcher closest in size to each of the banks in the diversified group For the sample as a whole, for each of these size-stratified quintiles and for the size matched sub-samples, I tested the major hypothesis that the focused peer group is riskier than the diversified one and the one that switches between strategies using the non-parametric Mann-Whitney *U* Test

as in Kwan (2004). Although originally proposed only for comparisons of samples of equal sizes, it was extended to arbitrary sample sizes by Mann and Whitney (1947). I have also used the same statistical test to compare the peer groups on the three other hypotheses, which focus respectively on returns on assets, standard deviations of the returns on assets, and capital-asset ratios, and to compare each of the focused sub-groups with a size-matched sample of diversified banks. Finally each of the six focused peer groups is compared to a set of diversified banks matched by asset size and to each other. The idea of using a t-test was considered but rejected because of severe non-normality for the variables.

The Mann-Whitney *U* Test assumes independent samples, continuous or discrete random variables, and similar distributional shapes including equal variances (Sheskin, 2004). There is no evident reason to believe that there is dependence between the samples in this research, and inspection of the data and boxplots did not reveal dissimilar distributional shapes. A Levene test of equal variances was carried out, and while the hypothesis of equal variances could not be rejected for return on assets, standard deviation of return on assets, and the assets to capital ratio, it was rejected for the risk index. The risk index in log units could not be rejected though, and accordingly this measure was used instead of the raw risk index for the statistical tests described below The Mann-Whitney *U* Test is a test of rank order – it is only the rank of observations that enters the calculation of the statistic. As a log transformation of observations does not alter the rank of the observations it does not alter the outcome of the statistical calculation. In its most general application, the Mann-Whitney *U* Test is a test for differences in distribution. If the distributions enjoy similar forms, in practice taken to

mean similar variances, then the test can also be considered a test of location. Transformation resulting in an inability to reject the hypothesis of equal variances contributes to one's justification for considering the test as a test for location of distributions[2].

The Mann-Whitney *U* Test also works best if there is a limited number of ties in the data. Leach (1979) provided a guideline of a maximum of 25% for the test to be viable and the proportion of ties in this data was significantly less than that limit.

---

[2] It is acknowledged that similarity of variances is only part of what is required to achieve similarity of distributional forms.

Chapter Five: **Data**

Data for the study were obtained through the Statistics on Depository Institutions website of the Federal Deposit Insurance Corporation at www2.fdic.gov/sdi/index.asp. This database includes balance sheet, income statement, condition and performance ratios, and demographic information for all federally regulated American banks, trust companies and savings and loan institutions. There are four federal regulators in the United States:

1. Federal Deposit Insurance Corporation (FDIC) - Responsible for state-chartered banks that are not members of the Federal Reserve System, and state chartered savings banks.
2. Federal Reserve Board (FRB) - Responsible for state-chartered commercial bank members of the Federal Reserve System.
3. Office of the Comptroller of the Currency (OCC) - Responsible for nationally chartered commercial banks.
4. Office of Thrift Supervision (OTS) - Responsible for federally chartered savings and loan associations, federal savings banks, and state-chartered savings and loan associations.

Information covers quarters ending from December 31, 2001 to December 31, 2007. An advantage of this twenty-four quarter time period is that the findings should not be driven by cyclical events since it includes both an economic contraction from March to November 2001 and then a subsequent expansion (Hall et al, 2003).

Following Sinkey and Nash (1993), banks were tested to identify those where the negative return on assets was more than twice the risk-based capital ratio. In that earlier study, these banks were eliminated because it was feared that inclusion of such banks might distort certain aggregate financial ratios since they were in severe economic distress.

In this data set no such banks existed. The following table shows the banks in the study with returns on capital worse than negative 15%.

Table 3

Banks with Returns on Assets Worse than Negative 15%

Name	Mean Return on Assets for the Period (%)	Capital to Assets Ratio (%)
First Electronic Bank	-96.7	173.9
National Advisors Trust Company	-82.8	232.7
The MassMutual Trust Company	-68.0	2,200.1
INA Trust,	-54.7	215.6
Auto Club Trust	-47.2	513.5
Guardian Trust Company	-35.0	230.3
MMA Trust Company	-22.3	210.3
TIAA-CREF Trust Company	-21.4	175.1
Fiduciary Trust Company International	-20.5	32.6
Young Americans Bank	-17.0	36.3
Northwestern Mutual Wealth Management	-15.2	263.7

These eleven banks had returns on assets of less than negative 15%, but all of them held capital of more than 32% of risk-weighted assets so did not meet the criteria for elimination. To avoid the impact of failures and new bank start-ups on data consistency, only banks that had the same FDIC number and had information available for all quarters in the observation period were included in this study.

Prior to eliminations due to these conditions the number of banks in the FDIC database by fiscal quarter ranged from 9,620 to 8,533 with 7,668 in existence for the full period. This was a period of consolidation in the banking industry with the number of banks declining in every quarter from the 9,620 in existence at December 31, 2001.

Banks organized as tax-free S-Corporations under the American tax code were eliminated as discussed in Chapter 3. After the 2,409 banks of this type were eliminated 5,259 banks remained. The largest was JP Morgan Chase Bank with $873 billion in average assets, and the smallest was Oakwood State Bank of Oakwood Texas with only $2.3 million in assets. The following table lists the banks with average assets over $100 billion during the study period.

Table 4

Banks with Average Assets During Period Over $100 Billion

Name	Average Assets ($ Billions)
JP Morgan Chase Bank	873
Bank of America	866
Citibank	709
Wachovia Bank	410
Wells Fargo Bank	315
Washington Mutual Bank	281
U.S. Bank	196
SunTrust Bank	144

The dataset of banks skews towards smaller banks with 99% having less than $20 billion in assets.

Table 5

Number of Banks in Various Asset Size Categories

Assets	Number of Banks	Percentage of Sample
Less than $1 Billion	4804	91.35%
Over $1 Billion to $2 Billion	201	3.82%
Over $2 Billion to $3 Billion	59	1.12%
Over $3 Billion to $4 Billion	34	0.65%
Total less than $4 Billion	**5098**	**96.94%**
Over $4 Billion to $8 Billion	61	1.16%
Over $8 Billion to $12 Billion	28	0.53%
Over $12 Billion to $16 Billion	13	0.25%
Over $16 Billion to $20 Billion	8	0.15%
Total less than $20 Billion	**5208**	**99.03%**
Over $20 Billion to $40 Billion	24	0.46%
Over $40 Billion to $60 Billion	8	0.15%
Over $60 Billion to $80 Billion	6	0.11%
Over $80 Billion to $100 Billion	5	0.10%
Over $100 Billion	8	0.15%
Total	**5259**	**100.00%**

The group of banks with less than $20 billion in assets skews towards even smaller banks and the same trend is apparent for even smaller banks with less than $4 billion in assets. Those smallest banks with less than $1 billion in assets constitute fully 91% of the dataset.

The lowest risk bank had a risk index score of 506.28 while the riskiest bank scored only 0.29. The mean and median respectively for this measure were 68.19 and 55.86. The overall dataset for the risk index skewed towards lower scores, although not to the same extent as it did for asset size.

Table 6

Categorization of Banks
By Risk Index Score

Risk Index Score	Number of Banks	Proportion of Sample
Less than 100	4240	80.624%
Over 100 to 200	881	16.752%
Over 200 to 300	117	2.225%
Over 300 to 400	16	0.304%
Over 400 to 500	4	0.076%
Over 500	1	0.019%

The FDIC divides the universe of American banks into six focused peer groups and three diversified peer groups. The focused peer group categories include those banks with concentrations of certain types of loans greater than specified thresholds detailed below. A bank is considered to be diversified if it does not meet any of these asset concentration thresholds. Banks in any one of the focused peer groups for all quarters during the period are considered to be following a focused strategy while banks in any one of the three diversified groups for all quarters during the period are classified as pursuing a diversification strategy. Banks that changed from focused to diversified or vice versa were placed in a third group and are called "switchers." Based on this division, there are 194 diversified banks, 3,539 focused ones and 1,526 switchers.

The first of the six focused groups using the applicable practitioner definition is the agricultural group comprising banks having agricultural production loans plus real estate loans secured by farmland in excess of 25 percent of total loans and leases. There are 607 banks that qualify. The credit-card peer group includes all institutions with credit-card loans plus securitized receivables in excess of 50 percent of total assets plus

securitized receivables. 18 banks are in this group. The commercial lending specialists included 1,851 banks, where commercial and industrial loans, plus real estate construction and development loans, plus loans secured by commercial real estate properties were in excess of 25 percent of total assets. The 444 mortgage lenders include those banks that had residential mortgage loans, plus mortgage-backed securities, in excess of fifty percent of total assets. There were 16 consumer lending banks defined as those with residential mortgage loans, plus credit-card loans, plus other loans to individuals, in excess of fifty percent of total assets. The final focused group consisted of the 82 miscellaneous institutions with assets less than $1 billion and with loans and leases less than 40 percent of total assets. These banks depend on fee income rather than interest for most of their revenues. Finally there were 521 banks that were in one of these focused categories throughout the whole period but not always the same one. They are included in the aggregate, quintile and size-matched comparisons below but not in the comparisons to the other focused groups. The following table summarizes the key characteristics of the peer groups following a focused strategy.

Table 7

Sample Size and Definition of Focused Groups

Focus	Number of Banks	Criteria for Inclusion
Agricultural	607	Agricultural production loans plus real estate loans secured by farmland in excess of 25 percent of total loans and leases.
Credit Cards	18	Credit-card loans plus securitized receivables in excess of 50 percent of total assets plus securitized receivables.
Commercial	1,851	Commercial and industrial loans, plus real estate construction and development loans, plus loans secured by commercial real estate properties in excess of 25 percent of total assets.
Mortgage	444	Residential mortgage loans plus mortgage-backed securities in excess of fifty percent of total assets.
Consumer	16	Residential mortgage loans plus credit-card loans plus other loans to individuals, in excess of fifty percent of total assets.
Miscellaneous Focused	82	Assets less than $1 billion and with loans and leases less than 40 percent of total assets.
Focused but change groups	521	Banks in one of the above categories for the entire period but not always the same one.
Total Number of Focused Banks	3,539	

The first of the three diversified peer groups contains multi-national banks with assets greater than $10 billion and more than 25 percent of total assets in foreign offices. Only two banks meet this definition: JPMorgan Chase Bank and Citibank. The FDIC subdivides the remaining diversified banks by size into two groups. The first contains 174 banks with assets less than $1 billion that do not meet any of the focused definitions

above. They have significant lending activity with no identified asset concentrations. The second diversified group also does not meet any of the focused group definitions and the banks in it have total assets greater than $1 billion. It has 11 banks.

Table 8

Sample Size and Definitions of Diversified Groups

Group Name	Number of Banks	Criteria for Inclusion
International	2	Assets greater than $10 billion and more than 25 percent of total assets in foreign offices.
Less than $1 Billion in Assets	174	Assets less than $1 billion and significant lending activity with no identified asset concentrations.
More than $1 Billion in Assets	11	Assets more than $1 billion and significant lending activity with no identified asset concentrations.
Diversified but change groups	7	Banks in one of the above categories for the entire period but not always the same one
Total Number of Diversified Banks	194	

Size ranges for the three groups are reflected in the following table:

Table 9

Size Ranges for Aggregate Groups

Average Assets During the Study Period	Diversified	Switchers	Focused
Smallest Bank	$10.3 million	$2.0 million	$2.4 million
Largest Bank	$872.6 billion	$866.1 billion	$281.3 billion

In the size quintile comparisons all banks with assets less than $10.3 million or more than $281.3 billion were eliminated as banks outside of that range did not have counterparts of the same size in all three groups. Quintiles were then formed by sub-dividing the group with the fewest members, the diversified banks, into fifths and including those banks of comparable size from the other two groups into the comparative quintiles. Again, it is important to note that these eliminations apply only to the quintile comparisons discussed below. In the comparisons of the aggregate groups and the comparisons of the different focused groups all banks are included. As a result of this procedure the quintile categorization was as follows:

Table 10

Number of Banks in Asset Size Quintiles

Quintile	Assets	Number of Banks		
		Diversified	Focused	Switchers
1	$10.3m-$44.7m	38	496	262
2	$45.3m to $79.0m	38	455	256
3	$79.2m to $113.4m	38	379	196
4	$114.2m to $216.9m	39	744	303
5	$223.6m to $281.3b	39	1,375	455
Total		192	3,449	1,472

In the size-matched comparisons each bank in the diversified group, the smallest of the three groups, was matched with the focused bank and switcher which was closest in size to it. The two largest banks in the diversified group, with average assets of over $708 billion, did not have counterparts of comparable size in the other two groups and therefore were discarded from the data set used in this comparison.

Chapter Six: **Results**

The following sections provide summary data and the results of the statistical tests for each of the four hypotheses. For ease of reference, the relevant hypothesis is repeated at the beginning of each section. Each hypothesis is tested by comparing diversified banks to two different comparator groups: the focused banks and the switchers[3].

The comparisons are done in the following ways:

a) The entire sample: The group of all diversified banks versus a group comprised of all the focused banks versus a group comprised of all the switchers;
b) The entire sample divided into quintiles by asset size: The group of all diversified banks versus a group comprised of all the focused banks versus a group comprised of all the switchers;
c) The entire sample of diversified banks versus the entire sample of the six focused groups of banks;
d) Each of the six focused groups versus a size-matched subset from the diversified group. Size matching is based on total assets.

Each section comprises four sub-sections. The first sub-section reports the results of the test for the entire sample, the quintiles by size and the size-matched sample. The second sub-section reports the results of the tests comparing each of the six focused groups to the entire sample of diversified banks and the third sub-section covering the results of the tests comparing the diversified banks to the size-matched sub-samples of focused banks. The final sub-section summarizes the findings for each of the four hypotheses.

---

[3] Recall that switchers are banks that changed from focused to diversified or vice versa for any quarter in the study.

6.1 Hypothesis One: Risk Index

Hypothesis one is that total risk, as proxied for by the mean log of risk index, is lower for the diversified groups than for the focused groups and the switchers. Recall that a higher risk index score means lower risk.

6.1.1 All Banks, Size Quintiles and Size-Matched Sub-Groups

Table 11

Hypothesis One
Sample Statistics and
Results of Comparisons

	Focused			Switchers			Diversified	
	Number of Banks	Log Risk Index (Mean/ Median	P-Value Focused Vs. Diversified	Number of Banks	Log Risk Index (Mean/ Median	P-Value Switchers Vs. Diversified	Number of Banks	Log Risk Index (Mean/ Median
All Banks	3,539	1.71/ 1.74	<0.0005	1,526	1.71/ 1.75	<0.0005	194	1.89/ 1.90
Size Matched	192	1.69/ 1.70	<0.0005	192	1.72/ 1.74	<0.0005	192	1.89/ 1.90
Quintile								
1	496	1.72/ 1.76	0.470	262	1.65/ 1.72	0.098	38	1.80/ 1.80
2	455	1.67/ 1.70	0.008	256	1.68/ 1.72	0.022	38	1.83/ 1.88
3	379	1.69/ 1.73	<0.0005	196	1.73/ 1.77	<0.0005	38	2.04/ 2.06
4	744	1.72/ 1.74	<0.0005	303	1.74/ 1.75	<0.0005	39	1.95/ 1.92
5	1,375	1.73/ 1.75	0.021	455	1.73/ 1.75	0.036	39	1.83/ 1.88

The primary hypothesis was strongly supported in the comparison of the full sample of banks, in the size-matched sample and for four of the size quintiles. For the quintile one sample the mean log of the risk index for the diversified banks was greater

than that of the focused group and the switchers which suggests a lower level of risk for the diversified banks. However, the difference was not statistically significant at 5% using the Mann-Whitney test, with p-ratios of 0.470 and 0.098 respectively.

6.1.2 Comparisons for Individual Focused Peer Groups to Entire Sample of Diversified Banks

The following table shows the relative risk levels of the different peer groups and the entire diversified group. The mean log of the risk index for the diversified banks was again greater than that of each of the focused groups indicating a lower level of risk.

Table 12

Hypothesis One
Individual Focused Peer Groups versus
Entire Sample of Diversified Banks

Group	Group Size	Log of Risk Index	
		Mean	Median
Diversified	194	1.89	1.90
Agricultural	607	1.83	1.87
Commercial	1,851	1.70	1.72
Consumer	16	1.56	1.56
Credit Card	18	1.34	1.37
Miscellaneous Focused	82	1.70	1.78
Residential Mortgage	444	1.76	1.76

6.1.3 Comparisons for Individual Focused Peer Groups to Diversified Groups Matched By Asset Size

While there is considerable variation in the mean log of risk indices of the six focused peer groups, each is riskier than its comparator group of size-matched diversified banks and the difference was statistically significant at the 5% level in each case. Size-matching was carried out based on common upper and lower bounds of asset size as described above in Chapter Five.

Table 13

Hypothesis One
Individual Focused Groups versus
Size-Matched Sample of Diversified Groups Banks

	Focused			Diversified			
	Log of Risk Index		Number of Banks	Log of Risk Index		Number of Banks	P-Value
	Mean	Median		Mean	Median		
Agricultural	1.83	1.87	607	1.91	1.91	175	0.006
Commercial	1.70	1.72	1,851	1.91	1.91	149	<0.0005
Consumer	1.56	1.56	16	1.93	1.92	159	<0.0005
Credit Card	1.34	1.37	18	1.92	1.91	85	<0.0005
Miscellaneous Focused	1.70	1.78	82	1.91	1.91	174	0.002
Residential Mortgage	1.76	1.76	444	1.89	1.90	192	<0.0005

6.1.4 Hypothesis One Summary

For the size quintiles there was strong evidence that diversified banks are less risky than focused ones and switchers. Only for the smallest quintile of banks was the difference not significant at the 5% level. When this is combined with the aggregate level data, the results for the size-matched sample and the peer group specific data there is strong support for the first hypothesis of a negative relationship between risk and diversification.

6.2 Hypothesis Two: Return on Assets

Hypothesis two is that the mean return on assets ratio is lower for the diversified groups than for the focused groups and the switchers.

6.2.1 All Banks, Size Quintiles and Size-Matched Sub-Groups

Table 14

Hypothesis Two
Sample Statistics and
Results of Comparisons

	Focused			Switchers			Diversified	
	Number of Banks	Mean /Median ROA	P-Value Focused Vs. Diversified	Number of Banks	Mean/ Median ROA	P-Value Switchers Vs. Diversified	Number of Banks	Mean/ Median ROA
All	3,539	2.25/ 1.33	<0.0005	1,526	1.54/ 1.39	<0.0005	194	1.72/ 1.71
Size Matched	192	1.19/ 1.18	<0.0005	192	1.89/ 1.47	<0.0005	192	1.73/ 1.71
Quintile								
1	496	3.18/ 1.21	0.262	262	1.05/ 1.17	0.111	38	1.35/ 1.30
2	455	1.52/ 1.29	0.146	256	1.17/ 1.30	0.158	38	1.45/ 1.47
3	379	1.27/ 1.26	<0.0005	196	1.32/ 1.38	<0.0005	38	2.01/ 2.04
4	744	1.38/ 1.27	<0.0005	303	1.85/ 1.38	0.001	39	1.86/ 1.91
5	1,375	1.69/ 1.44	<0.0005	455	1.93/ 1.50	0.001	39	1.96/ 1.94

As hypothesized, the mean return on assets ratio for the diversified banks was less than that for the focused banks for the full sample. This was not the case for the switchers. In both cases the differences were statistically significant using the Mann-Whitney test. For the size quintiles, the mean return on assets ratio for the diversified banks was less than that for the focused banks for the two smallest groups but the reverse was true for the three larger ones. Both this result and the result for the size-matched sample may be an artefact of the diversified banks being slightly better capitalized than their focused counterparts. The switchers' mean return on assets ratio was lower than that of the diversified banks for all quintiles. For the size-matched sample the return on assets ratio for the diversified banks was, as hypothesized, less than that of the switchers

but, in contrast to the hypothesis, was greater than that of the focused banks. The difference was statistically significant at 5% using the Mann-Whitney test, with p-ratios less than 0.0005 for both comparisons.

6.2.2 Comparisons for Individual Focused Peer Groups to Entire Sample of Diversified Banks

For the focused peer group comparisons to the entire sample of diversified banks, only two of the six focused groups, those specializing in credit cards and the miscellaneous focused banks had higher return on assets ratios than their diversified peers as was hypothesized.

Table 15

Hypothesis Two
Individual Focused Peer Groups versus
Entire Sample of Diversified Banks

Group	Group Size	Return on Assets	
		Mean	Median
Diversified Banks	194	1.72	1.71
Agricultural Banks	607	1.41	1.38
Commercial Banks	1,851	1.31	1.32
Consumer Banks	16	1.61	1.59
Credit Card Banks	18	3.82	3.56
Miscellaneous Focused Banks	82	17.21	2.62
Residential Mortgage Banks	444	1.43	1.29

6.2.3 Comparisons for Individual Focused Peer Groups to Diversified Banks Matched by Asset Size

The comparison of the size-matched diversified groups to the focused groups shows similar results with only the credit card and miscellaneous focused banks surpassing their diversified counterparts in terms of returns on assets.

Table 16

Hypothesis Two
Comparison of Individual Focused Groups versus Diversified Groups Matched by Asset Size

	Focused			Diversified			
	Return on Assets		Number of Banks	Return on Assets		Number of Banks	P-Value
	Mean	Median		Mean	Median		
Agricultural	1.41	1.38	607	1.69	1.67	175	<0.0005
Commercial	1.31	1.32	1,851	1.67	1.64	149	<0.0005
Consumer	1.61	1.59	16	1.76	1.78	159	0.402
Credit Card	3.82	3.56	18	1.92	1.92	85	<0.0005
Miscellaneous Focused	17.21	2.62	82	1.69	1.67	174	<0.0005
Residential Mortgage	1.43	1.29	444	1.73	1.71	192	<0.0005

6.2.4 Hypothesis Two Summary

There was mixed evidence for the hypothesis that diversified banks have lower return on assets ratios than focused ones and switchers. While the full sample provided support for that hypothesis, the three largest quintiles contradicted it, as did four of the six peer group comparisons with their size-matched diversified counterparts and the size-matched comparison of the diversified and focused banks.

6.3 Hypothesis Three: Standard Deviation of Return on Assets

Hypothesis three is that the standard deviation of the return on assets ratio is lower for the diversified groups than for the focused groups and the switchers.

6.3.1 All Banks, Size Quintiles and Size-Matched Sub-Groups

Table 17

Hypothesis Three
Sample Statistics and
Results of Comparisons

	Focused			Switchers			Diversified	
	Number of Banks	Mean/ Median St. Dev. of ROA	P-Value Focused Vs. Diversified	Number of Banks	Mean/ Median St. Dev. of ROA	P-Value Switchers Vs. Diversified	Number of Banks	Mean/Median St. Dev. of ROA
All	3,539	1.7221/ 0.3149	0.003	1,526	0.7286/ 0.3441	<0.0005	194	0.3471/ 0.2735
Size Matched	192	0.4989/ 0.3435	<0.0005	192	0.8774/ 0.3438	<0.0005	192	0.3466/ 0.2722
Quintile								
1	496	2.7417/ 0.3987	0.261	262	0.8182/ 0.4549	0.059	38	0.4268/ 0.3557
2	455	0.6839/ 0.4022	0.016	256	0.6870/ 0.3781	0.022	38	0.3755/ 0.2749
3	379	0.5382/ 0.3305	<0.0005	196	0.6098/ 0.3313	<0.0005	38	0.2463/ 0.2292
4	744	0.5304/ 0.2916	0.088	303	0.7725/ 0.3040	0.011	39	0.2876/ 0.2433
5	1,375	0.5331/ 0.2735	0.913	455	0.7572/ 0.3075	0.223	39	0.3968/ 0.2693

Hypothesis three was strongly supported in the comparison of the full sample of banks, for the size-matched sample and for most of the size quintiles. While the direction of the effect was as hypothesized for the smallest and two largest quintiles, the comparison was not significant at the 5% level for comparison between both the switchers, the focused and the diversified for the smallest and largest groups and for the comparison between the focused group and the diversified for the second largest.

6.3.2 Comparisons for Individual Focused Peer Groups to Entire Sample of Diversified Banks

The following table shows the relative levels of the standard deviations of return on assets for the different peer groups and the entire diversified group. The diversified

groups, as hypothesized, had lower mean standard deviations of return on assets than all six focused group.

Table 18

Hypothesis Three
Individual Focused Peer Groups versus
Entire Sample of Diversified Banks

Group	Group Size	Standard Deviation of Return on Assets	
		Mean	Median
Diversified Banks	194	0.3471	0.2735
Agricultural Banks	607	0.3880	0.2678
Commercial Banks	1,851	0.4018	0.2731
Consumer Banks	16	0.6032	0.4312
Credit Card Banks	18	1.4609	0.8833
Miscellaneous Focused Banks	82	14.3428	0.6311
Residential Mortgage Banks	444	0.5222	0.4139

6.3.3 Comparisons for Individual Focused Peer Groups to Diversified Banks Matched by Asset Size

All of the diversified peer groups also had lower mean and median standard deviations of return on assets than their comparative focused groups matched by asset size, with four of the six comparisons statistically significant at the 5% level. Only the differences between the agricultural and commercial focused groups and their diversified counterparts were not statistically significant at 5%.

Table 19

Hypothesis Three
Individual Focused Peer Groups versus
Diversified Groups Matched by Asset Size

	Focused			Diversified			
	St. Dev. of Return on Assets		Number of Banks	Mean St. Dev. of Return on Assets		Number of Banks	P-Value
	Mean	Median		Mean	Median		
Agricultural	0.3880	0.2678	607	0.3223	0.2717	175	0.497
Commercial	0.4018	0.2731	1,851	0.3326	0.2719	149	0.712
Consumer	0.6032	0.4312	16	0.3059	0.2584	159	0.002
Credit Card	1.4609	0.8833	18	0.3259	0.2559	85	<0.0005
Miscellaneous Focused	14.3428	0.6311	82	0.3230	0.2718	174	<0.0005
Residential Mortgage	0.5222	0.4139	444	0.3466	0.2728	192	<0.0005

6.3.4 Hypothesis Three Summary

For the size quintiles there was strong evidence that diversified banks have lower standard deviations of returns on assets than focused ones and switchers although the difference was not significant at the 5% level in certain cases. When this is combined with the entire sample data, the results from the size-matched sample and the peer group specific data there is strong support for the third hypothesis.

6.4 Hypothesis Four: Capital to Assets Ratio

Hypothesis four is that the capital to assets ratio is lower for the diversified groups than for the focused groups and the switchers.

6.4.1 All Banks, Size Quintiles and Size-Matched Sub-Groups

Table 20

Hypothesis Four
Sample Statistics and
Results of Comparisons

	Focused			Switchers			Diversified	
	Number of Banks	Mean/ Median Capital to Assets	P-Value Focused Vs. Diversified	Number of Banks	Mean/ median Capital to Assets	P-Value Switchers Vs. Diversified	Number of Banks	Mean/ Median Capital to Assets
All	3,539	21.7/ 14.2	<0.0005	1,526	20.5/ 17.0	<0.0005	194	21.0/ 19.3
Size Matched	192	18.0/ 15.0	<0.0005	192	19.3/ 17.1	<0.0005	192	21.0/ 19.3
Quintile								
1	496	33.8/ 20.3	0.871	262	23.8/ 19.8	0.946	38	21.6/ 19.2
2	455	21.6/ 16.9	0.114	256	20.7/ 18.1	0.624	38	20.4/ 18.2
3	379	18.4/ 15.0	<0.0005	196	19.4/ 17.0	<0.0005	38	23.1/ 21.6
4	744	16.6/ 13.8	<0.0005	303	19.0/ 14.7	<0.0005	39	20.8/ 21.0
5	1,375	15.1/ 12.5	<0.0005	455	19.0/ 15.3	0.133	39	19.6/ 16.6

Hypothesis four was strongly supported in the comparison of the full sample of banks for the comparison between the diversified and focus banks but the direction of the effect was the reverse of what was hypothesized for the comparison between the

switchers and the diversified banks and for both comparison for the size-matched sample and for the three largest size quintiles.

6.4.2 Comparisons for Individual Focused Peer Groups to Entire Sample of Diversified Banks

Table 21

Hypothesis Four
Individual Focused Peer Groups versus
Entire Sample of Diversified Banks

	Group Size	Capital to Assets Ratio (%)	
		Mean	Median
Diversified	194	21.0	19.3
Agricultural	607	19.7	16.9
Commercial	1851	13.5	12.3
Consumer	16	15.9	16.8
Credit Card	18	18.9	17.5
Miscellaneous Focused	82	95.2	38.1
Residential Mortgage	444	25.2	21.4

The capital to assets ratio for the entire sample of diversified banks was, in direct contrast to the hypothesis, greater than that of four of the six focused bank groups. The four were the agricultural, commercial, consumer and credit card groups.

6.4.3 Comparisons for Individual Focused Peer Groups to Diversified Groups Matched By Asset Size

The following table shows the relative levels of the capital to assets ratios for the different peer groups and the size-matched diversified groups.

Table 22

Hypothesis Four
Individual Focused Peer Groups versus
Diversified Banks Matched by Asset Size

	Focused			Diversified			
	Capital to Asset Ratio		Number of Banks	Capital to Asset Ratio		Number of Banks	P-Value
	Mean	Median		Mean	Median		
Agricultural Banks	19.7	16.9	607	21.0	19.6	175	<0.0005
Commercial Banks	13.5	12.3	1,851	21.4	19.6	149	<0.0005
Consumer Banks	15.9	16.8	16	20.70	19.6	159	0.002
Credit Card Banks	18.9	17.5	18	20.70	19.2	85	0.414
Miscellaneous Focused Banks	95.2	38.1	82	21.10	19.6	174	<0.0005
Residential Mortgage Banks	25.2	21.4	444	21.00	19.3	192	0.001

Again, and in contrast to this hypothesis four of the six diversified peer groups have capital ratios greater than their focused counterparts matched by size with the differences statistically significant in three of those cases. The four are the agricultural, credit card, commercial and consumer groups. In support of the hypothesis, though, the residential mortgage and miscellaneous focused banks hold higher capital than their diversified counterparts.

6.4.4 Hypothesis Four Summary

The size-matched comparison and the larger size quintiles provide evidence that contradicts the hypothesis that diversified banks will carry less capital. This is in contrast, though, to the aggregate sample for the comparison between diversified and focused banks which does support the hypothesis. Further, evidence from certain of the peer group comparisons supports this hypothesis while other comparisons contradict it. Overall therefore, the evidence for this hypothesis is mixed especially for smaller banks, but the data leans toward rejection of this hypothesis.

6.5 Alternative Methodologies

In this dissertation, the mean risk index for a group is the mean of the individual risk indices of each member comprising the group. Kimball (1997) calculated the mean risk index for a group by first calculating the mean for the group of each of the three components in the risk index expression and then using these means in the expression. Re-calculating the risk index in this manner had no material effect on the final conclusions as, in the aggregate group and in all quintiles, the diversified banks' mean risk index score still exceeded that for the focused group and switchers.

Similarly, changing size quintiles so that they were based on the book value of loans rather than book value of assets had limited effect. For the risk index, the statistical tests all came out the same. For return on assets and standard deviation of return on assets, the statistical tests for three of the quintiles were unchanged. For the capital to assets ratio comparison, the statistical tests for four of the quintiles were identical. Further, in the cases where the results differed they were not significant at the 5% level.

Chapter Seven: **Discussion**

7.1 Hypothesis One: Risk Index

The data provide strong support for the first hypothesis that diversified banks are less risky than more focused banks and those switching between the two strategies. The exception is for the smallest quintile where the difference exists but is not statistically significant. Two reasons can be put forward for the lack of a statistically significant difference for the smallest banks. Perhaps they are so small that these "diversified" banks, which have been classified as such based on their percentages of assets held in specific categories, are not truly diversified because of their very small size. In terms of assets, for example they have less than $45 million which would make effective economic diversification difficult. An alternative explanation is that this small sub-group may include a large number of relatively new banks which are typically considered by practitioners to be more risky than their longer-established counterparts regardless of the strategy they pursue.

7.2 Hypothesis Two: Return on Assets

There appears to be a size effect for the hypothesis regarding returns on assets. As hypothesized, the focused group had higher returns than the diversified group for the aggregate sample, the size-matched sub-sample, and for the two smallest quintiles, although the differences were not statistically significant for those quintiles. In contrast, for the larger quintiles the diversified banks had the higher returns and the difference was strongly statistically significant in each case. This may be related to the finding that the diversified banks appear to be better capitalized than their focused counterparts (see

Berger and Mester, 1997, for a discussion of the contributions that can be obtained by controlling for the size of equity).

The following table shows the reasons behind the differences between the aggregate sample and a majority of the quintile sub-samples:

Table 23

Return on Assets for Focused Banks and Diversified Banks by Asset Size Quintile

Asset Quintile	Return On Assets Focused Banks (Size of Sample)	Return On Assets Diversified Banks (Size of Sample)
Smallest Quintile	**3.18% (496)**	1.35% (38)
Second Smallest Quintile	1.52% (455)	1.47% (38)
Third Smallest Quintile	1.27% (379)	1.32% (38)
Fourth Smallest Quintile	1.38% (744)	1.86% (39)
Largest Quintile	1.69% (1,375)	1.96% (39)
Aggregate Sample	2.25% (3,539)	1.72% (194)

The group of smallest focused banks with assets less than $45 million has a much higher return on assets than any of the other sub-groups. There is also a large variability of returns in this sub-group. Possible reasons for both these findings are discussed in the next section.

It has been hypothesized here that the switchers will have returns similar to the focused banks. An alternative hypothesis would be that if they are effective in deciding when to switch from one strategy to another they should exhibit higher returns than the other two groups. There is little evidence of this. In fact for the aggregate group they have the lowest returns on assets of the three and this is also true for the two smallest

quintiles. The evidence, therefore, does not support the idea that management can effectively decide when to time changes in strategy.

7.3 Hypothesis Three: Standard Deviation of Returns on Assets

The data provide solid support for the idea that the standard deviation of returns will be lower for diversified banks than for focused banks and the switchers. As noted in the previous section, the smallest quintile of focused banks had much higher returns on assets than any other sub-group. The same result is apparent in the standard deviation of returns.

Table 24

Standard Deviation of Return on Assets for Focused and Diversified Banks by Asset Size Quintile

Asset Quintile	Standard Deviation of Return On Assets Focused Banks (Size of Sample)	Standard Deviation of Return On Assets Diversified Banks (Size of Sample)
Smallest Quintile	**2.7417% (496)**	0.4268% (38)
Second Smallest Quintile	0.6839% (455)	0.3755% (38)
Third Smallest Quintile	0.5382% (379)	0.2463% (38)
Fourth Smallest Quintile	0.5304% (744)	0.2876% (39)
Largest Quintile	0.5331% (1,375)	0.3968% (39)
Aggregate Sample	1.7221% (3,539)	0.3471% (194)

It is not surprising that this should be the case as these banks combine the effects of small size and a focused strategy. Both of these can be hypothesized to be positively related to higher variability of returns and may magnify the impact of each other. The same trend is also apparent for the diversified banks where the smallest quintile displays the highest standard deviation of returns on assets. Age of the banks in question may also play a role. It is likely that these small banks also have a disproportionate number of

young banks where the loan portfolio has not had a chance to season. This refers to the fact that newer loans are more likely to fall into arrears than those that have been outstanding for a longer period of time. Rogers and Sinkey (1999) may also provide some insight into this result. In their study using US data from 1989 to 1983, they find that banks with larger components of non-traditional bank income tend to exhibit less risk, and that it is the larger banks that tend to have relatively larger non-traditional bank income components. Thus, when we observe larger diversified banks with lower standard deviation of returns than their focussed counterparts, it is easy to imagine that this may arise due to diversified banks' comparatively greater ability to find sources of non-traditional bank income as compared to their focused counterparts. DeYoung and Rice (2004a) also find that relatively larger banks have relatively larger components of non-interest income using data from the years 1986, 1990, 1995, 2000, and 2003. While they are consistent with Rogers and Sinkey (1999) in this respect, they assert, as do Stiroh and Rumble (2006), that non-interest income can be more volatile than traditional bank income. Our study is not conclusive on this matter as it develops no theoretical statements concerning the matter and makes no statistical tests relating to non-interest income. Further research should consider the extent to which differences in the standard deviation of return on assets between focused and diversified banks, and between the relatively larger banks versus the smaller banks, can be explained by different non-interest income components in their respective income statements.

7.4 Hypothesis Four-Capital to Assets

The evidence on capital ratios is mixed. While the overall sample provides support for the hypothesis that diversified banks will hold less capital than focused ones there appears to be a clear size effect with that finding driven by the very high capital ratio levels of the smallest focused banks. For the larger sub-groups the pattern reverses.

Table 25

Capital to Asset Ratio for Focused and Diversified Banks by Asset Size Quintile

Asset Quintile	Capital to Asset Ratio Focused Banks (Size of Sample)	Capital to Asset Ratio Diversified Banks (Size of Sample)
Smallest Quintile	**33.8% (496)**	21.6% (38)
Second Smallest Quintile	21.6% (455)	20.4% (39)
Third Smallest Quintile	18.4% (379)*	23.1% (38)*
Fourth Smallest Quintile	16.6% (744)*	20.8% (39)*
Largest Quintile	15.1% (1,375)*	19.6% (39)*
Aggregate Sample	21.69% (3,539)	20.95% (194)

*Difference significant at the 5% level.

The three largest asset quintiles have diversified banks holding more capital than the focused ones with the difference statistically significant to the 5% level. It is difficult to explain this finding. It may be that the larger banks are more likely to be publicly traded and thus are required by market forces to hold larger amounts of capital. Further, these banks rely more heavily on wholesale deposits and may be required to hold more capital in order to attract these more sophisticated investors. Finally, regulators may require these banks to hold more capital to guard against the larger costs involved in their failure. This theory stands in direct contradiction to the too big too fail doctrine however.

7.5 Recent Failures

This research indicates that diversification and risk may be negatively linked. The history of bank failures in recent years supports this conclusion. Of the seven banks that have been closed by regulators due to poor financial performance between 2004 and February 2007 none would qualify under the definition used in this study as diversified.

Table 26

Recent American Bank Failures

Name	Date Closed	Group
First Integrity Bank, NA	May 30, 2008	Focused (Commercial Bank)
ANB Financial, NA	May 9, 2008	Focused (Commercial Bank)
Hume Bank	March 7, 2008	Focused (Agricultural Bank)
Douglass National Bank	January 25, 2008	Focused (Commercial Bank)
Miami Valley Bank	October 4, 2007	Switcher
NetBank	September 28, 2007	Switcher
Metropolitan Savings Bank	February 2, 2007	Focused (Residential Mortgage Bank)

These failures also support the assumed relationship in this research between the risk index and failure as five of the seven failed banks had very low risk index scores.

Table 27

Risk Index Score of Failed Banks

Name	Risk Index Score
First Integrity Bank, NA	5.0
ANB Financial, NA	6.1
Hume Bank	20.8
Douglass National Bank	2.5
Miami Valley Bank	5.8
NetBank	1.5
Metropolitan Savings Bank	43.0

Hume Bank and Metropolitan Savings Bank had a somewhat higher risk index score but still ranked considerably below the mean risk index score for focused banks of 66.7. Further, Hume Bank was assessed by its regulator to have intentionally misreported its financial standing (McClure, 2008) which may have contributed to the accounting measure not fully reflecting the level of risk involved.

Chapter Eight: **Conclusions**

The data strongly supports the major hypothesis that diversified banks are less risky than focused banks. As such, the results of this study align with the research in the centre column of Table 1. This result also differs from the findings of Stiroh and Rumble (2006), who found benefits to diversification, but with those benefits offset by the increased volatility of the income types into which the firms tended to diversify. Their results were with respect to financial holding companies, however, and as such, may not be generalizable to banks. In the case of banks, it seems that diversification provides benefits, but that possessing a broad range of income sources does not necessarily imply that the sources are increasingly risky.

The idea that diversified banks are less risky than focused banks is supported by data for the aggregate groups, by the size- segregated quintiles, by the size-matched sub-samples and by the comparisons of the individual groups. The relative level of risk is driven largely by the standard deviation of returns rather than by diversified banks holding higher levels of capital or generating higher returns. It appears that the benefits of diversification manifest themselves in lower variability of returns. The results are not completely clear-cut because of the high level of variability on all four of the measures in the group of smallest banks.

8.1 Practitioner Applications

Given recent turbulence in financial and banking markets, regulators such as the Federal Reserve Board have been increasingly attracted to the idea of using regulation selectively and aggressively to target specific excesses (Guha, 2008). A better understanding of the relationship between bank strategies and risk and the relative risk of various types of banks would be beneficial in this regard as it could lead to better allocation of regulatory resources towards higher risk banks by regulators and deposit insurers. Banks in higher risk categories could be subject to more frequent and more intensive on-site and off-site monitoring. Further, banks posing higher levels of risk to the financial safety net could be required to hold higher levels of capital, pay higher deposit insurance premiums, or engage in other activities such as the purchase of credit default protection in order to mitigate that risk. Obviously, the benefits of these types of measures would have to be weighed against potential costs including direct expenditures and the hindrance of competition and innovation in the banking sector.

Experience from the periods of high failure rates in the 1980's and 1990's suggest that early and accurate recognition of heightened risk allows more successful intervention strategies thus minimizing systemic costs. Internationally there are a large number of bank regulators and deposit insurers who could benefit from this research. In Canada alone when the credit union sector is taken onto consideration there are more than twenty federal and provincial regulators and deposit insurance or liquidity support funds.

This research may have further application to other sectors such as insurance which also have their own regulators, both on the federal and provincial or state level and customer compensation fund arrangements. In the US for example insurance regulation

is a state matter meaning there are over fifty insurance regulators once non-state jurisdictions are considered.

Note that our findings disclose a variety of risk and return relationships and are thus consistent with DeYoung and Rice (2004b) in finding that there are a variety of different, but probably justifiable, bank business strategies.

8.2 Areas for Future Research

Further validation of the risk index as a proxy for bank risk is an obvious avenue for future research. This could be done through comparison to risk as measured by other methods such as an implied volatility approach or with any or all of examiner or bond rating agency scores, credit default swap premiums, bank subordinated debt spreads relative to risk-free bonds or eventual failure since the implicit assumption is that risky banks are more likely to fail. While failures have been rare in recent years many are predicting that they will increase substantially in the near future which would make this line of research feasible. One estimate was that as a many as 150 banks nationwide could fail over the next 12 to 18 months (Story, 2008).

Research into the sub-component ratios of the risk index may also have value. As has been noted, banks are prone to income smoothing so perhaps other return measures rather than net income such as operating income or income before taxes and interest expenses may be more effective in capturing changes in and relative levels of risk. Similarly other capital ratios such as tangible capital, which is often utilized by credit rating agencies, may be more effective than the measure utilized here. The length of time

over which the standard deviation of returns should be measured could also benefit from sensitivity analysis to evaluate overall effectiveness.

As has been seen there is considerable variation in the level of risk of the focused peer groups. Drilling down to the underlying drivers of this variance such as loan return distributions and focusing on how they are related to the level of risk would be useful (Winton, 1999). It may well be that varying levels of risk exist for the different industry sub-groups and types of loan and studies in those areas could yield useful insights.

Investigation into how bank efficiency is related to risk also promises to be useful. The literature shows that efficiency, capital and risk are all interrelated. Altunbas et al (2007) for example, have shown that inefficient European banks hold more capital than more efficient ones. As they point out, though, different hypotheses about the link between capital, risk and efficiency exist. It is possible that regulators allow well-managed banks, as demonstrated by their efficiency, to operate with lower levels of capital. On the other hand, poorly managed, inefficient firms may take on riskier loans in an attempt to boost profitability. Also, a bank may choose to boost short-term profits through reducing budgets for loan underwriting and monitoring thus boosting short-term profits and creating a positive link between efficiency and risk at least in the short-term. A better understanding of these relationships would be beneficial.

Other hypotheses could be examined using the accounting risk measure utilized in this study. For example there are conflicting views as to whether new banks, commonly called de novo banks, are more risky than older ones. Many observers believe that younger banks are riskier since they have not yet developed an established market

franchise but others believe they are less risky as they typically have more capital and lower levels of loans relative to total assets. This line of research could shed light on the underlying reasons for the finding from this data that smaller banks have much higher returns on assets and variability of those returns than their larger brethren. It may be that a strong correlation between size and age is the underlying common factor.

It has been pointed out that "the risk index by itself is not an all encompassing risk measure since deposit insurers, regulators and other stakeholders may ultimately care about the expected cost to the bank safety net, which is a function of not just the probability of failure which is estimated by the risk index but also the cost of failure, should failure occur" (Kwan and Laderman, 1999, p. 201). Given this reality further research into the costs of failures of various types of banks would also merit attention. The risk index may be seen as a proxy for the probability of default but the loss given default is a second important variable in this type of analysis which warrants further study.

The literature and this study also indicate that size appears to be related to risk although the direction is not clear. Further work to examine this question would therefore be beneficial. This line of research could also provide empirical tests of the existence of a too big to fail belief. Research into the reason why diversification seems to have less of an impact for the smallest banks would also be worthwhile.

Extensions of this type of study into other countries and time periods would be valuable. The period examined here was a relatively benign one for the banking industry and may not be representative of all eras. The American banking industry with its large

number of very small banks is also unique in the world and for these two reasons these results may not generalize to other countries. Further, there have been substantial changes in the regulatory and competitive environments worldwide in the recent past and an analysis of their relationship with bank risk over time would be warranted.

Finally, research into the reasons behind larger diversified banks holding higher levels of capital than focused ones would be useful. One possible factor to investigate would be the role of market forces such as whether being publicly-traded or more dependent on wholesale rather than retail deposits is linked to the higher capital levels. A second possibility is that regulatory actions are driving the higher capital levels.

APPENDIX A: RISK INDEX AND PROBABILITY OF BANKRUPTCY

Boyd et al (1993) demonstrated the relationship between the risk index and the probability of bankruptcy by defining bankruptcy as the situation in which capital is insufficient to offset losses or $\Pi < -K$ where Π =net income and K= capital. Letting A = total assets, $r = \Pi / A$, and $k = -K/A$, the probability of bankruptcy is then

$$p(\Pi < -K) = p(r<k) = \int_{\infty}^{k} F(r)dr \qquad (1)$$

where p (·) is a probability and *F(r)* is the probability density function of r. As in De Nicolo (2000) if *F* is normally distributed, we may rewrite (1) as

$$p(r<k) = \int_{\infty}^{k} N(0,1)dz$$

$$z = (k - p)/\sigma$$

where p is the true mean and σ the true standard deviation of the r distribution. Thus, z is the number of standard deviations below the mean by which profits must fall in order to wipe-out the bank's capital. By the Bienaymé-Tchebycheff inequality:

$$p(r \leq)k \leq (\sigma / (p-k))^2 = 1/z^2.$$

In this paper I use sample estimates for p and σ to construct the risk index.

APPENDIX B: RELATIVE RISK OF FOCUSED PEER GROUPS

The following two tables show the relative risk rank of the six focused peer groups, from the least to the most risky, and the respective p-values of the Mann-Whitney tests of the comparisons between each of the six groups and each of the others:

Relative Risk Rank of the Six Focused Peer Groups

Group	Group Size	Mean Log of Risk Index
1. Agricultural	607	1.83
2. Residential Mortgage	444	1.76
3. Commercial	1,851	1.70
4. Miscellaneous	82	1.70
5. Consumer	16	1.56
6. Credit Card	18	1.34

P-Values of the Mann-Whitney Tests

Group	Agricultural	Residential Mortgage	Commercial	Miscellaneous	Consumer
Residential Mortgage	<0.0005				
Commercial	<0.0005	<0.0005			
Miscellaneous	0.044	0.069	0.129		
Consumer	0.001	0.001	<0.0005	0.016	
Credit Card	<0.0005	<0.0005	<0.0005	0.001	<0.0005

The differences in the logs of the risk indices for the individual peer groups are statistically significant at the 5% level in every comparison with the exception of two:

those between the miscellaneous focused peer group and the residential mortgage and commercial groups. These tests clearly indicate, though, that the agricultural group poses the lowest risk during this period and the consumer and credit card banks pose the highest level of risk. The other three groups: miscellaneous; residential mortgage; and commercial; fall in between, although the exact order is not clear based on this data.

APPENDIX C: CROSS-SECTIONAL REGRESSION OF RISK INDEX AND SIZE

Cross-sectional regressions were carried out to test the relationships between size, as measured by average assets, and the log of risk index, return on assets, standard deviation of return on assets and the capital to assets ratios. These tests were conducted on the full bank sample and separately on the focused banks, the diversified banks and the switchers. There were no statistically significant correlations with the exception of in the diversified peer group where both the log of the risk index and the standard deviation of return on assets were correlated, with p-values of 0.001 and 0.002 respectively. Adjusted R square values in both cases were low at 0.052 and 0.046, meaning that while size is correlated with risk for this category of banks, its explanatory value is not material.

APPENDIX D: RELATIONSHIP BETWEEN RISK, RETURNS AND SWITCHING BETWEEN FOCUSED AND DIVERSIFIED STRATEGIES

In order to further investigate the relationship between risk, returns and changing between focused and diversified strategies, a sub-set of banks that changed strategies from focused to diversified in the first half of the study time period was compared with those banks that maintained the focused strategy for the entire period. Similarly, a sub-set of banks that changed strategies in the opposite direction, from diversified to focused, in the first half was compared with those banks that maintained the diversified strategy for the entire period.

Sample	**Sample Size**	**Median Return on Assets**	**Median Log of Risk Index**
Switchers from Focused to Diversified	40	1.59	1.83
Focused Banks	3,539	1.33	1.74
Switchers from Diversified to Focused	192	1.70	1.75
Diversified Banks	194	1.40	1.90

While the change in strategies was related to higher returns in both cases, those higher returns came at the cost of higher levels of risk for those banks switching from a diversified to a focused strategy. Both comparisons of the banks switching from the diversified to focused strategy with the diversified group were statistically significant at the 5% level. For banks switching the opposite way, from focused to diversified, neither difference was statistically significant at the 5% level, with p-values of 0.066 and 0.073

respectively. There is some support in these sub-samples, therefore, for the hypothesis that switching strategies is related to higher returns.

References

Acharya, V., I. Hasan and A. Saunders. 2002. *Should banks be diversified: Evidence from individual bank loan portfolios.* Basel Switzerland: Bank of International Settlements.

Aggarwal, R. K. and A. A. Samwick. 2003. "Why Do Managers Diversify Their Firms? Agency Reconsidered." *Journal of Finance* 58(1):71-118.

Allen, L. and J. Jagtiani. 1999. *The impact of new bank powers (securities and insurance activities) on bank holding companies' risk.* Chicago: Federal Reserve Bank of Chicago.

Altman, E.I. 2000. "Predicting the financial distress of companies: Revisiting the Z-Score and Zeta models.":1-46.

------. 1977. "Predicting performance in the savings and loan association industry." *Journal of Monetary Economics* 3:443-466.

------. 1968. "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy." *Journal of Finance* XXIII(4):589-609.

Altunbas, Y., S. Carbo, E. Gardener and P. Molyneux. 2007. "Examining the relationship between capital, risk and efficiency in European banking." *European Financial Management* 13(1):49-70.

Amihud, Y. and B. Lev. 1981. "Risk reduction as a managerial motive for conglomerate mergers." *The Bell Journal of Economics* 12(2):605-617.

Anandarajan, Asokan. 2007. "Use of loan loss provisions for capital, earnings management and signalling by Australian banks." *Accounting & Finance* 47(3):357–379.

Avery, R., T. Belton and M. Goldberg. 1988. "Market discipline in regulating bank risk: new evidence from the capital markets." *Journal of Money, Credit and Banking* 20(4):597-610.

Avery, R. and A. Berger. 1991. "Loan commitments and bank risk exposure." *Journal of Banking and Finance* 15(1):173-192.

Baele, L., O. De Jonghe and R. Vennet. 2007. "Does the stock market value bank diversification?" *Journal of Banking and Finance* 31:1999-2023.

Beaver, W. 1966. "Financial ratios as predictors as failure." *Journal of Accounting Research* 4:71-111.

Beaver, W., P. Kettler and M. Scholes. 1970. "The association between market determined and accounting determined risk measures." *The Accounting Review* 45(4):654-682.

Beck, T. and L. Laeven. 2006. *Resolution of failed banks by deposit insurers : cross-country evidence.* The World Bank.

Bell, J. and D. Pain. 2000. "Leading indicator models of banking crises: a critical review." *Financial Stability Review* 9(3):113-129.

Benston, G., W. Hunter and L. Wall. 1995. "Motivation for bank mergers and acquisitions: Enhancing the deposit insurance put option versus earning diversification." *Journal of Money, Credit and Banking* 27(3):777-788.

Berger, A. and L. Mester. 2003. "Explaining the dramatic changes in performance of US banks: technological change, deregulation, and dynamic changes in competition." *Journal of Financial Intermediation* 12:57-95.

------. 1997. "Inside the black box: what explains differences in the efficiencies of financial institutions?" *Journal of Banking and Finance* 21:895-947.

Berger, A. and G. Udell. 2002. "Small business credit availability and relationship lending: The importance of bank organizational structure " *The Economic Review* 112(477):F32-F53.

------. 1990. "Collateral, loan quality and bank risk." *Journal of Monetary Economics* 25(1):21-42.

Berkovitch, E. and M. Narayanan. 1993. "Motives for takeovers: an empirical investigation." *The Journal of Financial and Quantitative Analysis* 28(3):347-362.

Bernanake, B. and M. Gertler. 1990. "Financial fragility and economic performance." *The Quarterly Journal of Economics* 105(1):87-114.

Bhargava, R. and D. Fraser. 1998. "On the wealth and risk effects of commercial bank expansion into securities underwriting: An analysis of Section 20 subsidiaries." *Journal of Banking & Finance* 22(4):447-465.

Bhattacharya, S. and A. Thakor. 1993. "Contemporary Banking Theory." *Journal of Financial Intermediation* 3(1):2-50.

Boot, A. and A. Thakor. 1991. "Off-balance sheet liabilities, deposit insurance and capital regulation." *Journal of Banking and Finance* 15(4-5):825-846.

Boyd, J. and G. De Nicolo. 2005. "The theory of bank risk taking and competition revisited." *The Journal of Finance* LX(3):1329-1343.

Boyd, J. and M. Gertler. 1994. "The role of large banks in the recent US banking crisis." *Federal Reserve Bank of Minneapolis Quarterly Review* 18(1):1-26.

Boyd, J. and S. Graham. 1988. "The profitability and risk effects of allowing bank holding companies to merge with other financial firms: A simulation study." *Federal Reserve Bank of Minneapolis Quarterly Review* 12(2):1-18.

------. 1986. "Risk, regulation and bank holding company expansion into nonbanking." *Federal Reserve Bank of Minneapolis Quarterly Review* 10:2-17.

Boyd, J., S. Graham and R. Hewitt. 1993. "Bank holding company mergers with nonbank financial firms." *Journal of Banking and Finance* 17:43-63.

Boyd, J. and E. Prescott. 1986. "Financial intermediary-coalitions." *Journal of Economic Theory* 38:211-232.

Boyd, J. and D. Runkle. 1993. "Size and performance of banking firms: testing the predictions of theory." *Journal of Monetary Economics* 31(1):47-67.

Brewer III, E. 1989. "Relationship between bank holding company risk and non-bank activity." *Journal of Economics and Business* 41(4):337-353.

Brewer III, E., D. Fortier and C. Pavel. 1988. "Bank risk from nonbank activities." *Federal Reserve Bank of Chicago Economic Review*:14-26.

Brickley, J., J. Linck and C. Smith. 2003. "Boundaries of the firm: evidence from the banking industry." *Journal of Financial Economics* 70:351-383.

Brooks, R. and R. Faff. 2000. "U.S. banking sector risk in an era of regulatory change: A bivariate GARCH approach." *Review of Quantitative Finance & Accounting* 14(1):17.

Caprio, G. and B. Wilson. 1997. *On Not Putting All the Eggs in One Basket: The Role of Diversification in Banking.* Washington, DC: World Bank.

Carey, M. and R. Stulz. 2005. "Systemic risk and regulation: The Risks of Financial Institutions."4:1-33.

Carter, D., J. McNulty and J. Verbrugge. 2004. "Do Small Banks have an Advantage in Lending? An Examination of Risk-Adjusted Yields on Business Loans at Large and Small Banks." *Journal of Financial Services Research* 25(2):233-252.

Cerasi, V. and S. Daltung. 2000. "The optimal size of a bank: Costs and benefits of diversification." *European Economic Review* 44:1701-1726.

Chan-Lau, J. A. and A. N. R. Sy. 2006. "Distance-to-default in banking: A Bridge too far?" *IMF Working Paper* 6(215):1-17.

Chirinko, R. and G. Guill. 1991. "A framework for assessing credit risk in depository institutions: Toward regulatory reform." *Journal of Banking and Finance* 15(4-5):785-804.

Cole, R. and H. Mehran. 1998. "The effect of changes in ownership structure on performance: Evidence from the thrift industry." *Journal of Financial Economics* 50(3):291-317.

Cordell, L., G. Donald and M. Wohar. 1993. "Corporate Ownership and the Thrift Crisis." *Journal of Law and Economics* 36(2):719-756.

Craig, B. and J. dos Santos. 1997. "The risk effects of bank acquisitions." *Federal Reserve Bank of Cleveland Economic Review* Second Quarter:25-35.

Das, S. and A. Nanda. 1999. "A theory of banking structure." *Journal of Banking & Finance* 23(6):863-895.

Davies, S. and D. McManus. 1991. "The effects of closure policies on bank risk-taking." *Journal of Banking and Finance* 15(4-5):917-938.

De Nicolo, G. 2000. *Size, charter value and risk in banking: An international perspective.* Washington, DC: Board of Governors of the Federal Reserve System.

De Nicolo, G., P. Bartholomew, J. Zaman and M. Zephirin. 2004. "Bank consolidation, internationalization and conglomeration: Trends and implications for financial risk." *Financial Markets, Institutions and Instruments* 13(4):173-217.

De Nicolo, G. and V. Loukoianova. 2007. *Bank ownership, market structure and risk.* Washington DC: International Monetary Fund.

DeLong, G. 2001. "Stockholder gains from focusing versus diversifying bank mergers." *Journal of Financial Economics* 59:221-252.

Demirgüc-Kunt, A., E. Detrabiache and T. Tressel. 2006. "Banking on the principles: Compliance with Basel core principles and bank soundness." *IMF Working Paper* 242.

Demsetz, R., M. Saidenberg and P. Strahan. 1997. *Agency Problems and Risk Taking at Banks.* New York: Federal Reserve Bank of New York.

Demsetz, H. and K. Lehn. 1985. "The structure of corporate ownership: causes and consequences." *The Journal of Political Economy* 93(6):1155-1177.

Dennis, D. and J. McConnell. 1986. "Corporate mergers and security returns." *Journal of Financial Economics* 16(2):143-187.

DeYoung, R. 2007. "Safety, soundness and the evolution of the US banking industry." *Federal Reserve Bank of Atlanta Economic Review*:41-66.

DeYoung, R., W. Hunter and G. Udell. 2004. "The past present and probable future for community banks." *The Journal of Financial Services Research* 25(2/3):85-133.

DeYoung, R. and T. Rice. 2004a. "How do banks make money? The fallacies of fee income." *Economic Perspectives.* Quarter 4, p. 34 – 51.

DeYoung, R. and T. Rice. 2004b. "How do banks make Money? A variety of business strategies." *Economic Perspectives.* Quarter 4, p. 52 – 67.

DeYoung, R. and T. Rice. 2004c. "Noninterest income and financial performance at u.s. commercial banks." *The Financial Review.* Vol. 39, p. 101 – 127.

DeYoung, R. and K. Roland. 2001. "Product mix and earnings volatility at commercial banks: Evidence from a degree of total leverage model." *Journal of Financial Intermediation* 10(1):54-84.

Diamond, D. 1984. "Financial intermediation and delegated monitoring." *Review of Economic Studies* 51:393-414.

Diamond, D. and R. Rajan. 2005. "Liquidity shortages and banking crises." *Journal of Finance* 60(2):615-647.

Dick, A. 2006. "Nationwide branching and its impact on market structure, quality and bank performance." *Journal of Business* 79:562-592.

Eisenbeis, R. 1984. "Consequences of deregulation for commercial banking: discussion." *The Journal of Finance* 39(3):803-805.

Eisenbeis, R., R. Harris and J. Lakonishok. 1984. "Benefits of bank diversification: The evidence from shareholder returns." *The Journal of Finance* 39(3):881-892.

Eisenbeis, R. and M. Kwast. 1991. "Are real estate specializing depositories viable? Evidence from commercial banks." *Journal of Financial Services Research* 5(1):5-24.

Elyasiani, E., I. Mansur and M. Pagano. 2007. "Convergence and risk-return linkages across financial services firms." *Journal of Banking and Finance* 31:1167-1190.

Emmons, W., R. Gilbert and T. Yeager. 2004. "Reducing the risk at small community banks: Is it size or geographic diversification that matters?" *Journal of Financial Services Research* 25(2/3):259-281.

Ennis, H. and H. Malek. 2005. "Bank risk of failure and the too-big-to-fail policy." *Federal Reserve Bank of Richmond Economic Quarterly* 91(2):21-44.

Esty, B. 1997. "Organizational form and risk taking in the savings and loan industry." *Journal of Financial Economics* 44(1):25-55.

Federal Deposit Insurance Corporation. 2008. *FDIC 2007 Annual Report.* Washington: Federal Deposit Insurance Corporation.

------. 2008. "Statement of Sheila C. Bair Chairman of the FDIC on the state of the banking industry before the Committee on Banking, Housing and Urban Affairs US Senate " Washington DC: FDIC, Retrieved April 15, 2008, 2008 (www.fdic.gov/news/speeches/chairman/spmar0408.html).

------. 1997. "History of the eighties, lessons for the future." 2:1-118.

Fraser, D. and A. Zardkoohi. 1996. "Ownership structure, deregulation, and risk in the savings and loan industry." *Journal of Business Research* 37(1):63-69.

French, G. 1991. "Early corrective action for troubled banks." *FDIC Banking Review* 4(2):1-12.

Furlong, F. 2004. "Comment on Emmons, Gilbert and Yeager." *Journal of Financial Services Research* 25(2/3):283-283.

Gallo, J., V. Apilado and J. Kolari. 1996. "Commercial bank mutual fund activities: Implications for bank risk and profitability." *Journal of Banking & Finance* 20(10):1775-1791.

Gennotte, G. and D. Pyle. 1991. "Capital controls and bank risk." *Journal of Banking and Finance* 15(4-5):805-824.

Gomes, J. and D. Livdan. 2004. "Optimal diversification: reconciling theory and evidence." *Journal of Finance* 59(2):507-535.

Gorton, G. and R. Rosen. 1995. "Corporate control, portfolio choice, and the decline of banking." *Journal of Finance* 50(5):1377-1420.

Gorton, G. and A. Santomero. 1990. "Market discipline and bank subordinated debt." *Journal of Money, Credit & Banking* 22(1):119-128.

Graham, J., M. Lemmon and J. Wolf. 2002. "Does corporate diversification destroy value?" *Journal of Finance* 57(2):695.

Guha, K. 2008. "Troubled by Bubbles." *Financial Times,* May 16, 2008, Markets.

Hall, R., M. Feldstein, J. Frankel, R. Gordon, C. Romer, D. Romer and V. Zarnowitz. 2003. *The NBER's Business-Cycle Dating Procedure.*National Bureau of Economic Research.

Hannan, T. H. and G. A. Hanweck. 1988. "Bank insolvency risk and the market for large certificates of deposit." *Journal of Money, Credit and Banking* 20(2):203-211.

Hassan, M., G. Karell and M. Peterson. 1994. "Deposit insurance, market discipline and off-balance sheet banking risk of large US commercial banks." *Journal of Banking and Finance* 18(3):575-593.

Heggestad, A. 1977. "Market structure, risk and profitability in commercial banking." *Journal of Finance* 32:1207-1216.

Hein, S., T. Koch and S. MacDonald. 2005. "On the uniqueness of community banks." *Federal Reserve Bank of Atlanta Economic Review* 90(1):15-36.

Hirtle, B. 2003. "What market capital reporting tells us about bank risk." *Federal Reserve Bank of New York Economic Policy Review* 9(3):37-54.

Hirtle, B. J. and K. J. Stiroh. 2007. "The return to retail and the performance of US banks." *Journal of Banking and Finance* 31(4):1101-1133.

Holmstrom, B. and J. Tirole. 1997. "Financial intermediation, loanable funds, and the real sector." *The Quarterly Journal of Economics* 112(3):663-691.

Holzer, J. 2008. "FDIC Details a Miserable Quarter for Banks." *Wall Street Journal,* November 26, 2008, C2.

Houston, J. and C. James. 1995. "CEO compensation and bank risk: Is compensation in banking structured to promote risk taking?" *Journal of Monetary Economics* 36(2):405-431.

Houston, J. and K. Stiroh. 2006.

Three Decades of Financial Sector Risk. New York: Federal Reserve Bank of New York.

Hunter, W., J. Verbrugge and D. Whidbee. 1996. "Risk-taking and failure in de novo savings and loans in the 1980s." *Journal of Financial Services Research* 10(3):235-271.

Iannotta, G., G. Nocera and A. Sironi. 2007. "Ownership structure, risk and performance in the European banking industry. " *Journal of Banking and Finance* 31(7):2127-2149.

Imai, M. 2007. "The emergence of market monitoring in Japanese banks: Evidence from the subordinated debt market." *Journal of Banking and Finance* 31(5):1441-1460.

Jayaratne, J. and P. Strahan. 1996. "The finance-growth nexus: Evidence from bank branch deregulation." *Quarterly Journal of Economics* 111:639-670.

Jensen, M. and W. Meckling. "Theory of the firm: Managerial behavior, agency costs and ownership structure" *Journal of Financial Economics* 3(4):305-360.

Kane, E. and S. Buser. 1979. "Portfolio diversification at commercial banks." *The Journal of Finance* 34(1):19-34.

Kaufman, G. 1994. "Bank contagion: a review of the theory and evidence." *Journal of Financial Services Research* 8(2):123-150.

Keeley, M.. 1990. "Deposit insurance, risk, and market power in banking." *American Economic Review* 80(5):1183.

Keeley, M.. and F. Furlong. 1990. "A re-examination of mean-variance analysis of bank capital regulation." *Journal of Banking and Finance* 14(1):69-84.

Kelly, T. 2007. "Recuperate and Remodel." *Forbes,* September 3, pp. 96.

Kim, M. and W. Kross. 2002. "The ability of earnings to predict future operating cash flows has been increasing - not decreasing." 43(5):753-780.

Kim, D. and A. Santomero. 1988. "Risk in banking and capital regulation." *The Journal of Finance* 43(5):1219-1233.

Kimball, R. 1997. "Specialization, risk and capital in banking." *New England Economic Review*(November/December):51-73.

King, T., D. Nuxoll and T. Yeager. 2006. "Are the causes of bank distress changing? can researchers keep up?" *Federal Reserve Bank of St. Louis Review* 88(1):57-79.

Koehn, M. and A. Santomero. 1980. "Regulation of bank capital and portfolio risk." *The Journal of Finance* 35(5):1235-1244.

Kryzanowski, L. and G. Roberts. 1993. "Canadian banking solvency, 1922-1940." *Journal of Money, Credit and Banking* 25(3, Part 1):361-376.

Kuritzkes, A. and T. Schuermann. 2006. *What we know, don't know and can't know about bank risks: A view from the trenches.* Wharton Financial Institutions Center.

Kwan, S. 2004. "Risk and return of publicly held versus privately owned banks." *Federal Reserve Bank of New York Economic Policy Review* 10(2):97-107.

------. 1998. *The securities activities by commercial banking firms' section 20 subsidiaries: Risk, return and diversification benefits.* San Francisco: Federal Reserve Bank of San Francisco.

------. "Comments on `Trends in organizational form and their relationship to performance: the case of foreign securities subsidiaries of US banking organizations.'." *Journal of Financial Services Research* 16(2):219.

Kwan, S. and E. Laderman. 1999. "On the portfolio effects of financial convergence: A review of the literature." *Federal Reserve Bank of San Francisco Economic Review* 2:18-31.

Kwast, M. 1989. "The impact of underwriting and dealing on bank returns and risks." *Journal of Banking and Finance* 13:101-125.

Laderman, E. 2000. *The potential diversification and failure reduction benefits of bank expansion into non-bank activities.* San Francisco: .

Laeven, L. and Ross Levine. "Bank Governance, Regulation, and Risk Taking." *SSRN eLibrary.*

Leach, C. 1979. *Introduction to statistics: A nonparametric approach for the social sciences.* New York: Wiley.

Liang, N. 1989. "Bank profits, risk, and local market concentration." *Journal of Economics and Business* 41(4):297-305.

Liang, N. and S. Rhoades. 1988. "Geographic diversification and risk in banking." *Journal of Economics and Business* 40(4):271-284.

Liang, N. and D. Savage. 1990. *New data on the performance of non-bank subsidiaries of bank holding companies.* Washington, DC: Board of Governors of the Federal Reserve System.

Lown, C., C. Osler, P. Strahan and A. Sufi. 2000. "The changing landscape of the financial services industry: What lies ahead." *Federal Reserve Bank of New York Economic Policy Review*:1-55.

Mann, H. B. and D. R. Whitney. 1947. "On a test of whether one of two random variables is stochastically larger than the other." *The Annals of Mathematical Statistics* 18(1):50-60.

Mansi, S. A. and D. M. Reeb. 2002. "Corporate diversification: what gets discounted?" *Journal of Finance* 57(5):2167-2183.

McAllister, P. and D. McManus. 1993. "Resolving the scale efficiency puzzle in banking." *Journal of Banking and Finance* 17(2-3):389-405.

McClure, E. 2008. *Press Release from Division of Finance of the State of Missouri.* Jefferson City, Missouri:

Merton, R. 1977. "An analytic derivation of the cost of deposit insurance and loan guarantees: An application of modern option pricing theory." *Journal of Banking and Finance* 1(1):3-11.

Montgomery, C. and H. Singh. 1984. "Diversification strategy and systematic risk." *Strategic Management Journal* 5(2):181-191.

Nash, R. and Sinkey, J., Jr. 1997. "On competition, risk, and hidden assets in the market for bank credit cards." *Journal of Banking & Finance* 21(1):89-112.

Nichols, C., J. Wahlen and M. Wieland. 2005. *Publicly-Traded versus Privately-Held: Implications for Bank Profitability, Growth, Risk, and Accounting Conservatism.*

O'Hara, M. 1981. "Property rights and the financial firm." *Journal of Law and Economics* 21(2):317-332.

Palepu, K. 1985. "Diversification strategy, profit performance and the entropy measure." *Strategic Management Journal* 6(3):239-255.

Pettway, R. H. and Sinkey, J., Jr. 1980. "Establishing on-site bank examination priorities: An early warning system using accounting and market information." *Journal of Finance* 35(1):137-150.

Phillips, P. and D. Sul. 2003. "Dynamic panel estimation and homogeneity testing under cross section dependence." *Econometrics Journal* 6(1):217-42.

Prahalad, C. K. and Richard A. Bettis. 1986. "The dominant logic: a new linkage between diversity and performance." *Strategic Management Journal* 7(6):485-501.

Purnanandam, A. 2005. *Interest rate risk management at commercial banks: An empirical investigation.* FDIC.

Rappaprt, L., J. Perry and D. Blumberg. 2008. "New Fears Jolt Credit Markets." *Wall Street Journal,* March 6, A.

Rasmusen, E. 1988. "Mutual banks and stock banks." *Journal of Law and Economics* 31(2):395-421.

Reichert, A. and L. Wall. 2000. "The potential for portfolio diversification in financial services." *Federal Reserve Bank of Atlanta Economic Review*: 35-51.

Rhoades, S. and R. Rutz. 1982. "Market power and firm risk." *Journal of Monetary Economics* 9(1):73-85.

Rivard, Richard J. 2003. "Income smoothing behavior of U.S. banks under revised international capital requirements." *International Advances in Economic Research* 9(4) p. 288 – 294.

Rivard, R. and C. Thomas. 1997. "The effect of interstate banking on large bank holding company profitability and risk." *Journal of Economics and Business* 49(1):61-76.

Rogers, K. 1998. "Nontraditional activities and the efficiency of US commercial banks." *Journal of Banking & Finance* 22(4):467-482.

Rogers, K. And J. F. Sinkey. 1999. "An analysis of non-traditional activities at U.S. commercial banks." *Review of Financial Economics*, Vol. 8., p. 25 – 39.

Ronn, E. I. and A. K. Verma. 1987. "A multi-attribute comparative evaluation of relative risk for a sample of banks." *Journal of Banking and Finance* 11(3):499-523.

Rose, P. 1987. "The impact of mergers in banking." *Journal of Economics and Business* 39(4):289-312.

Rosen, R., P. Lloyd-Davies, M. Kwast and D. Humphrey. 1989. "New banking powers: A portfolio analysis of bank investment in real estate." *Journal of Banking and Finance* 13:355-366.

Ross, S. 1977. "The determination of financial structure: the incentive-signalling approach." *The Bell Journal of Economics* 8(1):23-40.

Roy, A. D. 1952. "Safety first and the holding of assets." *Econometrica* 20(3):431-449.

Saunders, A., E. Strock and N. Travlos. 1990. "Ownership structure, deregulation, and bank risk taking." *Journal of Finance* 45(2):643-654.

Saunders, A., B. Wilson and G. Caprio. 1997. *Mexico's Banking Crisis: Devaluation and Asset Concentration Effects.* Washington, DC: World Bank.

Schrand, C. and H. Unal. 1998. "Hedging and coordinated risk management: Evidence from thrift conversions." *Journal of Finance* 53(3):979.

Sheskin, D. 2004. *Handbook of Parametric and Nonparametric Statistical Procedures.* New York: Chapman and Hall/CRC.

Shibut, L., T. Critchfield and S. Bohn. 2003. "Differentiating among critically undercapitalized banks and thrifts." *FDIC Banking Review* 15(2):1-38.

Silhan, P. and H. Thomas. 1986. "Using simulated mergers to evaluate corporate diversification strategies." *Strategic Management Journal* 7(6):523-534.

Sinkey, J., Jr. 1978. "
Identifying "problem" banks how do the banking authorities measure a bank's risk exposure?." *Journal of Money, Credit, And Banking* 10(2):184-193.

------. 1975. "A multivariate statistical analysis of the characteristics of problem banks." *The Journal of Finance* 30(1):21-36.

Sinkey, J., Jr. and R. Nash. 1993. "Assessing the riskiness and profitability of credit card banks." *Journal of Financial Services Research* 7(2):127-150.

Smoluk, H., B. Andrews and J. Voyer. 2003. "A methodology for analyzing the effects of geographic diversification for financial institutions." *American Business Review* 21(1):47-55.

Song, F. and A. Thakor. 2007. "Relationship banking, fragility, and the asset-liability matching problem." *Review of Financial Studies* 20(6):2129-2177.

Stiroh, K. 2006. "A portfolio view of banking with interest and noninterest activities." *Journal of Money, Credit and Banking* 38(5):1351-1361.

------. 2004. "Diversification in banking: is non-interest income the answer?" *Journal of Money, Credit, and Banking* 36(5):853-882.

------. 2004. "Do community banks benefit from diversification?" *Journal of Financial Services Research* 25(2/3):135-160.

Stiroh, K. and J. Houston. 2006. *Three decades of financial sector risk.* New York: Federal Reserve Bank.

Stiroh, K. and A. Rumble. 2006. "The dark side of diversification: The case of US financial holding companies." *Journal of Banking and Finance.* Vol 30, p 2131 – 2161.

Story, L. 2008. "Analysts Say More Banks Will Fail." *New York Times,* July 14, 2008, C.

Templeton, W. and J. Severiens. 1992. "The effect of nonbank diversification on bank holding company risk." *Quarterly Journal of Business and Economics* 31(4):3-17.

Valnek, T. 1999. "The comparative performance of mutual building societies and stock retail banks." *Journal of Banking & Finance* 23(6):925-938.

Villalonga, B. 2004. "Diversification Discount or Premium? New Evidence from the Business Information Tracking Series." *Journal of Finance* 59(2):479-506.

Wall, L. 2004. "Comment on Carter, McNulty and Verbrugge." *Journal of Financial Services Research* 25(2/3):253-258.

------. 1987. "Has bank holding companies' diversification affected their risk of failure?" *Journal of Economics and Business* 39(4):313-326.

Wall, L., A. Reichert and S. Mohanty. 1993. "Deregulation and the opportunity for commercial bank diversification." *Federal Reserve Bank of Atlanta Economic Review*:1-25.

Whalen, G. 1999. *The risks and returns associated with the insurance activities of foreign subsidiaries of US banking organizations.* Washington, DC: Office of the Comptroller of the Currency.

------. 1999. "Trends in organizational form and their relationship to performance: The case of foreign subsidiaries of US banking organizations." *Journal of Financial Services Research*:181-218.

------. 1998. *The securities activities of the foreign subsidiaries of US banks: Evidence on risk and returns.* Washington, DC: .

Wheelock, D. and P. Wilson. 2000. "Why do banks disappear? The determinants of US bank failures and acquisitions." *Review of Economics & Statistics* 82(1):127.

Whited, T. 2001. "Is it inefficient investment that causes the diversification discount?" *Journal of Finance* 56(5).

Winton, A. 1999. *Don't put all your eggs in one basket?* Minneapolis, Minnesota: University of Minnesota.

Zoubi, Taisier A. 2007. Empirical testing of the loss provisions of banks in the GCC region. *Managerial Finance* 33(7) p. 500 – 511.