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The Relative Riskiness of Various Asset Focus Alternatives in Banking

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Revised: January 15, 2011

Abstract

This research examines whether the risk of focused banks is higher than that of diversified ones. Focused banks are defined as those with a large proportion of assets in one of six narrow industry segments including agricultural loans, credit cards, commercial lending, mortgage lending, consumer lending, and other focused loans. It also compares the relative levels of risk of those focused banks.

This study takes a bank supervisor approach rather than adopting the perspective of a shareholder. It differs from similar work in the past because it 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. The data in this study confirms the major hypothesis that banks following a diversified strategy are less risky than banks following an industry-focused approach. Interestingly, our study finds that, despite being more risky, the focused groups reported return-on-asset ratios below those of the diversified comparator groups in the majority of our comparisons. This study is also the first to examine the relative levels of risk of different bank asset focus strategies.

1. Introduction

This study investigates the relationship between diversification and risk of banks by comparing banks following a focused strategy with ones pursuing a diversification strategy. Bankers and their regulators face two competing theories about the relationship between risk and diversification. The first theory predicts that diversified banks will be less risky than focused banks in the same manner that there can be benefits to diversification in portfolio formation. The second theory predicts that focus on a specific market segment will lead to segment-specific expertise in monitoring and screening of borrowers that will render focused banks less risky than their diversified counterparts.

Studies that address this question tend to compare the riskiness of a single focused strategy (e.g. credit card banks) to the riskiness of a pool of all other banks. Such studies are limited in the sense of examining only a single focused strategy, but also because the comparator groups against which the focused strategy is evaluations tend to be comprised of both focused and diversified banks. This study 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.

Each of the six different focused peer groups considered in this study includes banks that hold a large proportion of their assets in a narrow industry segment. The specific segments are: agricultural loans; credit cards; commercial lending; mortgage lending; consumer lending; and, miscellaneous focused loans. We examine the link between membership in a focused peer group and bank risk. In order to better understand the underlying drivers of the level of risk and relative returns, we also examine the variance of returns and capital levels of the diversified strategy and the various focused

strategies.   We also compare focused and diversified strategies using size-matched samples to control for possible size-effects that may be related to relative riskiness.

The findings are intended to help banking supervisors decide how to allocate supervisory resources, and specify policies, such as calling for capital levels that are linked to levels of risk. Our supervisory focus differs from other studies in the literature, which typically consider diversification from the point of view of shareholders, or less frequently, management or bondholders. Regulators are different from shareholders and bondholders because they cannot easily diversify risk. Typically regulators have a defined mandate over a specific group of entities, and cannot easily change the regulations or the regulated. Thus, it is important for them to understand relative riskiness among the regulated so as to understand the main sources of the risks they are attempting to manage.

The primary risk measure in this study is the risk index defined as:

$$Risk\ Index = \frac{\left(\left(\frac{\Pi}{A}\right) + \left(\frac{K}{A}\right)\right)}{\sigma_{\Pi/A}} \quad . \qquad (1)$$

In equation (1), Π is net income, A is total assets, and K is total regulatory capital held by the bank. The asset measure in this study includes both on-balance sheet and estimated off-balance sheet assets. This differs from most other research, which tends to be based on assets reported only on the balance sheet. The risk index, as defined above, has been widely and regularly used as a proxy for risk in the financial and non-financial literature since Roy (1952) (c.f. Hannan & Hanweck, 1988; Sinkey & Nash, 1993; Boyd et al, 1993; Kwan & Laderman, 1999; and, Beck & Laeven, 2006).

The risk index is often referred to as the distance-to-default orthe z-score[3]. It incorporates net income volatility, the level of returns, and the amount of capital held relative to assets in a single measure. Inclusion of capital in the measure is important because it serves as a buffer against failure. Studies using the risk index include: Boyd & Graham (1988) who looked at the relationship between risk and the degree of involvement in non-bank activities; Hannan & Hanweck (1988) who investigated whether there was, as they expected, a positive relationship between bank risk-taking and the spreads over the default free rate; and, Kimball (1997) who compared banks specializing in small business micro-loans with a mixed peer group matched by size and location, and who found that the focused peer group was riskier than the diversified peer group.

Eisenbeis & Kwast (1991) conducted a study similar to this one, but addressed only one type of focused peer group. They compared banks specializing in real estate lending with their more broadly diversified counterparts and found little difference in risk between the two. In contrast to that study, Liang & 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 & Kwast (1991) included low-risk residential real estate categories that were not included in the Liang & Savage (1990) study.

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[3] Altman (1968, 2000) also uses the term z-score, but in his case the z-score is determined by inserting selected financial ratios of a specific company into a function whose parameters have been determined by discriminant analysis of the financial ratios of a sample set of other companies, some of which entered bankruptcy and some of which didn't. The Altman z-score is used to predict bankruptcy.

Sinkey & Nash (1993) also conducted a study similar to this one, but again, with only one type of focused peer group. They used the risk index to compare banks focusing on credit cards with those pursuing a diversified strategy. They found that the credit card banks were riskier despite generating higher returns than their more diversified counterparts.

While the risk index has been a useful research measure, it has some shortcomings. First, it measures risk in a single period and therefore does not take into account that higher levels of risk may result from a sequence of losses over more than one period. It also relies on the accuracy of accounting data, which is a challengeable assumption, since the literature indicates that banks tend to smooth earnings across accounting periods. The potential result of this is that earnings and asset levels in a specific accounting period may not reflect the underlying economic reality for that period (Beck & Laeven, 2006). Notwithstanding these concerns, the risk index remains a useful research tool for comparing risk levels across banks or groups of banks at a point in time.

A main focus of this study is to improve understanding of the relationship between diversification and bank risk. Stiroh (2004, p. 135) points out that although "one might expect diversification to directly reduce risk, recent research for United States banks has been mixed". The earliest research used industry-level data from the 1950's to the 1970's, obtained from the Internal Revenue Service, to compare the volatilities and correlations of earnings of banks with other financial institutions, such as securities firms, insurance companies, real estate brokers, leasing companies, and thrift institutions (DeYoung & Roland, 2001). Since the correlations were very low, or sometimes even

negative, diversification, defined as adding non-bank financial services to an existing banking business, was assumed to lower risk.

Allen & Jagtiani (1999) created synthetic universal banks consisting of a bank, a securities firm, and an insurance company to test the relationship of diversification into these business lines with bank risk. They found that the resultant synthetic entities had lower levels of overall risk but higher systematic risk when compared to undiversified banks. Boyd & 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, and found that certain examples of this type of diversification were linked with reduced risk, but others, such as those between banks and securities or real estate firms, were not.

Laderman (2000) used a very similar methodology to Boyd & Graham (1988), but instead of limiting her sample to a subset of possible combinations, she used all possible combinations. Her data indicated that substantial diversification into life insurance underwriting, casualty insurance underwriting, and securities brokerage was related to a reduction in overall risk. Smoluk et al (2003) also used this type of modelling and found that New England banks that diversified into various other regions of the United Stated exhibited lower levels of risk.

Simulated bank diversification by direct equity investment in real estate has been shown to have marginal contributions to risk reduction at low levels of investment, but is linked to higher levels of risk when the investment level increases (Rosen et al, 1989). Rivard & Thomas (1997) compared interstate banks with banks 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. Acharya et al, (2002) examined diversification and its relationship with bank risk, and found that in certain cases there was a positive correlation. That 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 associated with diversification for certain banks. Both industrial and sectoral diversification corresponded to increases in risk, while geographic diversification corresponded to decreases in risk.

Studies using stock market data provide evidence to support the idea that diversification is related to lower levels of risk. Baele et al (2007) used a panel data approach to model the risk-return trade-off of publicly-traded European banks during 1989 to 2004; they found that the markets favoured more diversified banks. Templeton & 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 the percentage of non-bank assets relative to the market value of total assets as the proxy for diversification.

Table 1 summarizes the research findings for the link between bank diversification and risk. While the research results are mixed, the view that diversification and bank risk are negatively correlated seems to prevail.

Table 1

**Findings in the Literature on the
Relationship between Diversification and Risk**

Type of Study	Positive Correlation	Negative Correlation	Mixed Results
Simulated Merger	Stiroh, (2006) DeYoung & Roland (2001)	Kwan & Laderman (1999) Smoluk et al (2003) Kwast (1989) Kwan (1998) Reichart & Wall (2000)	Winton (1999) Allen & Jagtiani (1999) Boyd & Graham (1988) Rosen et al (1989)
Empirical with Accounting Risk Measure		Sinkey & Nash (1993) Rivard & Thomas (1997) Acharya et al, 2002	
Empirical with Market Risk Measure	Bhargava & Fraser (1998)	Baele et al (2007) Templeton & Severiens (1992) Eisenbeis et al (1984)	

2. Theoretical Framework

A standard theoretical view is that diversification is negatively related to risk. This is based on portfolio theory, which says that the variance of returns of a diversified portfolio comprised of less than perfectly correlated assets tends to be lower than that of a focused portfolio of similar assets. This idea suggests that a bank's expected level and variability of return-on-assets is related to the mix of assets the bank holds, and that a portfolio of cash-flows from less than perfectly correlated sources ought to be more stable than its constituent parts taken individually (Baele et al, 2007).

Cerasi & Daltung (2000) 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 tend to be indivisible[4] and illiquid. Diversification in a bank's asset base is part of what enables it to finance these illiquid assets with liquid liabilities. Hence, banks provide liquidity intermediation to the financial system through diversification.

Other theorists have put forward a more complex relationship between informational economies of scale, diversification, and risk (De Nicolo, 2000). While a bank may anticipate the benefits to diversification predicted by portfolio theory, its quality of monitoring and project evaluation may suffer when it enters a new sector. 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 the sector, the new entrant may be exposed to the winner's curse. Finally, expansion into the new sector may mean the bank is increasing in size which could lead to scale inefficiencies (Acharya et al, 2002). Winton (1999) points out that an increase in risk relative to returns can also arise if a bank diversifies into a sector that offers relatively lower returns from monitoring; this can occur if the new sector involves lower than usual levels of collateral, or fewer than usual creditors' rights. He showed that diversification can be positively related with insolvency risk when certain structures of monitoring costs exist, and when there are skewed loan return distributions.

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[4] In the current setting, where bank club deals and syndications are common, a large deal would appear somewhat divisible from the borrower's point of view because the deal can be broken down into tranches, but a tranche taken up by an individual bank is indivisible, for practical purposes, from that lender's point of view.

Although most of the theoretical literature focuses on monitoring, banks also screen borrowers and structure loans when underwriting. Most of the same arguments supporting the case for specialization in monitoring apply to screening as well. Better screening means a superior ability to distinguish between higher and lower risk borrowers leading to lower credit write-offs and workout costs, and lower wealth transfers to borrowers due to loan mis-pricing at the outset.

Overall therefore, the question of whether diversification is linked to higher or lower levels of risk is not completely clear. For the most part, the literature seems to take the view that diversification and bank risk are negatively correlated, although there may be structural reasons leading to a different result.

3. Hypotheses

We test four different hypotheses in this study. The primary one is that banks in the diversified peer groups are less risky than banks in the focused peer groups. In specifying a focused bank, we follow the definitions used by the Federal Deposit Insurance Corporation in the United States (the "FDIC"). Essentially, a focused bank is a bank with a large proportion of its assets in one of six narrow industry segments: agriculture; credit cards; commercial lending; mortgage lending; consumer lending; and, the miscellaneous but focused segment. We elaborate on the definitions of these groups in Table 7.

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

$$\text{Risk Index} = \frac{\left(\left(\frac{\Pi}{A}\right) + \left(\frac{K}{A}\right)\right)}{\sigma_{\Pi/A}}. \tag{2}$$

In equation (2), Π is net income after tax, A is risk-weighted assets, Π/A is return-on-assets, K is total regulatory capital held by the bank, and $\sigma_{\Pi/A}$ is the standard deviation of return-on-assets.

Risk-weighted assets, A, includes all assets owned by the institution including cash, loans, securities, bank premises and other assets, and also off-balance-sheet assets[5]. Net income, Π, is comprised of 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[6]. Regulatory capital, K, is comprised 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. The literature and practitioners commonly refer to K/A as the capital-asset ratio, and we follow that approach in this study.

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[5] Off balance sheet assets and risk-weightings were as self-reported by the banks to the FDIC. Federal regulatory agencies regularly review these reports during their periodic examinations.

The higher the risk index, the greater is the equity capital and average level of returns available to cushion a bank against a loss relative to volatility of returns. Thus, the risk index is typically interpreted as follows: the higher the risk index, the lower the probability of failure. The risk index has the advantage of combining profitability, leverage, and returns volatility in a single measure. It is also an intuitively appealing measure: it increases when profitability and the capital held by a bank relative to its assets go up, and decreases when profit volatility increases.

Hannan & 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:

$$p \leq \left(\frac{1}{2}\right) \frac{\sigma^2}{\left(E\left[\frac{\Pi}{2}\right] + \frac{K}{A}\right)^2}$$

(3)

The ½ in this inequality accounts for the fact that failure occurs only in one tail of the distribution. 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 its equity is wiped out (Beck & Laeven, 2006). Because of this relationship, the risk index is sometimes referred to as the probability of failure (see, for example, Kwan & Laderman, 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 it specifies failure only if a one-period loss exceeds a bank's total

capital. Realistically, however, a bank could experience losses on a much smaller scale and still experience liquidity problems, creditor runs, or regulatory interventions, any of which could precipitate bankruptcy (Boyd & Graham, 1986).

The next three hypotheses address the sub-components of the risk index: return-on-assets; standard deviation of return-on-assets; and, the capital-to-assets ratio. In the second hypothesis we address the level of returns: we posit that the diversified peer groups have lower returns on assets than the focused peer groups, as was found by Sinkey & Nash (1993). In the third hypothesis we address the standard deviation of return-on-assets: we posit that the diversified peer groups have a lower standard deviation of return-on-assets than the focused peer groups. Finally, we address the capital-to-assets ratio: following Boyd & Gertler (1994), we posit that the diversified peer groups hold less capital relative to assets than the focused peer groups. In summary then, the four hypotheses are:

H_1: Total risk, as proxied by the risk index, is lower (that is, the risk index value is larger) for the diversified groups than for the focused groups;

H_2: Returns measured relative to risk-weighted assets are lower for the diversified groups than for the focused groups;

H_3: Volatility risk, as proxied by the standard deviation of return-on-assets, is lower for the diversified groups than for the focused groups;

H_4: The capital-asset ratio is lower for the diversified groups than for the focused groups.

We control for size since theory and certain of the literature indicate that size can be related to the components of the risk index. McAllister & McManus (1993), for

example, support Boyd, et al'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 & Strahan (1997) also found a relationship between size and capital ratios with larger banks operating with lower capital ratios.

4. 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 we follow it here. 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 & Schuermann (2006), and Estrella, Park & 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. Our approach 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

We tested the major hypothesis that the focused peer group differs from the diversified one 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 & Whitney (1947).

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-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[7].

The Mann-Whitney U Test also works best if only a limited number of ties exist 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 our data is much less than that limit.

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

5. Data

We obtained data for the study from the Statistics on Depository Institutions website of the Federal Deposit Insurance Corporation[8]. This database includes balance sheet, income statement, condition and performance ratios, and demographic information for all federally regulated Unites States banks, trust companies and savings and loan institutions.

The 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 are not likely to be driven by cyclical events, since the study period includes both an economic contraction from March to November 2001 and then a subsequent expansion (Hall et al, 2003). 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.

We excluded banks organized as tax-free S-Corporations under the American tax code as discussed above. 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 FDIC divides the universe of American banks into six focused peer groups and three diversified peer groups. Table 3 summarizes the key characteristics of the peer groups following a focused strategy.

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[8] c.f. www2.fdic.gov/sdi/index.asp

Table 3

**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% of total loans and leases.
Credit Cards	18	Credit-card loans plus securitized receivables in excess of 50% 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% of total assets.
Mortgage	444	Residential mortgage loans plus mortgage-backed securities in excess of 50% of total assets.
Consumer	16	Residential mortgage loans plus credit-card loans plus other loans to individuals, in excess of 50% of total assets.
Miscellaneous Focused	82	Assets less than $1 billion and with loans and leases less than 40% 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	3,539	

Table 4 summarizes the key characteristics of the peer groups following a diversified strategy.The first of the diversified peer groups contains large multi-national banks; only two banks meet this definition: JPMorgan Chase Bank and Citibank.

Table 4

**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	194	

Size ranges for the diversified and focused banks are shown in Table 5.

Table 5

Size Ranges for Aggregate Groups

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

In order to conduct size-matched comparisons, we formed quintiles of like-sized diversified and focused banks. To do this, it was necessary to exclude banks with assets less than $10.3 million and more than $281.3 billion because banks outside of this range did not have counterparts in both groups. We formed quintiles by ordering the diversified group by size from smallest to largest and including an almost equal number of banks in each quintile. The asset level of the smallest and largest bank in each quintile

formed the lower and upper asset-size bound for each quintile. We then allocated focused

banks to quintiles based on these lower and upper asset-size bounds. The quintile bounds

and allocations of banks to quintiles that resulted from this process are shown in Table 6.

Table 6

**Number of Banks in
Asset Size Quintiles**

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

6. Results

The following sections provide summary data and the results of the statistical tests

corresponding to each of our four hypotheses. For ease of reference, we repeat the

relevant hypothesis at the beginning of each section. We test each hypothesis by

comparing the diversified banks to the focused banks in the following ways:

    a) The entire sample: the group of all diversified banks versus the group of all focused banks (Panel A of Tables 8, 12, 15, and 18);

    b) The size matched sample: the group of all diversified banks versus a subset of focused banks matched by size to the members of the diversified group (Panel B of Tables 8, 12, 15, and 18). To create the size-matched comparison groups, we selected banks from the focused group that were closest in size to each of the banks in the diversified group;

    c) The entire sample divided into quintiles by asset size using the approach described at the end of Section 5: the diversified banks in

a quintile versus all the focused banks in the corresponding quintile (Panel C of Tables 8, 12, 15, and 18);

d) Each of the six focused groups versus a size-matched subset from the diversified group (Tables 9, 13, 16, and 19). To create a size-matched subset from the diversified group, we determined the upper and lower asset level bounds for each focused group and selected diversified banks with asset levels within those bounds.

6.1. Hypothesis One: Risk Index

In hypothesis one we posit that total risk, as proxied by the risk index, is lower (that is, the risk index value is larger) for the diversified group than for the focused groups. Recall that the higher the risk index, the lower the risk, so a higher risk index score means lower risk. Table 7 shows the risk index level for the diversified peer group and for each focused peer group. Consistent with our hypothesis, the mean and median of the log of the risk index for the diversified group exceeded those of each of the focused groups, indicating a lower level of risk for the diversified group.

Table 7

**Individual Focused Peer Groups vs.
Entire Sample of Diversified Banks**

Peer 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

Table 8 presents the results of our tests for statistical significance of the observed differences between the diversified group and the focused groups.

Table 8

**Sample Statistics and
Results of Comparisons[9]**

	Focused			Diversified	
	Number of Banks	**Log Risk Index (Mean/ Median)**	**P-Value**	**Number of Banks**	**Log Risk Index (Mean/ Median)**
Panel A					
All Banks	3,539	1.71/ 1.74	<0.0005	194	1.89/ 1.90
Panel B					
Size Matched	192	1.69/ 1.70	<0.0005	192	1.89/ 1.90
Panel C					
Quintile 1	496	1.72/ 1.76	0.470	38	1.80/ 1.80
2	455	1.67/ 1.70	0.008	38	1.83/ 1.88
3	379	1.69/ 1.73	<0.0005	38	2.04/ 2.06
4	744	1.72/ 1.74	<0.0005	39	1.95/ 1.92
5	1,375	1.73/ 1.75	0.021	39	1.83/ 1.88

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[9] 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.

Our tests indicate the difference between the diversified group and focused groups taken as a whole is significant at negligible P-values based on: a) comparison with the all focused banks considered as a single group; and, b) comparison with a size- matched sub-set of the focused banks considered as a single group (Panels A and B of Table 8). Thus, the primary hypothesis is strongly supported in both comparisons. The primary hypothesis is also supported in four of the five quintile comparisons (Panel C of Table 8). Although the mean and median risk measures for the quintile 1 sample indicate lower risk for the diversified group, the difference is not statistically significant. Quintile 1 covers the smallest asset sizes in our stratification (see Table 6). Thus, it may be that the benefits to diversification do not out outweigh the benefits to specialization in a statistically significant way at these asset levels.

Table 9 presents the results of our tests for statistical significance in the comparisons between individual focused groups and a size matched sub-set of the diversified group.

Table 9

**Individual Focused Peer Groups vs.
Size-Matched Sample of Diversified Banks**

	Focused			Diversified		
	Log of Risk Index		Number of Banks	Log of Risk Index		P-Value
Peer Group	Mean	Median		Mean	Median	
Agricultural	1.83	1.87	607	1.91	1.91	175	0.006
Residential Mortgage	1.76	1.76	444	1.89	1.90	192	<0.0005
Commercial	1.70	1.72	1,851	1.91	1.91	149	<0.0005
Miscellaneous Focused	1.70	1.78	82	1.91	1.91	174	0.002
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

In each of the comparisons the mean and median risk measure suggests the diversified banks are less risky than the comparator focused group. In addition, the difference appears to be significant at low or negligible P-values.

Table 10 presents the results of comparing each focused group to all other focused groups. The purpose of the comparisons is to determine if a particular focused group is more or less risky than other focused groups in a statistically significant way. The table lists the six focused peer groups in rank order from the least risky (i.e. largest risk index measure) to the most risky and P-values from the Mann-Whitney tests used to determine statistical significance of the observed differences in riskiness.

Table 10

**Peer Group vs. Peer
Group Comparisons**

Peer Group	Mean Log Risk Index	P-Values of the Mann-Whitney Tests					
		Agri.	Res. Mtg.	Comm.	Misc.	Cons.	Cr. Card
Agricultural	1.83						
Residential Mortgage	1.76	<0.0005					
Commercial	1.70	<0.0005	<0.0005				
Miscellaneous Focused	1.70	0.044	0.069	0.129			
Consumer	1.56	0.001	0.001	<0.0005	0.016		
Credit Card	1.34	<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 on the one hand, and the residential mortgage, and commercial groups, respectively, on the other hand. These tests suggest that the agricultural group posed the lowest risk during the study period and the consumer, and credit card banks posed the highest risk. The other three groups (miscellaneous; residential mortgage; and, commercial) fall in between, although the exact order is not clear based on our tests.

6.2. Hypothesis Two: Return-on-assets Ratio

In hypothesis two we posit that returns measured relative to risk-weighted assets are lower for the diversified group than for the focused groups. Contrary to the

expectation implicit in our hypothesis, mean and median returns for the diversified group

exceed those of the focused groups in four of the six comparisons.

Table 11

**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

The results of our statistical tests reported in Table 12 largely confirm that the data

does not support the hypothesis.

**Table 12**

**Sample Statistics and
Results of Comparisons**

	Focused			Diversified	
	Number of Banks	Mean /Median ROA	P-Value	Number of Banks	Mean/ Median ROA
Panel A					
All	3,539	2.25/ 1.33	<0.0005	194	1.72/ 1.71
Panel B					
Size Matched	192	1.19/ 1.18	<0.0005	192	1.73/ 1.71
Panel C					
Quintile 1	496	3.18/ 1.21	0.262	38	1.35/ 1.30
2	455	1.52/ 1.29	0.146	38	1.45/ 1.47
3	379	1.27/ 1.26	<0.0005	38	2.01/ 2.04
4	744	1.38/ 1.27	<0.0005	39	1.86/ 1.91
5	1,375	1.69/ 1.44	<0.0005	39	1.96/ 1.94

In the case of the comparison of all focused banks with all diversified banks (Panel A of Table 12), the test is significant at a negligible P-value. It is noteworthy, however, that the mean of the focused group's return-on-assets exceeds the mean of the diversified group, whereas the reverse is true for the median. The Mann-Whitney test is a test for both differences in distribution and relative location of distributions, but the latter holds only if the distributions of the observations being compared are identical in form. In the case where the mean and median give conflicting signals of central tendency, it may be that the distributions are not sufficiently similar in form to permit interpretation of the

Mann-Whitney test as a test of location. The interpretation is important in this case, because the point of the test is to determine which group tends to produce higher returns – the focused group or the diversified group. To help with interpretation of our results, we present a graph of the distribution of return-on-assets for the focused group (Series 1) and the diversified group (Series 2). The former produces a smoother plot than the latter because it is based on many more data points.

Graph 1

Return-on-assets
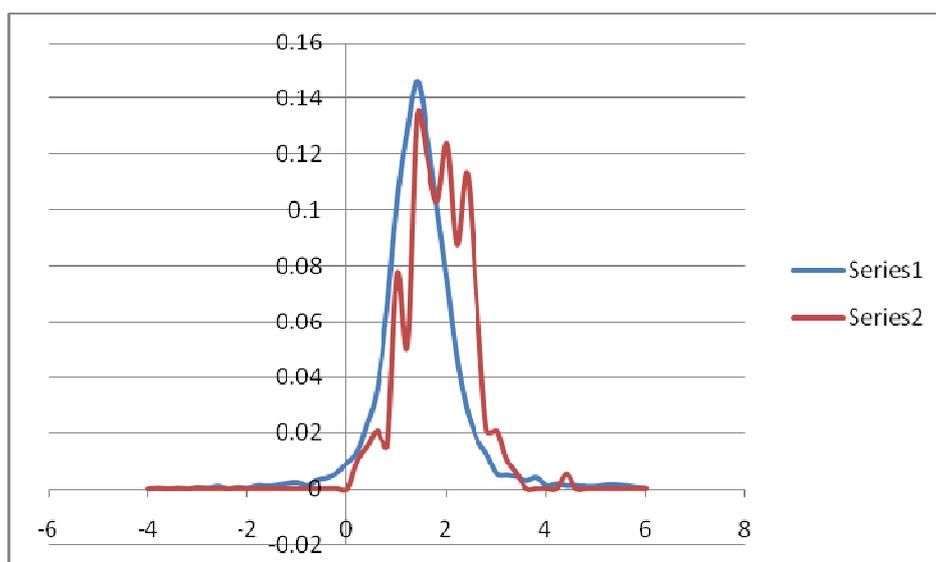
The fact that the distribution of return-on-assets ratios for the focused group tends to be to the left of the distribution for the diversified group supports the interpretation that there is a statistically significant tendency for return-on-assets for the focused group to fall short of that for the diversified group. Thus, the hypothesis is not supported by the data in this comparison; in fact the reverse seems to be confirmed. The result for the size-

matched sample would appear to be clear (Panel B of Table 12). The data is not only unsupportive of the hypothesis; it seems to confirm the opposite.

The results for the quintile comparisons are mixed (Panel C of Table 12). For quintiles 1 and 2, the smaller banks in the sample, the median and the mean again give conflicting signals of central tendency. As the test for these quintiles did not achieve statistical significance, we refrain from comparing plots of the returns distributions, and conclude that the hypothesis is not supported. For quintiles three through five – the larger banks in the sample – the mean and median of return-on-assets for the focused groups fall short of those for the diversified group, and the results are statistically significant. Thus, we conclude again that the data is not only unsupportive of the hypothesis; it seems to confirm the opposite.

Table 13 reports the results of the comparisons of individual focused groups to size-matched sub-sets of the diversified group.

Table 13

**Comparison of Individual Focused Peer Groups to
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

Return-on-assets for the agricultural and commercial groups appears to be statistically significantly less than for the diversified group in contradiction to our hypothesis. The consumer group achieved lower mean and median returns than the diversified group, but not statistically significantly so. Nonetheless, it is the case that the data for this group does not support our hypothesis. The miscellaneous focused group achieved mean and median returns in excess of its diversified comparator group, and the result appears to be statistically significant – the lone support for our hypothesis in the data. The residential mortgage group reports returns in contradiction to our hypothesis and the result appears to be statistically significant.

Thus, there is little support in the data for the hypothesis that focused banks achieve greater returns-on-assets than diversified banks, and this is despite the evidence

under our first hypothesis that the focused groups appear to be riskier than their comparator diversified groups.

6.3 Hypothesis Three: Standard Deviation of Return-on-assets

In hypothesis three we posit that the standard deviation of return-on-assets is lower for the diversified group than for the focused groups. Table 14 presents the standard deviations of return-on-assets for the diversified group and the various focused peer groups. The diversified group, as hypothesized, had lower mean standard deviation of return-on-assets than all six focused groups, and lower median standard deviation of return-on-assets than four of the six focused groups. In contradiction to our hypothesis, the agricultural and commercial groups outperformed the diversified group on this measure.

Table 14

**Individual Focused Peer Groups versus
Entire Sample of Diversified Banks**

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

Table 15 presents the results of our statistical tests.

Table 15

**Sample Statistics and
Results of Comparisons**

	Focused			Diversified	
	Number of Banks	**Mean/ Median St. Dev. of ROA**	**P-Value**	**Number of Banks**	**Mean/ Median St. Dev. of ROA**
Panel A					
All	3,539	1.7221/ 0.3149	0.003	194	0.3471/ 0.2735
Panel B					
Size Matched	192	0.4989/ 0.3435	<0.0005	192	0.3466/ 0.2722
Panel C					
Quintile 1	496	2.7417/ 0.3987	0.261	38	0.4268/ 0.3557
2	455	0.6839/ 0.4022	0.016	38	0.3755/ 0.2749
3	379	0.5382/ 0.3305	<0.0005	38	0.2463/ 0.2292
4	744	0.5304/ 0.2916	0.088	39	0.2876/ 0.2433
5	1,375	0.5331/ 0.2735	0.913	39	0.3968/ 0.2693

The mean and median standard deviation of return-on-assets over the study period for the entire sample of focused banks exceeded those of the diversified group, and the difference appears to be statistically different (Panel A of Table 15). The same held for the size matched sample (Panel B of Table 15). While the direction of the effect in the quintile comparisons was as hypothesized, the difference appears to be statistically significant only for quintiles 2 and 3 (Panel C of Table 15).

Table 16 presents the results of the comparisons of each focused group with a size- matched sub-set of diversified banks.

Table 16

**Individual Focused Peer Groups versus
Diversified Groups Matched by Asset Size**

	Focused			Diversified			
	St. Dev. of Return-on-assets		Number of Banks	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

The direction of the effect was as hypothesized in all cases except for the comparison of median standard deviation of return-on-assets for the agricultural group. The differences appear to be statistically significant in four of the six comparisons.

While somewhat mixed, we conclude that the data generally supports the hypothesis in this section.

6.4 Hypothesis Four: Capital-to-assets Ratio

In hypothesis four we posit that the capital-to-assets ratio is lower for the diversified group than for the focused groups. As shown in Table 17, the capital-to-assets

ratio for the entire sample of diversified banks was, in contrast to the hypothesis, greater

than that of four of the six focused bank groups.

Table 17

**Individual Focused Peer Groups versus
Entire Sample of Diversified Banks**

Group	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 results of our statistical tests are presented in Table 18.

Table 18

**Sample Statistics and
Results of Comparisons**

	Focused			Diversified	
	Number of Banks	**Mean/ Median Capital-to-assets**	**P-Value**	**Number of Banks**	**Mean/ Median Capital-to-assets**
Panel A					
All	3,539	21.7/ 14.2	<0.0005	194	21.0/ 19.3
Panel B					
Size Matched	192	18.0/ 15.0	<0.0005	192	21.0/ 19.3
Panel C					
Quintile 1	496	33.8/ 20.3	0.871	38	21.6/ 19.2
2	455	21.6/ 16.9	0.114	38	20.4/ 18.2
3	379	18.4/ 15.0	<0.0005	38	23.1/ 21.6
4	744	16.6/ 13.8	<0.0005	39	20.8/ 21.0
5	1,375	15.1/ 12.5	<0.0005	39	19.6/ 16.6

Similar to our discussion of return-on-assets (Table 12), the mean and median of the capital-to-assets ratios for the focused banks (Panel A of Table 18) give conflicting indications of central tendency versus the diversified banks. Consistent with our hypothesis, the mean for the focused banks exceeds that for the diversified banks, whereas the opposite is the case for the median. The difference in distributions appears to be statistically significant, but the conflicting signals of central tendency make it difficult to interpret the results. To help with interpretation, we again plot the frequency of

appearances of capital-to-asset ratios for both the focused group (Series 1) and the diversified group (Series 2) in Graph 2.

Graph 2

Capital-to-assets Ratio
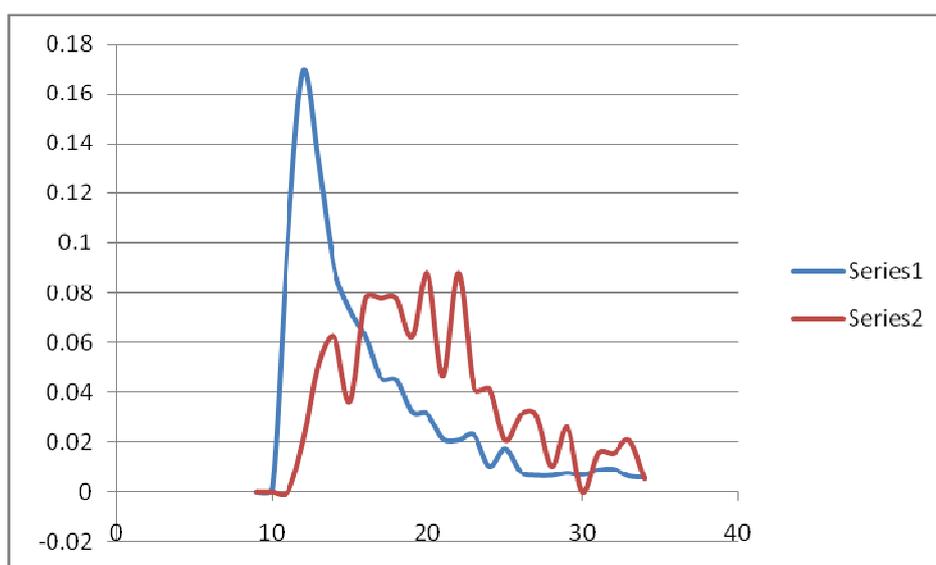
The fact that the distribution of the capital-to-assets ratios for the focused group tends to be to the left of the distribution for the diversified group supports the interpretation that there is a statistically significant tendency for capital-to-assets for the focused group to fall short of that for the diversified group. Thus, the hypothesis is not supported by the data in this comparison; in fact the reverse seems to be confirmed. The result for the size-matched sample would appear to be clear (Panel B of Table 18). The data is not only unsupportive of the hypothesis; it seems to confirm the opposite.

The results for the quintile comparisons are mixed (Panel C of Table 18). For quintile 1, the direction of the effect is consistent with our hypothesis, but the test is not

statistically significant. For quintile 2, the mean and median give conflicting signals concerning the direction of the effect, and the test is not statistically significant. For these quintiles we conclude that the data does not support the hypothesis. For quintiles three through five – the larger banks in the sample – the mean and median of return-on-assets for the focused groups fall short of those for the diversified group, and the results are statistically significant. Thus, we conclude again that the data is not only unsupportive of the hypothesis; it seems to confirm the opposite.

Table 19 reports the results of the comparisons of individual focused groups to size-matched sub-sets of the diversified group.

Table 19

**Individual Focused Peer Groups versus
Diversified Banks Matched by Asset Size**

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

In contrast to our hypothesis, four of the six focused peer groups have capital ratios less than their size-matched diversified comparator groups (agricultural; commercial; consumer; and, credit card), and the differences are statistically significant

in three of those cases (agricultural; commercial; and, consumer). The direction of the effect is consistent with the hypothesis for the residential mortgage and miscellaneous focused banks, and the result appears to be statistically significant. Overall therefore, we conclude that the data does not generally support this hypothesis.

7. Discussion

7.1 Hypothesis One: Risk Index

The data provide strong support for the first hypothesis: that focused banks are more risky than more diversified banks. The exception is for the smaller two quintiles where a difference exists, but is not statistically significant. Two reasons can be put forward for the lack of a statistically significant difference for the smaller banks. Perhaps they are so small that size-matched diversified banks in the comparator group are not truly diversified because of their very small size, or that the benefits to diversification at smaller bank sizes are small. In the smallest group asset levels are less than $45 million, which would make effective diversification difficult. An alternative explanation is that these sub-groups of small banks may include a disproportionate 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 Ratio

Rather than support our hypothesis, the data tended to confirm the opposite – that is, that diversified banks tend to have larger returns-on-assets than their riskier focused counterparts. Exceptions were the credit card and miscellaneous focused banks.

7.3 Hypothesis Three: Standard Deviation of Return-on-assets

The data provide solid support for the idea that the standard deviation of returns for focused banks exceeds that of diversified banks.

Rogers & 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 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, one can 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 & Rice (2004) 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 their findings are consistent with those of Rogers & Sinkey (1999) in this respect, they assert, as do Stiroh & 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 on this issue and conducts 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 streams.

7.4 Hypothesis Four: Capital-to-assets Ratio

In contrast to our hypothesis, the data seems to confirm that diversified banks hold more capital than their focused counterparts. It may be that diversified banks tend to be larger, and 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.

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