

**Is The Survival of Small Commercial Banks Threatened? A Comparative
Performance Evaluation of U.S. Commercial Banks:
1997-2002**

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Is The Survival of Small Commercial Banks Threatened? A Comparative Performance Evaluation of U.S. Commercial Banks: 1997-2002.

Abstract

In this study, we compare the performance of very small U.S. commercial banks with assets size less than \$25 million and all small banks with asset size less than \$1 billion to medium banks with assets size between \$1 billion and \$5 billion and large banks with asset size greater than \$5 billion during the period 1997-2002. We find that the small banks with asset size less than \$25 million are the least profit efficient according to PROFFEF analysis, least profitable according to ROA analysis and achieved the lowest level of interest income. These findings contradict earlier research findings of Berger and Mester [1997]; Akhigbe & McNulty [2003]] and Boyd and Runkle [1993] who report greater PROFFEF and ROA respectively at small banks than at large banks. The differences in mean PROFFEF tested significant at the 1 percent T-test level while the differences in mean ROA did not test significant at any level. We further find that small banks with assets size of less than \$25 show the highest level of non interest income. In contrast the small banks with asset size of less than \$1 billion show the lowest level of non interest income. The Mann-Whitney (U) test on the equality of the mean interest income and non interest of the different samples of banks tested significant for some years only at very low levels. The results of the statistical tests lead us to conclude that the small banks with averages assets size less than \$25 million are performing almost as well as the medium and large banks. The survival of small U.S. banks appears not to be in jeopardy at this point in time

1.0. Introduction

In this study, we use the profit efficiency test (PROFEFF), profitability ratio (ROA) and credit risk indicators such as provision for loan loss, actual loan loss and non-current loan to evaluate and compare the performance of small U.S. commercial banks with asset size less than \$25 million, small banks with asset size less than \$1 billion, medium size banks with assets of between \$1 billion and \$5 billion and large banks with assets size greater than \$5 billion for the period 1997-2002. Similar studies have been done. Most of these studies focused on small banks with larger assets: \$500 million, Akhigbe & McNulty [2001] or with reference to a specific category of small such as novo banks, DeYoung and Hassan [1998] or risk threshold of small commercial banks with average assets of less \$50 million and with one branch office Elyasiani and Mehdian [1995]. Empirical research findings indicate that the U.S. commercial banks that are most vulnerable to the deregulation and increased competition resulting from technological advances and e-commerce are the very small community banks. Most of the small banks with less than \$25million assets have one branch office. The number of this category of small banks has decreased from 1448 in 1997 to 784 in 2002, a decrease of 46 percent. Comparative decrease for medium banks is 11 percent and 2 percent for large banks.

2.0. Literature Review

The issue of survival of small banks in the present era of bank consolidation is of tremendous interest to scholars of financial services and regulators. Some regulatory factors that contribute to this threat of survival of small banks include: introduction of

interest bearing checking accounts, the removal of regulatory ceilings on bank deposit rates, relaxation of branching laws, increased competition from non-bank firms and the emergence of mega banks through mergers and acquisitions. In addition, during the second half of the 20th century, advances in communications technology, financial markets and banking production techniques have contributed to the erosion of fundamental advantages of community banks namely: the personal interaction between bankers, borrowers and depositors, especially small, unsophisticated borrowers and depositors. These developments have led to the marginalization of some small banks that flourished when the regulations and environment favored small-sized banks. Shaffer [1989]¹; Kutter [1991], and Fix [1988] find a dramatic increase in the proportion of failures occurring among the small banks and they cite performance data as evidence corroborating this view.

Shaffer [1995], Hunter and Timm, [1986], Evanoff, Israilevich and Merris, [1990], Noulas, Ray and Miller [1990], and Shaffer and David [1991] find significant scale economies for banks whose asset size extends well into the multibillion dollar range. In contrast some researchers find that little cost saving can be achieved by increasing the size of the banking firms (Berger, Hanweck and Humphrey [1987] and Gilligan and Smirlock [1984]).

There is research support for reasons why small banks may do better than large banks. Small banks may have both an inherent information advantage over large banks [Nakumura [1993] and Mester,

¹ Shaffer [1989] reports that in 1985 the annual number of failures had risen over 100, of which 77 were smallest banks with total assets of less than \$25 million dollars. Some 200 banks failed in 1987, of which 130 had less than 25 million dollars in assets and 167 had less than \$50 million in assets. In 1998

Nakumura and Renoult [1998]]. They find that small banks have access to better credit information than large banks [such as daily data on firm cash flows, which is available through monitoring checking accounts]. The findings of Berger, Alan, Miller, Peterson, Rjan and Stein [2002] suggest that small banks may have a comparative advantage in developing and using the "soft" information often associated with small business lending.

In addition, small banks seem also to have a structural advantage. The literature suggests that ceteris paribus, small banks in small communities can charge higher rates on loans and pay lower rates on deposits than other banks because there is less competition in small banking markets. See, for example, Gilbert [1984], Hannan [1991a, b], Berger, Hanweck and Humphrey [1987], and Gilligan and Smirlock [1984].

However, it is also suggested that ceteris paribus, managers of banks in less competitive markets may dissipate part of their advantages by enjoying perquisites such as higher salaries, more assistants, lavish office quarters, etc. See, for example, Arnold [1998], Berger and Hannan [1999], Hannan and Mavinga [1980], Purroy and Salas [2000], and Rhoades [1980]. Moreover, Rhoades and Rutz [1982] and Clark [1986] find that bank managers in smaller, less competitive markets may also shift the bank's asset composition to less risky loans and securities out of a desire to enjoy a "quiet life".

Many studies of bank performance report that small banks have higher returns on assets [but not necessarily equity] than large ones. Boyd and Runkle [1993] study banks with assets of more than \$1 billion and report an inverse relationship between bank size and return on assets, which they attribute to monopoly rents.

Berger and Mester [1997] and Akhigbe & McNulty [2003] report greater PROFEFF at small banks than at large banks. Elyasiani and Mehdiian [1995] suggest that because of deregulation, the future survival of small banks is in serious question. McNulty et al [2001] find no consistent evidence of superior loan quality at small banks. However this analysis is too restricted to one large state [Florida] in the US.

The Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 and the Gramm-Leach-Bliley Act of 1999 repealed the restrictions on banks affiliating with securities firms contained in sections 20 and 32 of the Glass-Steagall Act (Evanofit and Ors [2001]) and created a new "financial holding company" under section 4 of the Bank Holding Company Act. Such a holding company can engage in a statutorily provided list of financial activities, including insurance and securities underwriting and agency activities, merchant banking and insurance company portfolio investment activities. Activities that are "complementary" to financial activities also are authorized.

The abolition of the McFadden² and Glass-Steagall³ Act introduced a new environment in the banking industry giving large banks competitive advantage. Prior to these developments, branch banking was limited by regulation and there were restraints on the operation of the giant monopolies that dominate the financial system. Mergers and mega mergers within and across the financial industry have resulted (DeYoung, Hassan and Kirchhoff [1998]). Arguments in favor of these developments include

² The McFadden Act of 1927 prohibited interstate banking

³ The Glass-Steagall Act of 1933, barred banks, brokerage houses and insurance companies from entering other financial businesses thus separating investment banking and commercial banking.

greater access to branch banking by customers and greater national operating efficiency of financial institutions in general.

3.0. Reasons for Declining Profitability of Community Banks

Since community banks rely on local households and businesses for deposit financing, the marked rise in equity values, increased popularity of mutual funds, On-line brokerage accounts, sweep accounts and other new savings and investment vehicles have put competitive pressure on community banks' core deposit base. As these low cost funds have been replaced with funding from the Federal Home Loan Banks and capital markets, pressures on interest margins and liquidity have intensified. This raises risk management questions and the community banks ability to maintain adequate liquidity under these stressful conditions Greenspan [2000].

New communications' technology enables large banks to erode the domain of community banks and compete in local markets through the use of networks of ATMs, Internet kiosks, and transactional Internet websites. Financial institutions located outside the local market using new lending and financial technologies can now evaluate the credit-worthiness of local community banks' customers. Use of internet financial models, questionnaires for credit scoring and on-line credit applications permits large banks to build up a huge data base of the credit risk of small customers at low cost. The large banks also benefit from economies of scale by combining a high volume of loans with the use of asset securitization risk management techniques. There exists a possibility of exclusion of good quality borrowers but this risk is minimal. Research findings indicate that the distance between business borrowers and their bank lenders has increased substantially

over the past two decades Petersen and Rajan [2002]. The questions to be answered are these: is community bank profitability adversely affected by these developments and are small community banks operating on a comparable level of risk? Is their survival threatened?

4.0. The Relevance of Small Community Banks in the United States

In a study of the lending activities of 9,300 reporting commercial banks between 1994 and 1997, the Small Business Administration identified District of Columbia small-business friendly banks as small local banks with assets less than \$100 million of total assets. Moreover, primarily small local banks are meeting small businesses lending needs. Franklin National Bank of Washington and the Industrial Bank of Washington with assets of between \$100 million and \$500 million and assets over \$1 billion respectively were also identified as small-business friendly. Interestingly, none of the largest banks controlling 84 percent of all the deposits was designated as small-business friendly, Small Business Administration [1997]. A shortage of credit in poverty stricken areas has choked off attempts at revitalization over the years, making it hard for areas to attract new jobs and homeowners Porter [1995]. The resulting financial barrier is especially severe for small and minority owned businesses Bates [1997]. Financial institutions typically are not present in the community to offer full menu of banking services. They often associate residents, local and small businesses operating in distressed neighborhoods with high credit risks and therefore are reluctant to lend to such borrowers. In an empirical study of community-based lending for the District of Columbia, Flowers [1999] finds that challenges facing City First, a community bank include the following: capital adequacy,

expectation to extend credit to customers who have been largely underserved by other commercial lenders, facing a market with a disproportionate share of customers who are likely to be small businesses in the earliest stage of business development, customers with poor quality financial information, businesses with less sophisticated business managers and fewer financial resources, need to develop appropriate credit policy to meet the dual objectives of profitability and the needs of the customer and high cost loans due to additional requirements to determine the credit worthiness of small businesses as well as additional services to monitor the loans' performance. The need to strengthen banks that meet the capital requirements of small businesses has never been greater. Shaffer [1989] reports that in 1985, the annual number of failures had risen to over 100, of which 77 were smallest banks with total assets of less than \$25 million dollars. Some 200 banks failed in 1987, of which 130 had less than 25 million dollars in assets and 167 had less than \$50 million in assets.

5.0 Research Objectives

The objectives of this study are to examine the profit efficiency, profitability and risk threshold of small community banks with average assets of less \$25 million and small banks with asset size less than \$1 billion. We compare their performance to that of medium size banks with assets of between \$1 billion and \$5 billion and large banks with assets greater than \$5 billion. From the literature review it is apparent that the U.S. commercial banks that are most vulnerable to the deregulation and increased competition offered by deregulation, technological advances and e-commerce are the small banks [community banks].

6.0 Data

The samples includes all U.S banks with asset sizes less than \$25, less than \$1 billion, between \$1billion-\$5 billion and greater than \$5 billion in the Report of Condition and Income [call report] database available at the Federal Reserve Bank of Kansas, [www.kc.frb.org/BS&S/Bankpeer] which contain data for different bank peers from 1997 to 2002, FDIC, Federal Financial Institutions Examination Council Internet Reporting System <http://www2.fdic.gov/ubpr/>, <http://www2.fdic.gov/ubpr/BankList/default.asp> and the Federal Reserve Bank of Chicago's web page [www.frbchi.org] for which at least one year of data are available, including newly chartered banks. The observations range 9,082 in 1997, 8,715 in 1998, 8,521 in 1999, 8,256 in 2000, 8,023 in 2001 and 7,875 in 2002.

7.0. Methodology

We adopt several techniques in evaluating different asset categories of U.S commercial banks. We estimate the profit efficiency (PROFEFF) for the small banks with assets size less than \$1 billion and with assets size less than \$25 million, medium and large banks in order to determine their operational efficiency during the period. We calculate the return on assets (ROA) for the small banks with asset size less than \$1 billion and with asset size less than \$25 million, medium and large banks. We compare the annual mean PROFEFF and ROA of the various size banks and we apply the t-stats at 1, 2, and 5 percent degrees of freedom to determine the significance. The profit efficiency test and return on asset analysis give an indication of profitability and degree of management efficiency and effectiveness in the utilization of bank assets. We examine the two main sources of bank

income, the net interest income and the non interest income. We use the Man-Whitney (U) test, a non parametric variance analysis two sample test, to test the significance of the differences in net interest income and non interest income as percentages of average assets for the small, medium and large banks for the period 1997-2002.

We compare the operational risk for the various size banks as indicated by the level of non-current loan⁴, actual loan loss and loan loss reserve each as a percentage of total loans.

7.1. Profit Efficiency [PROFEFF] Analysis

Virtually all profit efficiency studies use a linear function to analyze the correlates of the profit efficiency function.⁵ PROFEFF is a sophisticated financial performance statistics, which measures how actual financial performance compares to a theoretical best practice frontier. For a bank under evaluation, it is measured as a percentage of the PROFEFF of the best practice bank. The frontier is estimated separately for each year and each bank's PROFEFF is also estimated using the following non-standard, Fourier-flexible form:

⁴ Non-current loans are loans that are past due for 90 days or more.

⁵ Berger and Mester [[1997];[2001]], Altunbas, Evans and Molyneux [2001], Akhigbe and McNulty [2003], and DeYoung and Nolle [1996]

$$\begin{aligned}
PREROA = & \alpha_0 + \sum_i^3 \beta_i Y_i + \frac{1}{2} \sum_i^3 \sum_i^3 \beta_{ij} Y_i Y_j + \sum \gamma_{mn} W_m W_n \\
& + \sum_k^3 \phi_k Z_k + \frac{1}{2} \sum_k^3 \sum_l^3 \phi_{kl} Z_k Z_l + \sum_i^3 \sum_m^3 \rho_{im} Y_i W_m + \sum_i^3 \sum_k^3 \phi_{ik} Y_i Z_k \\
& + \sum_m^3 \sum_k^3 \phi_{mk} W_m Z_k + \sum_{i=1}^9 [\delta_i \cos X_i + \theta_i \sin X_i] \\
& + \sum_{i=1}^9 \sum_{j=1}^9 [\delta_{ij} \cos(X_i + X_j) + \phi_{ij} \sin(X_i + X_j)] \\
& + \sum_{i=1}^9 \sum_{j=i}^9 \sum_{k=j}^9 [\delta_k \cos(X_i + X_j + X_k) + \phi_{ijk} \sin(X_i + X_j + X_k)] \\
& + \nu + \mu
\end{aligned} \tag{1}$$

Where:

1. PREROA = operating profits [earnings before taxes, extraordinary items, and loan losses] measured as a percentage of total assets
2. Y represents a vector of three outputs defined for each bank as:
 - a. total loans [the sum of consumer, commercial/industrial and real estate loans]
 - b. retail deposits [the sum of demand deposits and time deposits] and
 - c. non-interest income [representing fee-based financial services]
3. W represents a vector of three market prices for bank inputs, measured at the country level:
 - a. The wage rate for labor
 - b. The average interest rate for borrowed funds
 - c. A price for physical capital.⁶
4. Z vector contains three variables:
 - a. Equity capital [defined separately for each bank] to control for the potential increased cost of funds due to financial risk
 - b. A Hirschman-Herfindahl Index [HHI, defined at the country level] to control for differences in market structure among countries, and
 - c. The average non-performing loan ratio [defined at the country level] to control for differences in economic conditions across markets

⁶ The wage rate for labor equals total salaries and benefits divided by the number of full-time employees.

The price of capital equals expenses of premises and equipment divided by premises and fixed assets. The price of deposits and purchased funds total interest expense divided by total deposits and purchased funds.

5. X represents a set of nine variables that transform the output
[Y] variables to place them on an interval from 0 to 2π ⁷.

We assume that profits depend on input prices and output quantities. This is a reasonable assumption for loans, deposits and fee-based services. The Fourier function has been used in a large number of recent cost and profit efficiency studies. See, for example, Akhigbe and McNulty [2003], Berger and Mester [1997], [2001], DeYoung and Hassan [1998], DeYoung and Nolle [1996], McAllister and McMamus [1993], and Mitchell and Onvurall [1996]. For banks in which Y , W , and Z differ markedly from the sample mean. The Fourier form provides a better fit than other functions, such as the translog functions. The non-standard Fourier form assumes that banks have some control over output prices (DeYoung and Hasan [1998] and Humphrey and Pulley [1997]). Profits are assumed to depend on input prices and output quantities.

Since output prices are not exogenous under these assumptions, Equation 1 is very similar to the function used by Akhigbe and McNulty [2003] and DeYoung and Hassan, [1998]. This function avoids the difficulty in measuring output prices. Output quantities, rather than output prices explain a larger portion of variation in profitability. We apply the stochastic frontier approach suggested by Jondrow et. al. [1982] and used by Akhigbe and McNulty [2002] and DeYoung and Hassan [1998] to capture the bank's divergence from the best practice frontier. The stochastic frontier approach assumes that deviations from the frontier include inefficiencies [profit inefficiencies in our case] and random errors. Inefficiencies are assumed to follow an asymmetric, half normal distribution, and the

⁷ See Berger and Mester [1997], p.917n for the methodology for performing these transformations.

random errors follow a symmetric normal distribution. We estimate the inefficiency term as the expected value of profit inefficiency, conditional on the residuals from each year's profit function.

Equation [1] reflects the non-standard Fourier hybrids form since it contains both a quadratic profit function and a series of trigonometric [Fourier] terms. In recognition of software limitations and limitations on the number of observations, we estimate a slightly modified version of this function. Our function contains 18 trigonometric terms and 54 other terms for a total of 72 independent variables. Limiting the number of terms [especially the third-order terms] is consistent with other recent PROFEFF studies. See, for example, Akhigbe and McNulty [2002], DeYoung and Hassan [1998], DeYoung, Spong and Sullivan [2000], and Berger and Mester [1997], [2001].

POTENTIAL PREROA is defined as the estimated profitability of the bank if it is operated on the best-practice frontier. Since efficiency cannot be negative, as in other PROFEFF studies we define:

$$\begin{aligned} \text{PROFEFF} &= [\text{ACTUAL REROA}/\text{POTENTIAL PREROA}], \text{ if PREROA} > 0 \\ \text{PROFEFF} &= 0 \text{ IF PREROA} < 0 \end{aligned} \quad \text{_____ [2]}$$

PROFEFF is an efficiency measure which ranges from zero for banks experiencing losses to one for banks operating on the best practice frontier. We estimate a separate PROFEFF function [frontier] for each year. This approach allows the regression coefficients and the efficiency measures to vary over time, thereby allowing flexibility in the estimation procedure.

7.2. Return on Assets [ROA] Analysis

Return on Asset is the best ratio for comparing profitability performance of companies, even across industries. Whereas the return on

assets indicates the overall profitability of a company, it can be distorted by the occurrence of nonrecurring gains and losses, changes in the company's leverage and the incidence of restructuring and acquisitions. We use the ROA in this paper subject to these limitations.

$$\text{ROA} = \frac{\text{Net Income}}{\text{Total Assets}} \quad \text{Equation 3}$$

We examined the trends in the two main sources of bank income, net interest and non interest income. We used the Mann-Whitney U Test, a nonparametric variance analysis test, to test the equality of the small banks mean net interest income and non net interest income with first that of large banks and second with that of medium banks for the period 1997 to 2002.

$$U = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1$$

Where:

n_1 = number of observations for small banks

n_2 = number of observations for large banks

R_1 = sum of the ranks of observations for small banks

R_2 = sum of the ranks of observations for large banks

We test the hypothesis:

$H_0 : \mu_1 = \mu_2$ ← null hypothesis: There is no difference between the net interest income of small and large banks, in particular, both have the same

$H_0 : \mu_1 \neq \mu_2$ ← alternative hypothesis: There is a difference between the net interest income of small and large banks: in particular, they have different means

$\alpha = .05$ ← level of significance for testing these hypotheses

We repeat this test for small and medium banks. We also tested the hypothesis on the non interest income of small, medium and large banks for the period 1997-2002.

7.3. Risk Analysis

We evaluate the major commercial bank risk factor, credit risk by examining the loan loss reserve, non-current loan and actual loan loss each as a percentage of total loans. Since banks hold little owners' capital relative to aggregate value of their assets, only a relative small percentage of total loans need to turn bad in order to push any bank to the brink of failure Rose [1999]. The loan loss reserve indicates the extent to which a bank is preparing for loan losses by building up its loan-loss reserves by making allowances for loan losses through annual charges against current income. On the other hand, the non-current loans are loans that are past due for 90 days or more. Finally we analyze the actual charge-off by examining the net loan losses as a percentage of average loans.

8.0. Empirical Results

8.1. Profit Efficiency Tests Results

For the period under analysis, the small banks were the least profit efficient. The medium size banks were the most profit efficient. The differences in the PROFEFF means of small banks with asset size less than \$25 million, medium and large banks for the years 1997 to 2002 are significant at 1 percent level. The differences in the PROFEFF means of small banks with asset size less than \$1 billion and medium are significant at 1 percent level for the whole period. The differences in the PROFEFF means of small banks with asset size less than \$1 billion and large banks are significant at the 1 percent level for the years 1998, 1999, and 2000. Tables 1 and 2 contain the summary statistics. Figure 1 depicts the PROFEFF for the two small size samples, medium and large banks for the period. These findings are not consistent with earlier findings of Berger and Mester [1997] and Akhigbe and McNulty

[2003]. Both report greater PROFEFF at small banks than at large banks. Difference in asset definition for small, medium and large banks; and difference in periods covered in the studies may be responsible for this difference in findings.

Table 1

Summary Statistics for Profit Efficiency of a Sample of Banks (1997–2002)

| Panel A: Small versus Medium banks using a single frontier for all banks. | | | | | | | | |
|---|--|--------|--------|---|--------|--------|-------------------|----------|
| <u>Year</u> | <u>Small banks</u> [Asset size less than 25m] | | | <u>Medium banks</u> [Asset size \$1b - \$5b] | | | <u>Difference</u> | |
| | N | Mean | StdDev | N | Mean | StdDev | Mean | t-stat |
| 1997 | 1448 | 0.6418 | 0.1689 | 239 | 0.8624 | 0.1568 | -0.2206 | 30.12*** |
| 1998 | 1247 | 0.5199 | 0.1781 | 266 | 0.8624 | 0.1671 | -0.3425 | 44.47*** |
| 1999 | 1147 | 0.5512 | 0.2541 | 255 | 0.9141 | 0.1821 | -0.3629 | 45.89*** |
| 2000 | 1059 | 0.7067 | 0.2497 | 256 | 0.8528 | 0.2055 | -0.1461 | 23.01*** |
| 2001 | 867 | 0.4538 | 0.2063 | 262 | 0.9273 | 0.2055 | -0.4735 | 57.67*** |
| 2002 | 784 | 0.5718 | 0.2395 | 266 | 0.758 | 0.2162 | -0.1862 | 26.49*** |

| Panel B: Small versus Large banks using a single frontier for all banks | | | | | | | | |
|---|--|--------|--------|--|--------|--------|-------------------|----------|
| <u>Year</u> | <u>Small banks</u> [Asset size less than 25m] | | | <u>Large banks</u> [Asset size greater than \$5b] | | | <u>Difference</u> | |
| | N | Mean | StdDev | N | Mean | StdDev | Mean | t-stat |
| 1997 | 1448 | 0.6418 | 0.1689 | 124 | 0.7953 | 0.1503 | -0.1535 | 24.88*** |
| 1998 | 1247 | 0.5199 | 0.1781 | 120 | 0.7532 | 0.1582 | -0.2333 | 31.67*** |
| 1999 | 1147 | 0.5512 | 0.2541 | 129 | 0.8662 | 0.1819 | -0.315 | 42.08*** |
| 2000 | 1059 | 0.7067 | 0.2497 | 131 | 0.7899 | 0.1975 | -0.0832 | 11.88*** |
| 2001 | 867 | 0.4538 | 0.2063 | 128 | 0.7227 | 0.1993 | -0.2689 | 34.77*** |
| 2002 | 784 | 0.5718 | 0.2395 | 122 | 0.6671 | 0.2293 | -0.0953 | 12.3*** |

This table presents our PROFEFF estimates for the small banks with asset size less \$25 million and medium and large banks for the period 1997–2002. Panel A presents the results when a single PROFEFF frontier is estimated for small and medium banks. Panel B the results when a single PROFEFF frontier is estimated for small and large size banks.

*** Significant at the 1 percent level.

Table 2

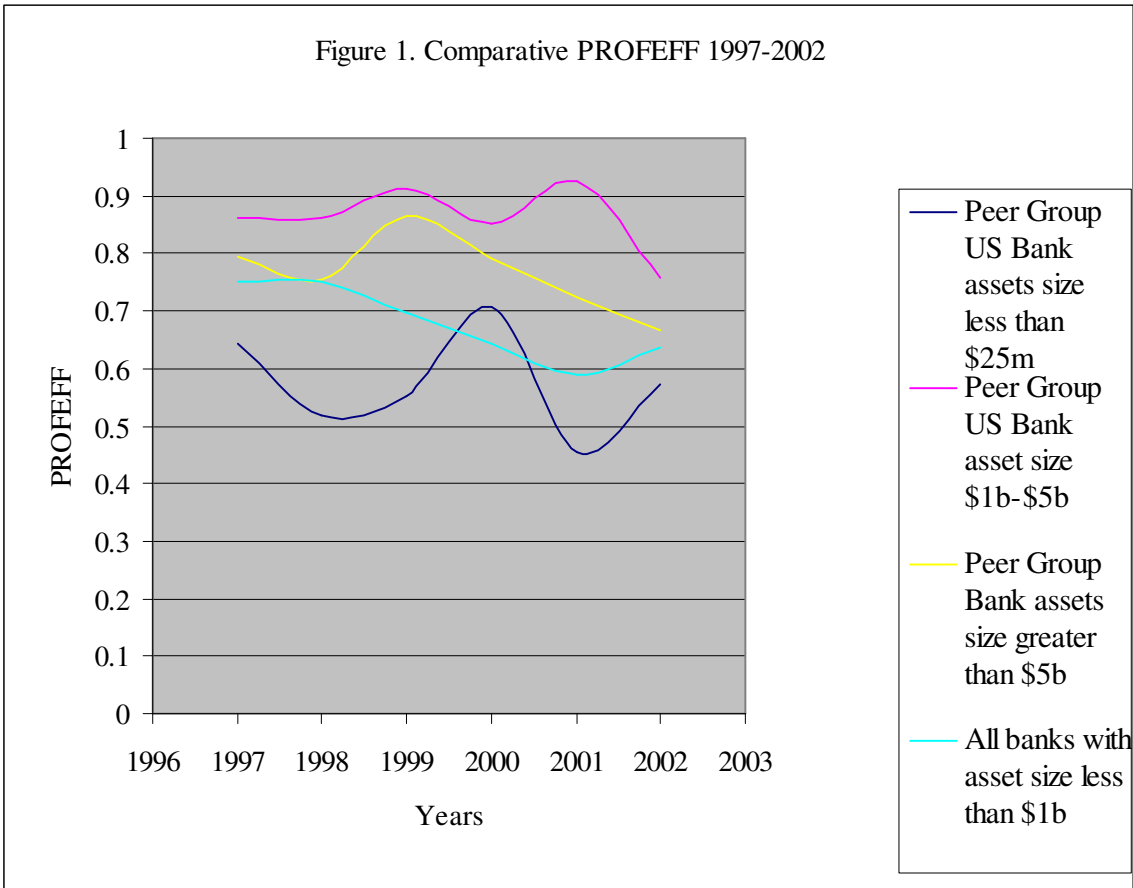
Summary Statistics for Profit Efficiency

| Panel A: Small versus Medium banks using a single frontier for all banks | | | | | | | | |
|--|----------------------------------|--------|--------|--------------------------|--------|--------|-------------------|----------|
| <u>Year</u> | <u>Small banks</u> | | | <u>Medium banks</u> | | | <u>Difference</u> | |
| | (All asset sizes less than \$1b) | | | (Asset size \$1b - \$5b) | | | Mean | t-stat |
| | N | Mean | StdDev | N | Mean | StdDev | | |
| 1997 | 8719 | 0.7502 | 0.1464 | 239 | 0.8624 | 0.1568 | -0.1122 | 21.01*** |
| 1998 | 8329 | 0.7512 | 0.1464 | 266 | 0.8624 | 0.1671 | 0.1122 | 21.01*** |
| 1999 | 8137 | 0.6959 | 0.1464 | 255 | 0.9141 | 0.1821 | 0.2182 | 27.12*** |
| 2000 | 7869 | 0.6426 | 0.1551 | 256 | 0.8528 | 0.2055 | -0.2102 | 29.12*** |
| 2001 | 7633 | 0.5906 | 0.1658 | 262 | 0.9273 | 0.2055 | -0.3367 | 40.89*** |
| 2002 | 7847 | 0.6368 | 0.2023 | 266 | 0.758 | 0.2162 | 0.1212 | 21.01*** |

| Panel B: Small versus Large banks using a single frontier for all banks | | | | | | | | |
|---|----------------------------------|---------|--------|--------------------------------|--------|--------|-------------------|----------|
| <u>Year</u> | <u>Small banks</u> | | | <u>Large banks</u> | | | <u>Difference</u> | |
| | (All asset sizes less than \$1b) | | | (Asset size greater than \$5b) | | | Mean | t-stat |
| | N | Mean | StdDev | N | Mean | StdDev | | |
| 1997 | 8719 | 0.8024 | 0.1464 | 124 | 0.7953 | 0.1503 | 0.0071 | 0.58 |
| 1998 | 8329 | 0.8555 | 0.1464 | 120 | 0.7532 | 0.1582 | 0.1023 | 16.01*** |
| 1999 | 8137 | 0.7789 | 0.1464 | 129 | 0.8662 | 0.1819 | -0.0873 | 10.01*** |
| 2000 | 7869 | 0.6776 | 0.1551 | 131 | 0.7899 | 0.1975 | -0.1123 | 21.01*** |
| 2001 | 7633 | 0.6776 | 0.1658 | 128 | 0.7227 | 0.1993 | -0.0451 | 6.88 |
| 2002 | 7847 | 0.64422 | 0.2023 | 122 | 0.6671 | 0.2293 | -0.0229 | 3.88 |

This table presents our PROFEFF estimates for all small banks with asset size less \$1billion and medium and large banks for the period 1997-2002. Panel A presents the results when a single PROFEFF frontier is estimated for small and medium banks. Panel B the results when a single PROFEFF frontier is estimated for small and large size banks.

*** Significant at the 1 percent level.



8.2. Return on Assets [ROA] Analysis Results

Both samples of small banks were the least profitable. The ROA of the small banks with asset size less than \$25 million registered the lowest profitability, fluctuated widely during the period and was consistently below that of the medium and large banks. After a decline in 1998 and 1998, the small banks ROA increased to 1.02 percent. The ROA of medium size banks was the highest during the period. The result contradicts earlier research findings. Many studies of bank performance report that small banks have higher returns on assets [but not necessarily equity] than large ones. Boyd and Runkle [1993] in their

study of banks with assets of more than \$1 billion, report an inverse relationship between bank size and return on assets, which they attribute to monopoly rents.

The results of the T-test indicates that the differences in the mean ROA for the various samples are not significant at any level. Tables 3 and 4 contain the ROA summary statistics for both comparisons. See Figure 2 for the trend in ROA.

Table 3

Summary Statistics for ROA of a Sample of Banks (1997-2002)

| <i>Panel A: Small banks versus Medium banks</i> | | | | | | | | |
|---|--|--------|--------|---|--------|--------|-------------------|--------|
| <u>Year</u> | <u>Small banks</u> (Asset size less than \$25m) | | | <u>Medium banks</u> (Asset size \$1b - \$ b) | | | <u>Difference</u> | |
| | N | Mean | StdDev | N | Mean | StdDev | Mean | t-stat |
| 1997 | 1448 | 0.0092 | 0.1689 | 239 | 0.0136 | 0.1244 | -0.0044 | 0.68 |
| 1998 | 1247 | 0.0073 | 0.1781 | 266 | 0.0145 | 0.1246 | -0.0072 | 0.63 |
| 1999 | 1147 | 0.0079 | 0.2541 | 255 | 0.0132 | 0.1344 | -0.0053 | 0.59 |
| 2000 | 1059 | 0.0102 | 0.2497 | 256 | 0.0115 | 0.1336 | -0.0013 | 0.54 |
| 2001 | 867 | 0.0069 | 0.2063 | 262 | 0.0115 | 0.145 | -0.0046 | 0.65 |
| 2002 | 784 | 0.0084 | 0.2395 | 266 | 0.0109 | 0.1556 | -0.0025 | 0.84 |

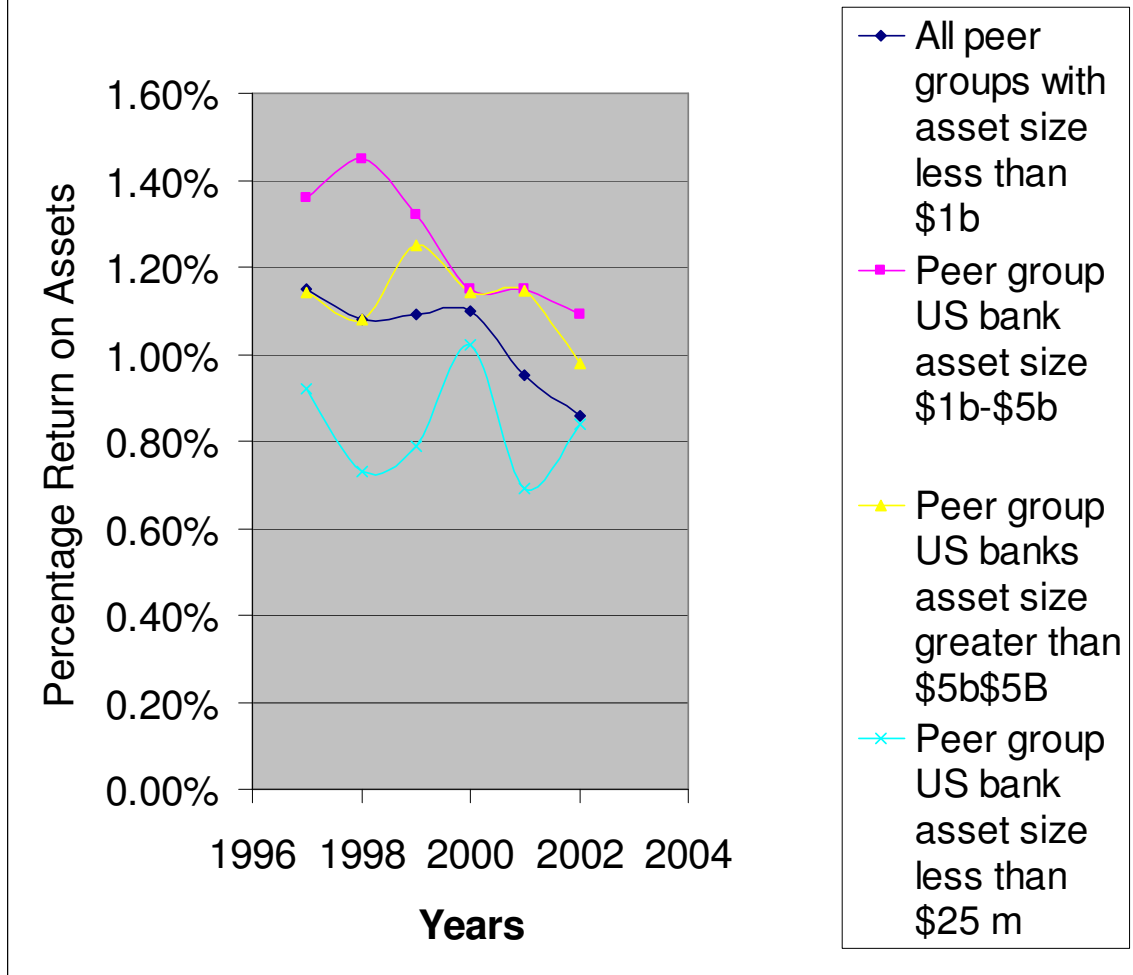
| <i>Panel B: Small versus Large banks</i> | | | | | | | | |
|--|---|--------|--------|--|--------|--------|-------------------|--------|
| <u>Year</u> | <u>Small banks</u> (Asset size less \$25m) | | | <u>Large banks</u> (Asset size greater than \$5b) | | | <u>Difference</u> | |
| Year | N | Mean | StdDev | N | Mean | StdDev | Mean | t-stat |
| 1997 | 1448 | 0.0092 | 0.1689 | 124 | 0.0114 | 0.1532 | -0.0022 | 0.82 |
| 1998 | 1247 | 0.0073 | 0.1781 | 120 | 0.0108 | 0.1634 | -0.0035 | 0.74 |
| 1999 | 1147 | 0.0079 | 0.2541 | 129 | 0.0125 | 0.1745 | -0.0046 | 0.73 |
| 2000 | 1059 | 0.0102 | 0.2497 | 131 | 0.0114 | 0.3358 | -0.0012 | 0.53 |
| 2001 | 867 | 0.0069 | 0.2063 | 128 | 0.0115 | 0.3577 | -0.0046 | 0.65 |
| 2002 | 784 | 0.0084 | 0.2395 | 122 | 0.0098 | 0.2788 | -0.0014 | 0.56 |

Table 4**Summary Statistics for ROA**

| <i>Panel A: Small banks versus Medium banks</i> | | | | | | | |
|---|--|--------|--------|---|--------|--------|--------|
| <u>Year</u> | <u>Small banks</u> (Asset size less than \$1 billion) | | | <u>Medium banks</u> (Asset size \$1b -\$5 b) | | | |
| | N | Mean | StdDev | N | Mean | StdDev | t-stat |
| 1997 | 9719 | 0.0115 | 0.1689 | 239 | 0.0136 | 0.12 | 0.75 |
| 1998 | 8329 | 0.0108 | 0.1781 | 266 | 0.0145 | 0.12 | 0.61 |
| 1999 | 8137 | 0.0109 | 0.2541 | 255 | 0.0132 | 0.13 | 0.45 |
| 2000 | 7869 | 0.011 | 0.2497 | 256 | 0.0115 | 0.13 | 0.44 |
| 2001 | 7633 | 0.0095 | 0.2063 | 262 | 0.0115 | 0.15 | 0.55 |
| 2002 | 7847 | 0.0086 | 0.2395 | 266 | 0.0109 | 0.16 | 0.47 |

| <i>Panel B: Small banks versus Large banks</i> | | | | | | | |
|--|--|--------|--------|---|--------|--------|--------|
| <u>Year</u> | <u>Small banks</u> (Asset size less than \$1 billion) | | | <u>Large banks</u> (Asset size greater than \$5 b) | | | |
| | N | Mean | StdDev | N | Mean | StdDev | t-stat |
| 1997 | 8719 | 0.0115 | 0.1689 | 124 | 0.0114 | 0.15 | 0.53 |
| 1998 | 8329 | 0.0108 | 0.1781 | 120 | 0.0108 | 0.16 | 0.41 |
| 1999 | 8137 | 0.0109 | 0.2541 | 129 | 0.0125 | 0.17 | 0.22 |
| 2000 | 7869 | 0.011 | 0.2497 | 131 | 0.0114 | 0.34 | 0.23 |
| 2001 | 7633 | 0.0095 | 0.2063 | 128 | 0.0115 | 0.36 | 0.14 |
| 2002 | 7847 | 0.0086 | 0.2395 | 122 | 0.0098 | 0.28 | 0.22 |

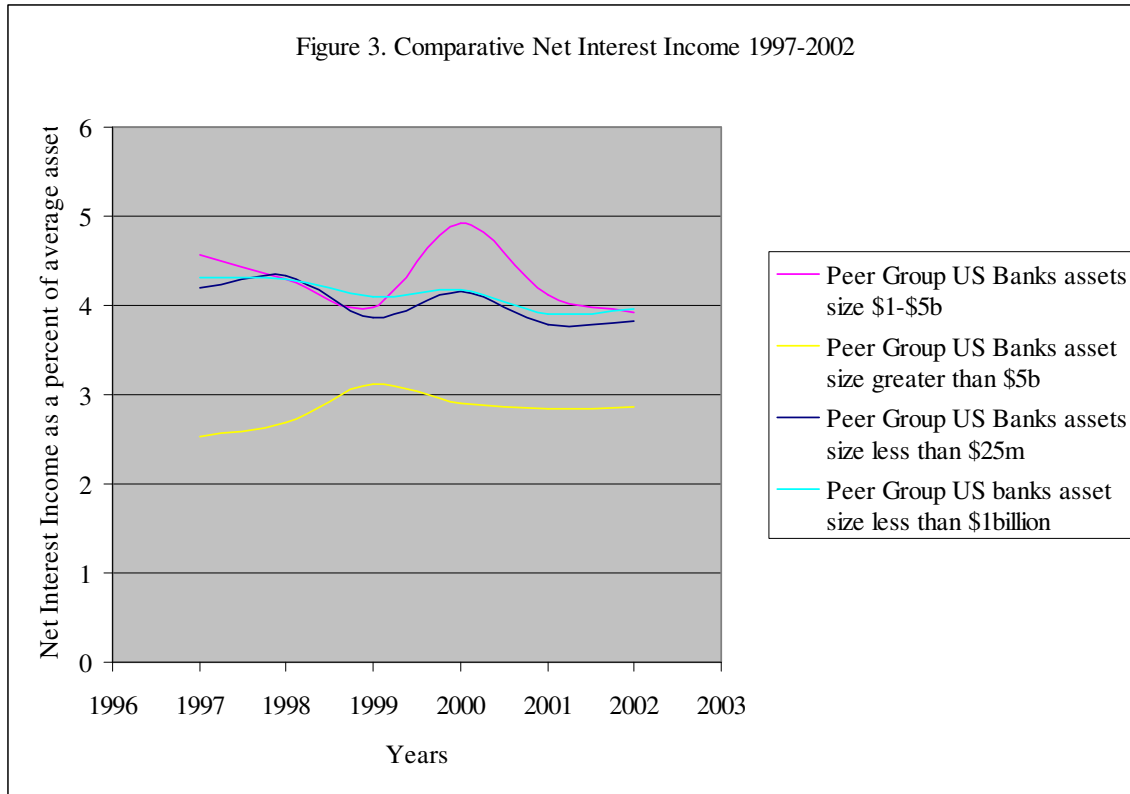
Comparative Return on Assets(ROA), 1997-2002.



The two main sources of commercial bank income are interest on loans and non interest income such as fees and commissions. The net interest income, sometimes referred to as interest margin is a key determinant of bank profitability. In order to determine the source of the poor or good performance of the banks, we examined both the levels of interest income and non interest income for the period. An examination of the trend in net interest income as a percentage of average assets for the three peers of banks reveals that the large banks consistently achieved

the lowest level of net interest income as a percentage of average assets. The medium size banks' net interest income as a percentage of average assets was the highest reaching 4.9 percent in 2000. In 1998 and 1999, the small and medium banks almost operated at par achieving 4.33 percent, 4.29 percent and 3.87 percent and 3.98 percent respectively.

This finding supports the view of Nakumura [1993] and Mester, Nakumura and Renault [1998] that small banks have access to better credit information than large banks [such as daily data on firm cash flows, which is available through monitoring checking accounts]. Perhaps the structural advantage of small banks as noted by [[Gilbert, 1984; Hannan, 1991 a, b,]; [Berger, Hanweck and Humphrey, 1987]; [Gilligan and Smirlock, 1984]] whereby they can charge higher rates on loans and pay lower rates on deposits than other banks because there is less competition in small banking markets contributes to this higher net interest achieved by small banks. See Figure 3 below. It is interesting to note that there is a highly positive correlation coefficient of .942, significant at I percent level [2-tail] between the net interest income of small banks and large banks.



Tables 5 and 6 below show the results of the normality on the interest income non interest income distributions for small, medium and large banks for the period 1997-2002. The W Test results indicate the non normality of both distributions.

Table 5

Results of W Test

Test for Normality on Net Interest Income as a percentage of average assets for small, medium and large banks.

| Year | Large banks | | | | Medium banks | | | | Small banks | | | |
|------|-------------|------|---------|--------|--------------|------|---------|--------|-------------|------|---------|--------|
| | N | R | P value | StdDev | N | R | P value | StdDev | N | R | P value | StdDev |
| 1997 | 124 | 0.89 | 0.01 | 1.39 | 239 | 0.65 | 0.01 | 2.48 | 1448 | 0.88 | 0.01 | 1.64 |
| 1998 | 120 | 0.86 | 0.01 | 1.39 | 266 | 0.65 | 0.01 | 2.57 | 1247 | 0.87 | 0.01 | 1.64 |
| 1999 | 129 | 0.93 | 0.01 | 1.85 | 255 | 0.69 | 0.01 | 1.53 | 1147 | 0.87 | 0.01 | 1.45 |
| 2000 | 131 | 0.91 | 0.01 | 1.15 | 256 | 0.65 | 0.01 | 2.06 | 1059 | 0.92 | 0.01 | 1.09 |
| 2001 | 128 | 0.88 | 0.01 | 1.40 | 262 | 0.77 | 0.01 | 1.77 | 867 | 0.92 | 0.01 | 1.64 |
| 2002 | 122 | 0.92 | 0.01 | 1.45 | 266 | 0.94 | 0.01 | 1.10 | 784 | 0.93 | 0.01 | 1.96 |

Table 6**Results of W Test****Test for Normality Net Non Interest Income as a percentage of average assets for large, medium, and small banks**

| Year | Large banks | | | | Medium banks | | | | Small banks | | | |
|------|-------------|------|---------|--------|--------------|------|---------|--------|-------------|------|---------|--------|
| | N | R | P value | StdDev | N | R | P value | StdDev | N | R | P value | StDev |
| 1997 | 124 | 0.89 | 0.01 | 1.68 | 239 | 0.67 | 0.01 | 3.69 | 1448 | 0.46 | 0.01 | 190.34 |
| 1998 | 120 | 0.85 | 0.01 | 1.60 | 266 | 0.68 | 0.01 | 3.70 | 1247 | 0.44 | 0.01 | 206.49 |
| 1999 | 129 | 0.30 | 0.01 | 304.89 | 255 | 0.67 | 0.01 | 2.89 | 1147 | 0.46 | 0.01 | 180.42 |
| 2000 | 131 | 0.93 | 0.01 | 1.33 | 256 | 0.68 | 0.01 | 3.20 | 1059 | 0.48 | 0.01 | 195.57 |
| 2001 | 128 | 0.91 | 0.01 | 1.36 | 262 | 0.65 | 0.01 | 2.67 | 867 | 0.48 | 0.01 | 88.59 |
| 2002 | 122 | 0.89 | 0.01 | 1.42 | 266 | 0.60 | 0.01 | 3.53 | 784 | 0.48 | 0.01 | 66.09 |

The results of the Mann-Whitney test on the equality of the interest income non interest income for small and large banks; small and medium banks for the period 1997-2002 are shown in Tables 5 and 6 below. The results indicate that for both comparisons the differences in the means were not significant at 5 percent significant level. So we accept the Null hypotheses that there is no difference between the interest income and non interest income of small, medium and large banks between 1997 and 2002. According to the Results of the U test in Table 6, we note that the differences in the means non interest income for small and medium banks tested significant at very low levels of between .19 percent in 1998, .03 percent in 1999 and .02 percent in 2000.

Table 7**Results of the Mann-Whitney Tests**

To compare the difference between interest income as a percentage of average assets between small banks and large banks, and between small banks and medium banks for the period 1997-2002.

| Year | Small banks & Large banks | | Small banks & Medium banks | |
|------|---------------------------|----|----------------------------|----|
| | W | C1 | W | C1 |

| | | | | |
|------|------|-------------------|------|-------------------|
| 1997 | 2887 | 6.3307/ 5.7883 | 2897 | 6.6448/ 6.1003 |
| 1998 | 2894 | 6.2779/ 5.688 | 2873 | 6.49/ 5.9314 |
| 1999 | 2953 | 6.576/ 6.003 | 2932 | 6.28/ 5.782 |
| 2000 | 2954 | 6.601/ 6.015 | 2932 | 6.87/ 6.295 |
| 2001 | 3018 | 5.688/ 5.238 | 2942 | 6.17/ 5.68 |
| 2002 | 2939 | 4.379/ 3.7212 | 2909 | 4.8872/ 4.2552 |

Table 8

Results of the Mann-Whitney Tests

Comparison of the difference between the Non Interest Income as a percentage of average assets between small banks and large banks, and between small banks and medium banks for the period 1998-2002.

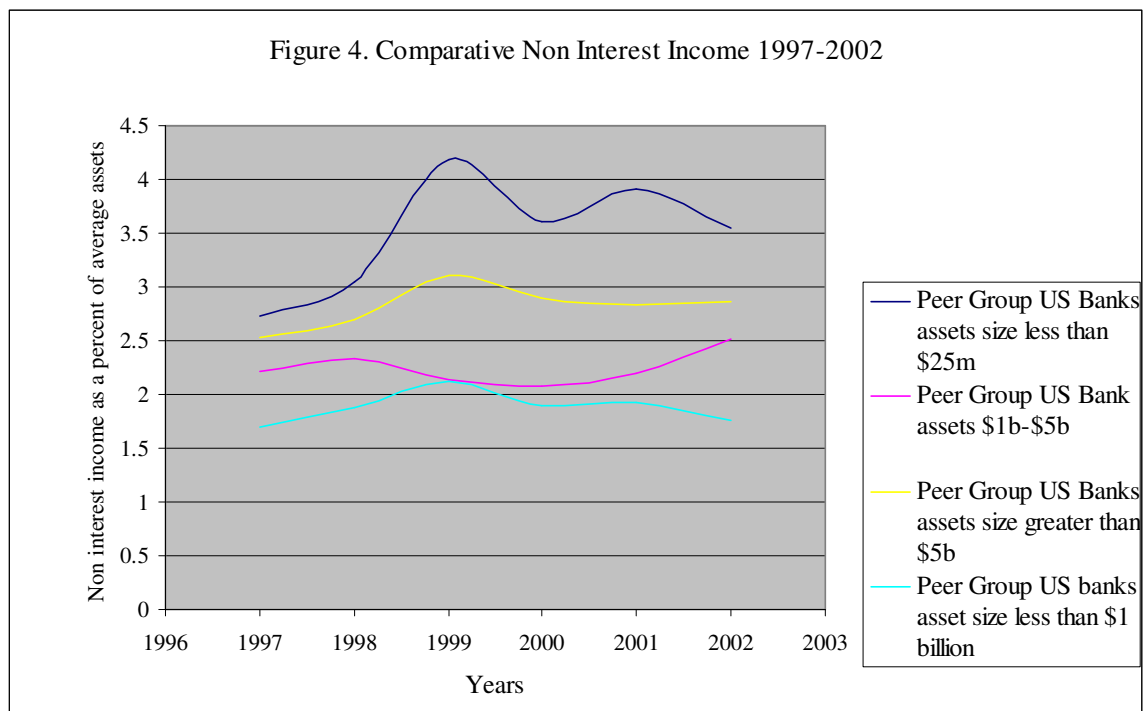
| Year | Small banks & Large banks | | Small banks & Medium banks | |
|------|---------------------------|------------------|----------------------------|------------------|
| | W | C1 | W | C1 |
| 1998 | 2957 | 6.2251 5.6482 | 4054**** | 0.6571 0.1396 |
| 1999 | 3351 | 1.15 0.692 | 3938*** | 0.616 0.174 |
| 2000 | 3454 | 1.151 0.639 | 3906.5** | 0.612 0.185 |
| 2001 | 3393 | 1.307 0.788 | 3755 | 0.675 0.247 |
| 2002 | 3381 | 1.2573 0.712 | 3820 | 0.6435 0.2382 |

** Significant at .0002
*** Significant at .0003
**** Significant at .0019

During the period, the small banks with asset size less than \$25 million consistently recorded the highest level of non interest income as a percentage of average assets. Interestingly, in contrast small banks with assets size of less than \$1 billion show the lowest level on non interest. This is because the banks with asset size of between

\$25million to \$1 billion performed very poorly in this regard with banks of assets size between \$25 million and \$100 million being the worst performers recording non interest income as a percent of average assets of 0.84 percent in 2002, 0.81 percent in 2001, 0.93 percent in 2000, 1.11 percent 1999, 1.35 percent 1998 and 1.14 percent in 1997 while banks with asset size less than \$25 million record 3.54 percent, 3.91 percent, 3.61 percent, 4.18 percent, 3.04 percent and 2.73 percent respectively.

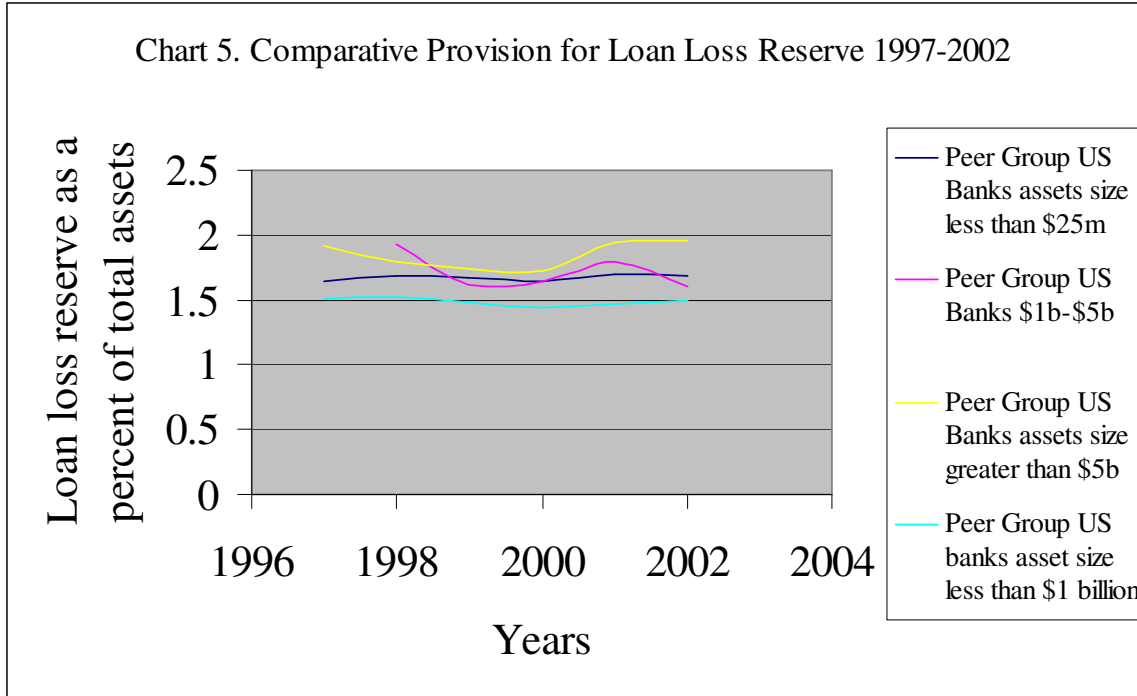
See Figure 4 below.



8.3. Risk Analysis Results

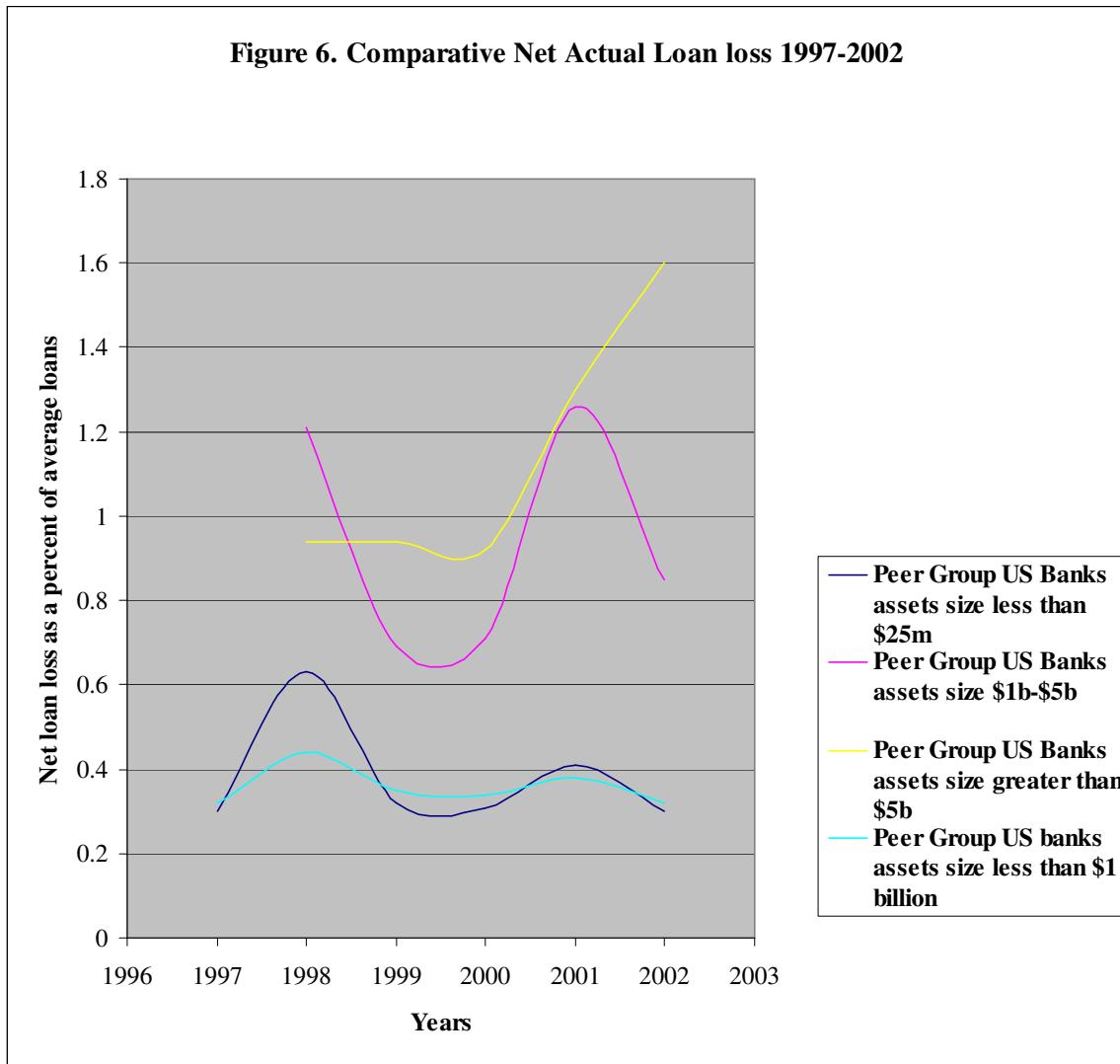
There is very little difference between the Loan loss reserve provisions of the three categories of banks. The large banks made slightly higher provisions from 2000 to 2002. Figure 5 shows the trend.

Chart 5. Comparative Provision for Loan Loss Reserve 1997-2002

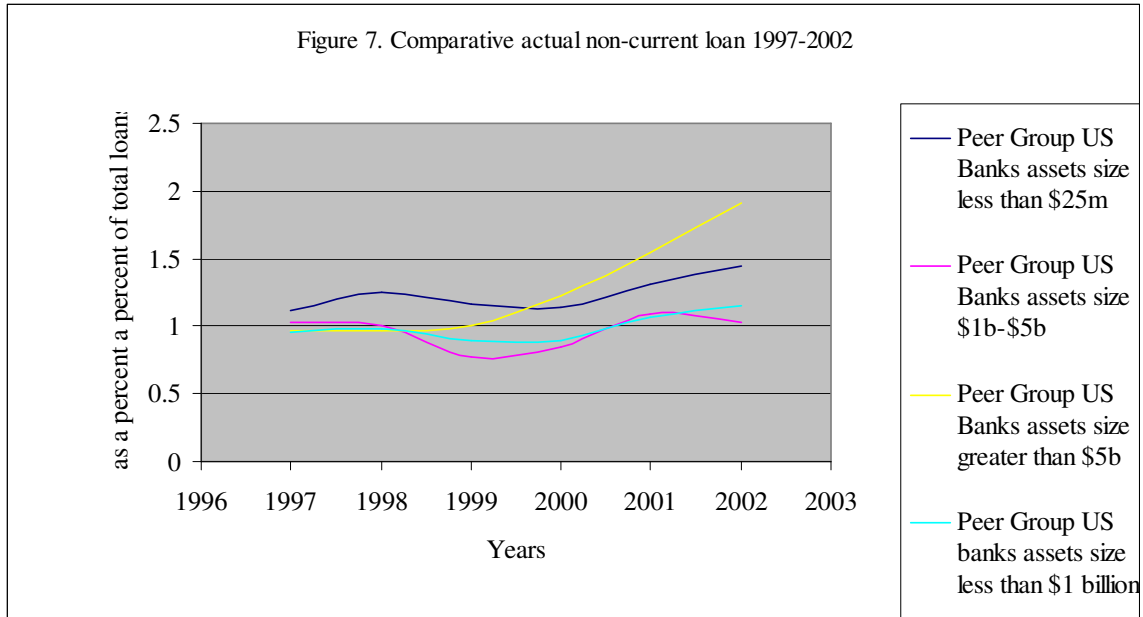


Small banks consistently maintained the lowest level of net actual loan losses. From 1999 to 2002, large banks suffered the highest level of loan loss. This is an interesting finding because it implies that small banks are more prudent in their credit risk management for even though they suffer lower level of actual loan loss, they make similar level loan loss provision as the medium and large banks. The trend of net loan loss for the period is contained on Figure 6.

Figure 6. Comparative Net Actual Loan loss 1997-2002



Between 1997 and 2000 the small banks maintained the highest level of non-current loan as a percentage of total loans. From 2000 to 2002, the large banks had the highest level. During the period, the medium size banks maintained the lowest level except for 1997 and 1998. This measure is an indication of deteriorating credit situation with respect to outstanding loans. Their trends are depicted on Figure 7.



9.0. Conclusion

Among the three categories of banks studied between 1997 and 2002, the small banks are the least profit efficient according to PROFFEF analysis and least profitable according to ROA analysis. Small banks with assets size of less than \$25 show the highest level of non interest income. In contrast the small banks with asset size of less than \$1 billion show the lowest level of non interest income. However the differences in efficiency, profitability did not test statistically significant at the 5 percent level. Some of the tests tested significant at very low levels. The results of the statistical tests lead us to conclude that the small banks with averages assets less than \$25 million are performing almost as well as the medium and large banks. The survival of small U.S. banks appears not to be in jeopardy at this point in time

The small banks seem to be vigorously pursuing the non interest income source of revenue. Our analysis shows that this category of

small banks consistently achieved the highest level of non interest income. They seem to be more prudent in their management activities as evidenced by their low levels of non current and actual loan loss. The small banks are also making provisions for possible losses. It is apparent that small U.S. Commercial banks of assets size less than \$25 million are indeed vulnerable to the deregulation and increased competition offered by deregulation, technological advances, e-commerce and negative economic situation such as the current recession even though extinction is not predicted at this point in time.

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