PROFIT EFFICIENCY SOURCES AND DIFFERENCES AMONG SMALL AND LARGE U.S. COMMERCIAL BANKS

*By Aigbe Akhigbe and James McNulty**

Abstract

Profit efficiency is an econometric financial performance measure of how well actual profitability compares to a best-practice frontier. We compare the profit efficiency of small (under $100 million in total assets), medium, and large (over $1 billion) commercial banks for the period 1995 to 2001 and examine the sources of profit efficiency for each. We also consider whether banks of different sizes attain their profit efficiency in different ways. We find that small and large banks have quite different ways of attaining high profits.

Introduction

Scale economies in banking have long been of interest to financial economists, and this interest has been heightened in recent years by two developments. The first is increased concern about the survivability of small community banks in an era of bank consolidation. This theme was the subject of a March 2003 conference at the Federal Reserve Bank of Chicago and formed the basis for a special March 2004 issue of the *Journal of Financial Services Research.*

The second development is recent academic research suggesting that small banks may have both an information advantage over large banks, as in Nakamura (1993), Mester, Nakamura, and Renault (2001), and Carter and McNulty (2004), and an incentive to use this information advantage in the lending process. Berger et al. (2002) provide evidence on the second point. They suggest that small banks may have a comparative advantage in developing and using the "soft" information often associated with small business lending. PROFEFF is an econometric financial performance measure that indicates how actual financial performance compares to a theoretical best-practice frontier. Considering differences in, and sources of, profit efficiency (PROFEFF) by bank size groups can help shed light on the issue of which banks use their capital more efficiently (provided profits are normalized by equity, which is the approach we take in this paper).

Relevant Literature and Estimation Issues

Most studies done in the 1980s and early 1990s suggest that scale economies are slight or nonexistent beyond asset sizes of $50 to $100 million. Some early examples are Benston, Hanweck, and Humphrey (1982), Gilligan, Smirlock, and Marshall (1984), Clark (1984), Nelson (1985), and Berger, Hanweck, and Humphrey (1987). Using 1984 data, Berger and Humphrey (1991) find that economies of scale at the firm level are exhausted beyond $200 million in asset size. Since this influential study, which found that gains from reducing cost inefficiencies dominate gains from realizing scale economies, the focus of most studies has shifted to inefficiencies and hence away from optimum size. However, using cost efficiency, Berger and Mester (1997) conclude that scale economies are exhausted well before $10 billion in asset size.

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Since these studies estimate cost economies, they cannot directly address the possibility that revenues may be more than proportionately higher for larger banks. However, another related trend in this literature has been increased recognition that profit efficiency is a more appropriate technique to use in evaluating bank performance than cost efficiency since PROFEFF incorporates both revenues and costs. Recent profit efficiency studies include Altunbas, Evans, and Molyneux (2001), Akhigbe and McNulty (2003), Berger and Mester (1997, 2001), DeYoung and Hasan (1998), and DeYoung and Nolle (1996), among others. Other recent studies of U.S. banking efficiency include Barr, Kilgo, Siems, and Stiroh (2000), Zimmel (2002), Berger and DeYoung (2001), and Wheelock and Walker (1999, 2000).

The keynote paper at the above-mentioned conference, by DeYoung, Hunter, and Udell (2004), argues that small banks and large banks have a different focus and a different business model—personalized service and customized financial services (e.g., small business loans) in the case of small banks and efficient distribution of relatively uniform types of financial services (e.g., credit cards and home equity loans) in the case of large banks. The business model of the small bank requires relatively high cost, while larger banks can keep cost low. Under this line of reasoning, both types of banks should have a role to play in the future financial services marketplace. Nonetheless, differences in PROFEFF are important because ultimately small and large banks compete for capital. For example, the decision of a smaller bank to join or not to join a large banking organization through a merger is ultimately a subjective decision about how its capital can be best employed.

Given these considerations, two important questions raised by Berger and Mester (1997) must be considered before we proceed. The first is the appropriate variable—assets or equity—to use in normalizing profits in computing the PROFEFF measure. The second is the use of one frontier or several frontiers in comparing banks of different sizes. Because PROFEFF, when normalized by equity, measures how well a bank utilizes its financial capital, we choose to use this measure. Some earlier studies comparing large and small banks, such as Akhigbe and McNulty (2003), use assets and find small banks have higher PROFEFF. Use of equity can be expected to produce the opposite result since large banks use more leverage than small banks. In other words, the PROFEFF measure that we use is closer to return on equity, which should show greater PROFEFF for large banks. Normalizing by assets is likely to produce the opposite result.

Since we want to consider the sources of the differences in PROFEFF, we use three different frontiers for small, medium, and large banks. This is consistent with the assumption that their focus, and their basic business model, is different. This procedure allows the PROFEFF measures to have maximum flexibility—small bank PROFEFF and its frontier are not constrained or affected in any way by the activities and balance-sheet structure of large banks, and vice versa. Thus, when we look at the determinants of PROFEFF for the three groups, if they are different, this will reflect real differences, and if they are the same, it will not be because the same frontier was imposed on all banks. We recognize the alternative argument that, in comparing the performance of different banks, one normally wants to use the same test, not two or three different tests.[1] (We made this argument ourselves in an earlier paper.)

[1] The best analogy is an academic setting, in which the same examination is usually given to all students.

Data and Profit Efficiency Methodology

Data. The sample used to estimate the profit efficiency frontier includes all banks in the Report of Condition and Income (call report) database available on 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) for the period 1995 to 2001.

Profit Efficiency. As noted, PROFEFF is a relatively sophisticated financial performance statistic, which measures how actual financial performance compares to a theoretical best-practice frontier. For a given bank, it is measured as a percentage of the PROFEFF of the best-practice bank. If PROFEFF is 0.70, that bank is 70 percent as profit efficient as the "best practice" bank. The frontier is estimated separately for small, medium, and large banks for the period as a whole (and each bank's PROFEFF is also estimated) using the nonstandard, Fourier-flexible form of (1).

$$
\begin{aligned}
\text{PREROE} = {} & \alpha_0 + \sum_{i}^{3} \beta_i Y_i + \frac{1}{2} \sum_{i}^{3} \sum_{j}^{3} \beta_{ij} Y_i Y_j + \sum_{m}^{3} \gamma_m W_m \\
& + \frac{1}{2} \sum_{m}^{3} \sum_{n}^{3} \gamma_{mn} W_m W_n + \sum_{k}^{3} \phi_k Z_k + \frac{1}{2} \sum_{k}^{3} \sum_{l}^{3} \phi_{kl} Z_k Z_l \\
& + \sum_{i}^{3} \sum_{m}^{3} \rho_{im} Y_i W_m + \sum_{i}^{3} \sum_{k}^{3} \phi_{ik} Y_i Z_k + \sum_{m}^{3} \sum_{k}^{3} \phi_{mk} W_m Z_k \\
& + \sum_{i=1}^{9} \left[\delta_i \cos X_i +_i \theta \sin X_i \right] + \sum_{i=1}^{9} \sum_{j=1}^{9} \left[\delta_{ij} \cos\left(X_i + X_j\right) \right. \\
& \left. + \phi_{ij} \sin\left(X_i + X_j\right) \right] + \sum_{i=1}^{9} \sum_{j=1}^{9} \sum_{k=j}^{9} \left[\delta_{ijk} \cos\left(X_i + X_j + X_k\right) \right. \\
& \left. + \phi_{ijk} \sin\left(X_i + X_j + X_k\right) \right] + \nu + \mu
\end{aligned}
\tag{1}
$$

PREROE is operating profits (earnings before taxes, extraordinary items, and loan losses) measured as a percentage of total equity capital. Y represents a vector of three outputs defined for each bank: (1) total loans (the sum of consumer, commercial/industrial, and real estate loans), (2) retail deposits (the sum of demand deposits and time/savings deposits), and (3) noninterest income (representing fee-based financial services). W represents a vector of three market prices for bank inputs, measured at the county level: (1) the wage rate for labor, (2) the average interest rate for borrowed funds, and (3) a price for physical capital.[2] The Z vector contains three variables: (1) equity capital (defined separately for each bank) to control for the potential increased cost of funds due to financial risk[3]; (2) a Hirschman-Herfindahl Index (HHI, defined at the county level) to control for differences in market structure among counties)[4]; and (3) the average nonperforming loan ratio (defined at the county level) to control for differences in economic conditions across markets. X

[2] The wage rate 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 equals total interest expense divided by total deposits and purchased funds.

[3] The control for risk is admittedly very rough. Hughes et al. (2001) deal with the effect of risk in efficiency studies and provide a more detailed discussion of the potential implications of incorporating risk considerations directly into the equations. While the context of their discussion is cost efficiency, the same general considerations apply to profit efficiency studies.

[4] The HHI was calculated using the FDIC's Summary of Deposits (branch office) data.

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

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 Hasan (1998), DeYoung and Nolle (1996), McAllister and McManus (1993), and Mitchell and Onvurall (1996).]The Fourier form provides a better fit than other functions, such as the translog function, for banks in which Y, W and Z differ markedly from the sample mean. The non-standard Fourier form assumes that banks have some control over output prices (e.g., DeYoung and Hasan (1998), Humphrey and Pulley (1997)). Profits are assumed to depend on input prices and output quantities, which is a reasonable assumption for loans, deposits and fee-based services.

Because 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 Hasan (1998). This function is appropriate because (1) it avoids the difficulty in measuring output prices, and (2) output quantities (rather than output prices) explain a larger portion of the variation in profitability. This is consistent with what we know about banking practice. All theoretically important determinants of profitability are included in the PROFEFF function. We use some of the variables used to construct the PROFEFF function as correlates in a later section. Other PROFEFF studies follow a similar approach.[6]

We employ the stochastic frontier approach suggested by Jondrow et al. (1982) and used by Akhigbe and McNulty (2003) and DeYoung and Hasan (1998) to capture each bank's divergence from the best-practice frontier. The stochastic frontier approach assumes that deviations from the frontier include inefficiencies (profit inefficiencies in our study) and random errors. Inefficiencies are assumed to follow an asymmetric, half normal distribution, and the 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 nonstandard Fourier hybrid form since it contains both a quadratic profit function and a series of trigonometric (Fourier) terms. Because 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 profit efficiency studies. [See, for example, Akhigbe and McNulty (2003), DeYoung and Hasan (1998), Berger and Mester (1997, 2001), and DeYoung, Spong and Sullivan (2000).]

We define POTENTIAL PREROE as the estimated profitability of the bank if it operates on the best-practice frontier. Since efficiency cannot be negative, we follow these other PROFEFF studies and define as in (2).

$$\text{PROFEFF} = (\text{ACTUAL PREROE}/\text{POTENTIAL PREROE}), \text{ if PREROE} > 0$$
$$\text{PROFEFF} = 0, \text{ if PREROE} < 0 \qquad (2)$$

POTENTIAL PREROE thus equals actual PREROE plus inefficiency. PROFEFF is an efficiency measure that 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 maximum flexibility in the estimation procedure.

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[5] The methodology for performing these transformations is described in Berger and Mester (1997), p. 917n.

[6] See Berger and Mester (2001) and DeYoung and Hasan (1998, p. 580n) for an explanation and justification for this procedure.

Correlates of the Profit Efficiency Measures

As noted, we consider the question of whether banks of different sizes attain their PROFEFF in different ways. We answer this question by regressing our PROFEFF estimates for each bank on variables that are expected to cause differences in profitability among banks. The correlates are very similar to those used by Akhigbe and McNulty (2003). The regression equation is given by (3) where EQUITY = the ratio of equity capital to total assets, AGE = bank age (in years), MKTNPL = the nonperforming loan ratio for all banks in the market (i.e., county), a measure of aggregate credit risk, MBHC = 1 for banks affiliated with a multibank holding company (otherwise zero), NATIONAL = 1 for national banks (otherwise zero), RELNPL = the relative nonperforming loan ratio, i.e., the difference between the nonperforming loan ratio for the bank and that for the county as a whole (MKTNPL), a measure of firm-specific credit risk, GROWTH = asset growth over the previous year, FEEREV = total noninterest income/total revenue, HHI = the Hirshman-Herfindahl index of deposit market concentration for the county,[7] NONMSA = 1 for banks headquartered in nonmetropolitan counties, 1-TOTLOANS = 1 - total loans/total assets (a proxy for investment in securities), and SALARY = total salaries/total assets.

$$\text{PROFEFF} = F(\text{EQUITY, AGE, MKTNPL, MBHC, NATIONAL, RELNPL, GROWTH, FEEREV, YEAR97, YEAR99, YEAR01, HHI, NONMSA, 1-TOTLOAND, and SALARY}) \quad (3)$$

Equity is included because, as noted, large and small banks use different degrees of leverage. In addition, as Berger and Mester point out, it is an important control variable used to account for differences in risk among institutions.[8] We expect EQUITY to have a negative coefficient because an increase in equity is a reduction in leverage, which reduces return on equity.

Age is included because DeYoung and Hasan find that it takes new banks about nine years to achieve the PROFEFF of established banks. In addition, Akhigbe and McNulty (2003) establish that relationship development is an important variable affecting PROFEFF; by definition, development of longstanding loan relationships takes time. Finally, Berger and Mester (1997) suggest that much of what goes on in banking involves "learning by doing," which would support a positive coefficient for the age variable. Clearly, we expect the coefficient of AGE to be positive.

The coefficient of MKTNPL is expected to be negative because bad loans reduce profitability and profit efficiency. MBHC was found to be negative in an earlier PROFEFF study by Akhigbe and McNulty (2003), and we expect the same result. NATIONAL was included because different regulatory environments can produce differences in profitability. Akhigbe and McNulty (2003) again find it to be negative, and we expect the same result. RELNPL is expected to be negative for the same reasons as MKTNPL.

Rapid growth usually has a depressing effect on bank profitability because it reflects an aggressive approach to acquiring loans, which usually lowers PROFEFF. Fee income has become an important source of income for banks in the past 20 years and, reflecting that trend, we expect the coefficient to be positive. Bank profitability is usually higher in more concentrated (less competitive) banking markets, so we expect the coefficient of the HHI to be positive. The NONMSA coefficient should be negative for the same reasons as the HHI. The 1-TOTLOANS coefficient should be negative since securities generally yield less than loans. Banks that fail to control expenses are generally poor performers, so we expect the SALARY coefficient to be negative.

[7] The HHI was computed using the FDIC's branch office survey.

[8] See Berger and Mester for a detailed discussion of this point.

We also include indicator variables for each year (YEAR97, YEAR99, and YEAR01) to control for differences in the condition of the banking industry.[9] Equation (3) is estimated using a Tobit regression because PROFEFF is bounded so that all observations fall on the interval (0,1).

Profit Efficiency Estimates and Descriptive Statistics

We define small banks as those under $100 million in assets, medium-sized banks as those between $100 million, and $1 billion and large banks as those over $1billion. Berger and Mester (1997) use a fourth measure, huge banks (over $10 billion) as an independent variable to explain PROFEFF, but the number of banks in this category is too small to construct a reliable frontier.

Table 1: Sumary Statistics for Profit Efficiency.

Panel A: Profit Efficiencies

	Bank Size								
	Small (< $100 million)			Medium (from $100m to $1b)			Large (> $1 billion)		
Year	Mean	Median	Std.	Mean	Median	Std.	Mean	Median	Std.
1995	0.7777	0.8000	0.1548	0.8206	0.8469	0.1340	0.8475	0.8763	0.1207
1997	0.7692	0.7967	0.1644	0.8363	0.8618	0.1205	0.8720	0.8969	0.0972
1999	0.7374	0.7716	0.1906	0.8276	0.8527	0.1268	0.8647	0.8826	0.1010
2001	0.7016	0.7383	0.2126	0.8075	0.8333	0.1416	0.8462	0.8779	0.1311

Panel B: Number of banks in the sample

Year	Small banks (< $100m)	Medium banks (from $100m to $1b)	Large banks (> $1b)
1995	6,027	2,725	252
1997	5,025	2,213	163
1999	4,214	2,305	165
2001	3,572	2,451	178
Total	18,838	9,694	758

Notes: This table presents profit efficiency estimates for the period 1995 to 2001. Profit efficiency is a sophisticated performance measure that takes differences in asset composition, liability composition, competition, and other factors into consideration. Profit efficiency ranges from zero for the least efficient banks to one for banks that are operating on the best practice frontier. Of the 6,027 small banks in the sample for 1995, 685 or 11.4 percent are de novos, which we define as banks less than 10 years old. The comparable figures for 1997 are 393 (7.8 percent), for 1999, 377 (8.9 percent); and for 2001, 483 (13.5 percent).

Table 1 shows our PROFEFF estimates for the three size categories and descriptive statistics for the variables used as correlates. It is important (as expected, given the fact that our PROFEFF estimates were normalized by equity) that profit efficiency is lowest for the smaller banks and highest for the larger banks. The differences are economically significant since approximately three and one-half to more than five percentage points separate the medium banks from the small banks and the large banks from the medium. Specifically, the mean PROFEFFs are 0.752 (small), 0.823 (medium) and

[9] Only YEAR97, YEAR99, and YEAR01 are included in the regression equation. If we were to use all four indicator variables for the four years as well as an intercept term, there would be perfect multicollinearity. To avoid this problem, we exclude the YEAR95 variable.

0.856 (large), while the medians are 0.783 (small), 0.849 (medium) and 0.882 (large). As noted in the table, the differences are significant at the 1 percent level. The results are consistent with the notion that very small banks suffer from potentially severe scale disadvantages. This notion is discussed by DeYoung, Hunter, and Udell (2004), and it is also consistent with Berger and Mester's (1997) cost-efficiency estimates.

The average age of the banks in the sample ranges from 66 to 74 years; their average size ranges from $48 million to $2.8 billion in total assets, and about 60 percent of these assets are loans. Fifty-six percent of these banks are located in nonmetropolitan areas. Their average pretax return on assets (before deducting extraordinary items and loan losses) is lower for small banks at 1.34 percent versus 1.68 percent (medium) and 1.91 percent (large). Return on equity, measured in a similar fashion, is 15.3 percent (small), 18.3 percent (medium), and 22.9 percent (large). Other characteristics of the banks are shown in the table.

Table 2. Descriptive Statistics for Profit Efficiencies and Correlates.

Variable	Bank Size								
	Small (< $100 million)			Medium (from $100m–$1b)			Large (> $1 billion)		
	Mean	Median	Std.	Mean	Median	Std.	Mean	Median	Std.
1 PROFEFF	0.7519	0.7831	0.1799	0.8225	0.8485	0.1317	0.8562	0.8820	0.1149
2 EQTASS	0.1190	0.0882	1.1188	0.1153	0.0887	0.8534	0.1089	0.0812	0.7758
3 AGE	66.23	78.000	36.25	66.18	69.000	39.650	73.84	73.00	42.99
4 MKTNPL	0.0058	0.0037	0.0276	0.0056	0.0036	0.0201	0.0097	0.0059	0.0136
5 MBHC	0.2028	0.0000	0.4021	0.2707	0.0000	0.4443	0.4146	0.0000	0.4929
6 NATIONAL	0.2248	0.0000	0.4174	0.3449	0.0000	0.4754	0.4628	0.0000	0.4989
7 RELNPL	0.0000	0.0000	0.0545	-0.0004	0.0000	0.0196	-0.0003	0.0000	0.0112
8 GROWTH	0.1600	0.1094	0.2917	0.2235	0.1509	0.5614	0.3835	0.1800	1.2447
9 FEEREV	0.0881	0.0760	0.0603	0.1105	0.0941	0.0827	0.1656	0.1430	0.1142
10 HHI	0.4621	0.3814	0.2666	0.3115	0.2551	0.1921	0.2325	0.2209	0.0961
11 NONMSA	0.6732	1.0000	0.4691	0.4057	0.0000	0.4910	0.0599	0.0000	0.2376
12 1-TOTLN	0.4194	0.4050	0.1421	0.3798	0.3648	0.1337	0.3643	0.3526	0.1518
13 SALARY	0.0170	0.0161	0.0099	0.0157	0.0147	0.0078	0.0132	0.0075	0.0125
14 PREROA	0.0134	0.0138	0.0424	0.0168	0.0164	0.0104	0.0191	0.0183	0.0126
15 PREROE	0.1528	0.1422	2.4399	0.1834	0.3211	0.1829	0.2295	0.2242	0.1519
16 ASSET	48.070	45.000	24.668	267.76	201.00	181.39	2806.6	2106.0	1905.1

Notes: Table 2 presents descriptive statistics for the sample. The variables are defined on pages 10–12.

Profit Efficiency Trends for Various Bank Size Groups

Table 2 shows our estimates of profit efficiency by year and by size class. PROFEFF has declined sharply in recent years for small banks, from 0.778 in 1995 to 0.702 in 2001. We consider the hypothesis that this decline may reflect an increasing number of de novo banks in the small bank category. FDIC data indicate that between 1992 and 1994 only 74 new banks per year were chartered, which no doubt reflects the depressed state of the banking industry at that time. In contrast, in the six-year period from 1995 to 2000, there were an average of 175 new bank charters per year. Many of these banks remain small for a number of years after being chartered. DeYoung and Hasan (1998)

show that de novo banks are much less profit efficient than older, similarly sized banks. In Table 1 the percent of banks in the under $100 million dollar category that are de novos (age under 10 years) has increased from 11.4 percent to 13.5 percent. Moreover, DeYoung and Hasan (1998) show that the first three years of operations show particularly low PROFEFF for new banks. The greater dispersion of the data for small banks in recent years also supports this explanation. Thus, the hypothesis that at least part of the decline in small bank PROFEFF between 1995 and 2001 reflects the performance of the de novo banks in the sample appears reasonable.

In contrast to the small banks, PROFEFF is relatively stable for medium-size and large banks when trends in both median and mean values are taken into account. For example, mean PROFEFF for medium size banks remains above 0.81 throughout the period and large bank PROFEFF remains above 0.84. Nonetheless, some decline is evident in the estimates, which probably reflects in part the fact that banks in all size groups are using less leverage because of pressures from regulators to increase the amount of equity capital on their balance sheet.

Results of the Regression Analysis of the Correlates of Profit Efficiency

As noted, we consider differences in the significance of the correlates among the size groups as an indication that banks of different sizes have different ways of achieving high profitability. The equity/assets ratio (EQUITY) is negative (as expected) and significant at medium and large banks. This indicates that, within these size groups, the more profit-efficient banks, *ceteris paribus,* use more leverage (less equity) than the other banks in the same size group. Age is positive and significant for small and medium-size banks but not for large ones. This would be consistent with the notion that the establishment of a strong credit culture is an important element in small and medium-size bank profitability. Overlapping generations of loan officers (each generation training the next in the *art* of making loans in the local community) and relationship development are important elements in developing such a culture. Successful implementation of these strategies would require that the bank be in existence for a considerable period of time. This is the "learning by doing" discussed by Berger and Mester (1997) and mentioned above.

The marketplace nonperforming loan ratio (MKTNPL) is significant with the expected negative sign for small and medium-sized banks but is actually positive for large banks. This ratio is not particularly relevant for larger banks since it only considers nonperforming loans in the county where the home office of the bank is located; most large banks have offices and loans in more than one county. Membership in a multibank holding company (MBHC) is negative and significant for small and medium-size banks but not for large ones. Apparently the most successful small and medium-sized banks are independent. It also suggests that large banks that are members of holding companies are less likely to be affected by developments at the holding company level than are the smaller and medium-sized holding company members. The relative nonperforming loan ratio (RELNPL) is significant and negative but only for medium-size banks.

Differences in fee revenue (FEEREV) are an important source of differences in profitability at small and medium-size banks (note the very high significance levels) but not at larger ones. The most likely explanation for this is that virtually *all* large banks depend on fee revenue rather than that fee revenue is unimportant for these banks. [See Table 1.] The year dummy variables are also significant for small and medium-size banks only. This suggests that larger banks have more consistent profitability over time than the other banks. Three variables—NATIONAL, GROWTH and SALARY—are not significant for any size group.

Competitive conditions matter but only for the two smaller size groups. Differences in PROFEFF among small banks are positively related to the HHI. In other words, *ceteris paribus*, PROFEFF is higher in more concentrated markets, which is exactly what we would expect. The same relationship holds for medium-size banks but not for large ones. Berger and Mester (1997) and Akhigbe and McNulty (2003) also find a positive relationship between PROFEFF and the HHI. In addition, most of the coefficients of the other correlates are consistent with the findings of Akhigbe and McNulty (2003). The fact that banks of different size attain high (or low) profit efficiency through different means is consistent with the above-mentioned recent analysis of DeYoung, Hunter, and Udell (2004) that suggests that banks of different sizes have different business models.

Table 3: Tobit Regression Results.

	Small		Medium		Large	
Variable	Mean	Chi-Square	Mean	Chi-Square	Mean	Chi-Square
Intercept	-0.3169	1,111.11***	-0.1796	516.67***	-0.1488	47.57***
EQTASS	-0.0011	0.42	-0.0028	4.14**	-0.0108	4.01**
AGE	0.0256	226.61***	0.0105	48.13***	0.0022	0.27
MKTNPL	-0.1035	4.88**	-0.3947	12.15***	0.8402	5.89***
MBHC	-0.0107	9.30***	-0.0293	103.72***	0.0015	0.04
NATIONAL	-0.0041	1.50	-0.0040	2.39	0.0021	0.08
RELNPL	0.0333	1.05	-0.2906	6.83***	-0.2820	0.88
GROWTH	-0.0080	2.11	0.0014	0.24	-0.0032	0.81
FEEREV	0.1904	37.03**	0.0739	14.20***	0.0528	2.18
HHI	0.0709	132.16***	0.0272	12.85***	0.0410	1.12
NONMSA	0.0060	2.74*	0.0059	3.85**	0.0384	6.64***
I-TOTLN	-0.0477	19.72***	-0.0154	2.50*	-0.0134	0.36
SALARY	0.0962	0.16	0.2024	0.81	0.6088	1.37
YEAR97	-0.0094	6.53***	0.0067	3.71**	0.0083	0.76
YEAR99	-0.0304	61.77***	-0.0008	0.05	0.0042	0.19
YEAR01	-0.0549	181.51***	-0.0142	16.91***	-0.0027	0.08
Sample Size	19,322		9,742		767	
No. of Obs.	18,838		9,694		758	
Missing Values	484		48		9	
Log Likelihood	146.95		4,678.99		551.84	

Notes: This table present the results of the following model: PROFEFF= function (EQTASS,AGE, MKTNPL, MBHC, NATIONAL, RELNPL, GROWTH, FEEREV, YEAR97, YEAR99, YEAR01, HHI NONMSA, (1-TOTLN), SALARY) where the variables are as defined on pages 10-12. The equation is estimated using a Tobit regression because PROFEFF is bounded so that all observations fall on the interval (0,1). ***Significant at the 1 percent level; **Significant at the 5 percent level; *Significant at the 10 percent level.

Summary and Conclusions

We examine the differences in profit efficiency at small (under $100 million in assets), medium size ($100 million to $1 billion) and large (more than $1 billion) banks for the period 1995 to 2001, and we also examine the sources of these differences. Since we calculate PROFEFF normalized by equity, it is not surprising that large banks rank highest. However, the differences are quite large. For the period as a whole, average PROFEFF is 0.752 for the small banks, 0.823 for the medium-size banks, and 0.856 for the large banks. In other words, the difference between small and large is more than 10 basis points, which is economically (and statistically) quite significant. Small banks can attain high PROFEFF by being older, by operating in markets with low default rates, by being independent of a holding company, by generating high fee income, by operating in a concentrated market, and by having more of their assets in loans as opposed to securities. Large banks that have high PROFEFF do so primarily by using more leverage since none of the other variables are significant.

DeYoung, Hunter, and Udell (2004) argue that different types of banks have different business models. The business model of the small bank is customized and personalized service but at high cost, while larger banks aim to deliver relatively uniform financial services to large groups of customers at lower cost. Our analysis is consistent with this notion that different types of banks attain high profitability in different ways.

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