Efficiency Performance of Commercial Banks in Lebanon

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Abstract

The study evaluates the key performance indicators of the banking sector in post war Lebanon in an attempt to assess the efficiency of the sector in producing the conventional outputs. Using data from 1993 through 2002, we observe that the sector grew significantly in size as measured by assets, but the growth in assets was not accompanied with growth in profits. Equity capital grew significantly over the period and the sector became safer. In fact, the prevalence of Lebanese treasury bills in the banks' asset portfolio indicates that the commercial banks during this period did not play their traditional role of financing the private sector initiatives; instead, the bulk of their funds financed the public sector. The stochastic frontier production and cost function estimates show that firm level inefficiency effects in producing loans and in the cost of producing loans are increased with increases in number of branches, number of employees per branch, and ratio of staff to operating expenses. Inefficiency decreases with time indicating that banks have become more efficient over the period of study.

Keywords: production and cost efficiency, stochastic frontier, commercial banks, Lebanon, Frontier 4.1

1. Introduction

Commercial banks represent one of the pillars of the Lebanese economy. This sector, while generally robust, witnessed several upheavals during the 15 year long civil war which culminated with a wave of bank failures. The government's response to the wave of failures during 1989-1990 was to adopt a law which defined the basis for auto-liquidation of banks in trouble and created a special banking tribunal for the prompt settlement of claims and litigation related to these banks. The structure of the banking sector in post war Lebanon was subject to major changes. With an attempt to encourage bank consolidation, the government introduced a law which provided for limited concessional loans from the Central Bank for the completion of mergers as well as income tax exemptions to the acquiring bank on a portion of its income provided it does not exceed the cost of merger and subject to a ceiling. As many as thirty two mergers and /or acquisitions took place over the period 1993-2001. At the end of 2004, the number of commercial banks in operation stood at 60, ten of them are foreign owned banks. With so much changes and challenges facing the industry, the question of interest to this study concerns the efficiency of the banks operating in Lebanon.

Production and cost efficiency of firms and institutions represent one of the core topics in the theory of the firm as advanced by the neo-classical economics. Producers are usually treated as successful optimizers and conventional econometric practice has been to use least squares based regressions to estimate production, cost, and profit functions following the theoretical paradigm. However, casual empiricism and the business press both make persuasive cases for the argument that while producers try to optimize, they do not always succeed Kumbhakar and Lovell (2003). The stochastic frontier production function, proposed independently by Aigner,

Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977), captures the possibility of inefficient outcomes. The proposed production function defines the boundary or the "frontier" and any deviations of observed outputs from this frontier reflect inefficiency, since they represent failures to achieve maximum possible output given the inputs.

Overall bank efficiency may be decomposed into four distinct components: scale, scope, pure technical and allocative efficiency measures. Scale efficiency occurs when the firm operates in the range of constant returns to scale. Scope efficiency occurs when the firm operates in diversified locations or provides diversified products. Pure technical efficiency occurs when the firm maximizes the output from a given level of input and allocative efficiency occurs when the firm chooses the revenue maximizing mix of outputs. Theoretically, a firm is efficient if it produces the output level and mix that maximize profits and minimize possible costs. There are a number of sources of inefficiency.

The objective of this study is to examine the technical efficiency of commercial banks in Lebanon. Following Battese and Coelli (1995), the study attempts to identify **simultaneously** stochastic production and cost frontiers and the determinants of inefficiency both over time and across firms. Although this is a frequently tested hypothesis in the empirical literature, the study is original in its application. There is no published research in this area on Lebanese banks. The study will be a valued contribution to the empirical literature. Although it will be a replication of other studies conducted mainly in developed countries, empirical support to the research question in a developing economy represents a welcomed addition. The study proceeds with a brief review of the literature in section 2. Section 3 presents the Battese and Coelli model that is estimated for a panel of Lebanese commercial banks. Section 4 describes the data and highlights

the characteristics of the banks in our sample, Section 5 presents and analyses the estimated model and Section 6 concludes the paper with recommendations.

2. Literature Review

The review of the literature on estimation of efficiency or inefficiency of firms reveals the existence of a wide range of econometric techniques, both parametric and non-parametric, to estimate the technical and economic efficiency with which firms approach the frontier. While it is conceivably easy to assess the notion of technical efficiency in the manufacturing industry, the lack of information on the use of technology by financial institutions makes it impossible to estimate production efficiency in the banking sector. Studies of frontier analysis in the banking sector rely on accounting measures of cost, inputs, outputs, revenues and profits. Berger et al. (1997) surveys 130 studies that apply frontier efficiency analysis to financial institutions in 21 countries, using five different frontier approaches:

1. Data envelopment analysis (DEA): nonparametric, linear programming technique;
2. Free disposal hull (FDH): a special case of DEA
3. Stochastic frontier approach (SFA): parametric; specific functional form
4. Distribution Free Approaches (DFA):parametric; specific functional form
5. Thick frontier approach (TFA): parametric

According to Berger et al. (1997) there is a lack of agreement as to which model is the "best". The parametric approaches impose functional forms and make behavioral assumptions, thus presupposing the shape of the frontier. The nonparametric approaches impose less structure on the frontier but restrict randomness that is inherent in such production processes. The term

stochastic reflects the presence of external forces contributing to random statistical noise that lead to inefficient outcomes.

The typical bank efficiency study found in the literature adopts a two-stage approach. In the first stage, it estimates a stochastic production function and predicts the technical inefficiency of an individual bank relative to the observed frontier (usually the best case scenario bank) and obtains a bank specific estimate of efficiency. The second stage involves usually the specification of a regression model to explain the predicted efficiency of the individual bank. There is a lack of information on what the main determinants of efficiency are both across firms within the financial industry and across branches within a single firm. Almost all of the studies which estimate efficiency and then regress it on sets of explanatory variables have been unable to explain more than just a small portion of its total variation.

3. The Model

The current study uses the parametric approach using a model proposed by Battese and Coelli (1995). This model is superior to the two stage approach found in the literature for it allows for the simultaneous estimation of the stochastic frontier production and cost functions and the firm specific inefficiency effects represented in the stochastic error terms of these functions. Battese and Coelli apply their model to the farming industry; Fillippini, Wild and Kuenzle (2002) apply the same model to assess the efficiency of the electricity networks. Applying the model to the banking industry is an extension that deserves to be investigated. The bank's stochastic frontier production/cost is specified as follows,

$$(1) \qquad \ln(Y_{it}) = \alpha + \sum_i \beta_i \ln(X_{it}) + \sum_i \chi_i R_{it} + \delta Time + \varepsilon GDPGrowth + V_{it} - U_{it}$$

where Y_{it} denotes the output/cost of the i-th bank in the t-th year; X_{it} and R_{it} are (i x k) vectors of inputs of production, prices of those inputs and other explanatory variables associated with the i-th bank in the t-th year; *Time* indicates the year of the observation involved and is included in the model to capture technological progress or any other improvement in hiring more qualified employees and other capital inputs. *GDP Growth* represents the growth rate in the real GDP and is included to control for the business cycle. α, β_i, χ_i , δ and ε represent the unknown parameters to be estimated; the V_{it}s are assumed to be identically, independently, and normally distributed random error terms with mean zero and variance σ_v^2 (iid N(0, σ_v^2)) independently distributed of the U_{it}s; the U_{it}s are non-negative random variables, associated with technical inefficiency of production/cost, which are assumed to be independently distributed, such that U_{it} is obtained by truncation (at zero) of the normal distribution with mean, $z_{it}\phi$, and variance, σ^2; z_{it} is a (1 x m) vector of explanatory variables associated with technical inefficiency of production of firms over time; and ϕ is an (m x 1) vector of unknown coefficients.

The technical inefficiency effects, U_{it}, in the stochastic production frontier model is specified by the following equation:

(2) $$U_{it} = \phi_0 + \phi_1 Z_{it} + W_{it}$$

where Z includes variables that are firm specific; W_{it}, is defined by the truncation of the normal distribution with zero mean and variance, σ^2, such that the point of truncation is $-z_{it}\phi$, i.e. $W_{it} \geq -z_{it}\phi$.

Battese and Coelli (1995) propose the simultaneous estimation of (1) and (2) using the method of maximum likelihood. The technical efficiency of production for the ith firm in the tth year is then defined by

(3) $$TE_{it} = \exp(-U_{it}) = \exp(-z_{it}\delta - W_{it}) .$$

Using the program Frontier version 4.1 developed by Coelli (1996), we estimate the system of equations (1) and (2) using a panel data of Lebanese commercial banks. The following section presents an overview of the data used in the analysis.

4. Description and Analysis of Data

We use the issues of Bilanbanques[1] from 1994 to 2003 to develop our initial sample of banks. To remain in the sample, the bank must be a commercial bank and must not be owned by the government[2] and it must have reported data for all the variables included in the study for at least three years during the period 1993-2002.

Our search resulted in a sample of 492 observations.[3]

Table 1 displays summary statistics of balance sheet accounts for banks with complete data. The data show that banks in Lebanon grew significantly in size. Assets increased from an average of LP331 billion in 1993 to LP2153 billion in 2002, an annual compounded growth of approximately 23 percent. This growth in assets was not accompanied by the same growth rate in profits. Average net profit was LP3.03 billion in 1993 and reached a peak of LP14.96 billion in 1998 to decline to LP12.84 billion in 2002.The lower increase in profits relative to the increase in assets translates into a significant decline in return on assets (ROA). Using a benchmark ROA

[1] Bilanbanques is published annually by Bank Data Financial Services in collaboration with the Association of Banks in Lebanon and it is sponsored by Banque du Credit Libanais. The data in Bilanbanques are furnished by individual banks. Each issue of Bilanbanques reports data for the two years immediately preceding the issuance year.

[2] We disregard banks owned by the government due to the difference in the composition of the balance sheets of these banks.

[3] At the beginning of 1993, there were 57 Lebanese commercial banks and 12 foreign commercial banks operating in Lebanon. At the end of 2002, the number of Lebanese banks remained the same, however, the number of foreign banks grew to 15. At the beginning of 1993, there were also four specialized banks and ten representative offices of foreign banks. At the end of 1997, the number of specialized banks grew to nine and the number of representative offices of foreign banks remained ten , but some of the names changed. There was also an Islamic bank operating in Lebanon at the end of 1997, Al-Baraka Bank Lebanon. While some of the banks during this period declared bankruptcy and were liquidated, new banks were established and other banks were merged with or purchased by larger banks.

of one percent as a minimum performance standard,[4] our sample banks pass this test only for the years 1994 through 1998. Since 1996, ROA has been declining, dropping from 1.22 percent in 1996 to 0.53 percent in 2002 (see Table 2).

In 1993, banks were undercapitalized due to the depreciation in the value of the Lebanese pound vis a vis all major currencies. Data in Table 1 indicate that Lebanese banks gradually built up their equity capital using their profits and outside financial sources.[5] The average amount of equity capital increased from LP7.2 billion in 1993 to LP145.1 billion in 2002, an annual compounded growth of approximately 39.6 percent. This increase was significantly higher than that of assets during the same period. This explains why the ratio of total equity to total assets (EA Ratio) increased significantly from 3.7 percent in 1993 to 8.1 percent in 2002. All other things being equal, Lebanese banks became safer (i.e., the traditional notion of bank capital as a buffer or cushion for absorbing losses) over our test period. Based on either measure, we attribute this improvement in bank safety to four factors: political (cessation of war), economic (lower inflation), regulatory (BIS capital requirements), and managerial (greater recognition of the importance of capital adequacy and risk management).

Data in Table 1 also indicate that average total deposits rose from LP291 billion in 1993 to LP1691.4 billion in 2002, which is a compounded annual growth of 21.6 percent. Approximately 70 percent of the total deposits in 1993 were denominated in foreign currencies, mostly US dollars; in 2002 this ratio remained unchanged.[6] This indicates that the depositors did

[4] This standard is based mainly on the US experience, excluding the ten largest banks. For example, during the 1980s a bank that did one percent or better on assets was a high-performance bank. After the early 1990s, banks that were not doing at least one percent on assets were underperforming. For example, see Bassett and Zakrejsek [2000].
[5] The Central Bank of Lebanon issued a decree requiring that all banks would have to raise their capital to at least LP10 billion with an additional LP 250 million for each branch by the end of 1997 or face the cancellation of their license. The Central Bank encouraged small banks, which had problems in raising the appropriate amount of capital to merge with larger banks.
[6] After the tragic death of Prime Minister Hariri the ratio of Deposits in Foreign currencies to total deposits has reached approximately 85 percent.

not enhance their trust in their national currency. They still prefer to invest their savings in currencies other than their own. The significant devaluation of the Lebanese currency especially in the late 1980s and early 1990s prompted the Lebanese depositors, who were lucky to convert their savings to US dollars. The lack of trust in the Lebanese pound persists despite the fact that deposits denominated in this currency earned a significant spread over those denominated in US dollars.[7]

Data in Table 1 also indicate that while loans in Lebanese pounds extended to the private sector in 1993 amounted to 8.6 percent of deposits in the same currency, 86 percent was invested in Lebanese treasury bills. In 2002 those percentages were 12 percent and 86 percent, respectively.[8] Lebanese banks like any other risk averse investors, preferred to earn more income with less risk. Banks were attracted by the high returns and low risk of Lebanese treasury bills (T-Bills). Private investors could not compete with the government in attracting funds because they did not have investment opportunities with such high returns compared to high lending rates. Commercial banks did not play the vital role to energize the economy by financing the private sector. In 1993, loans in foreign currencies (mostly in US dollars) to private businesses accounted for 59 percent of deposits in those currencies. This ratio fell slightly to 58 percent in 2002.[9] The relatively high ratios could be explained by the fact that lending rates on US dollars were relatively low to attract borrowers and banks had fewer more profitable alternatives**.** Off-balance sheet activities (OBSAs), which for Lebanese banks include guarantees and standby letters of credits (the largest of the items), documentary and commercial letters of credit, fiduciary deposits, and interest-rate swaps, have slightly increased from 1993 to 2002 relative to

[7] While the average return on deposits denominated in Lebanese pounds is currently around 10 percent, the average return on deposits denominated in US dollars is 4 percent. The interest rate on deposits in Lebanese Pounds reached 35 percent per year on certain accounts in 1995.

total assets. They have kept pace with the growth of total assets. As a percent of total assets, OBSAs have varied between 10.7 in 1993 and 12 percent in 2002.

Tables 1 and 2 present various measures of operating efficiency for the sampled Lebanese banks. Number of employees rose from an average of 253 employees per bank in 1993 to 394 in 2002 and number of branches doubled from an average of 10 per bank to 20 for the same period. Lebanese banks have been gradually reducing their operating expense per dollar of assets, which declined from 3.5 percent in 1993 to 1.9 percent in 2002. However, an alternative measure of operating efficiency, the ratio of interest expenses to interest income, has shown deterioration increasing from 65 percent in 1993 to 70 percent in 2002. Staff expenses of Lebanese banks relative to operating expenses rose significantly from 52 percent in 1993 to 59 percent in 2002. Over this same period, staff expenses per employee almost tripled rising from LP14.7 million (1993) to LP43.7 million (2002).

Table 1 shows that the distribution of total asset size is highly skewed as the standard deviation of asset size is larger than the mean for every one of the ten years.[10] To test for the effects of size on the efficiency measures of Lebanese banks, we divide our sample at the median asset size in each year and examine the groups above and below the median[11]. Our results presented in Table 4 do not show significant differences in ROA in each of the ten years, except in 1993. However, smaller banks were more capitalized than larger banks in each of the ten years as shown by greater equity to assets ratios. The sample of smaller banks has significantly smaller average staff expenses per employee for eight of the ten years (1995-2002), but significantly

[8] In 1993, banks were required to invest a minimum of 60 percent of deposits in Lebanese pounds in treasury bills. This percentage fell to 40 percent in 1997and this requirement was released later.
[9] Banks are allowed to loan out to private businesses only up to 70 percent of their deposits in foreign currencies.
[10] At the end of 2002, the largest bank was Banque du Liban et d'Outre-Mer with total assets of 10,773 billion Lebanese pounds ($7.1 billion) while the smallest bank was Lati Bank with total assets of 63 billion Lebanese pounds ($42 million).

higher operating expenses per dollar of assets during the entire period of 1993-2002. However, the bigger banks have slightly higher interest expenses per dollar of assets across seven years.

5. Estimation

Using the computer program Frontier 4.1, we estimate simultaneously the stochastic production function (SPF) and the stochastic cost function (SCF) and the corresponding firm level inefficiency effects. Tables 4 and 5 present the results.

In Table 4 we present the maximum likelihood estimates (MLE) of the SPF and the inefficiency effects for total loans. Total loans are used as a broad measure of bank output. It includes loans denominated in both Lebanese pounds (LbP) and foreign currency (FC) extended to both the private sector and the public sector in forms of private loans and T-Bills. The estimated coefficients of the production function conform to theoretical expectations to varying degrees. For instance, bank deposits, the traditional input measures in loan production, are expected to have a positive effect on output. In our model, deposits in LbPs (LPDEP) have the expected sign and significance indicating that increases in LbP deposits increase the production of loans; however, deposits in FC (FCDEP) have negative effect on the production of total loans. Note that, over the period of study, output was dominated by T-Bill production, as banks were required, by a decree from the Central Bank, to hold a reserve ratio of 30% on FC deposits and to invest 60% of LbP deposits in T-Bills.

The prices of inputs representing the second set of traditional input variables have the expected signs. The wage rate (*P_Labor*) and the interest rate (*P_Interest*) are both negative and significant; *P_Capital*, price of capital while negative, is insignificant. Total cost of production

[11] A t-test is conducted to compare the means of the two sub samples.

(*Cost)*, which is used to measure cost of all inputs, has a positive and significant coefficient estimate indicating that higher expenditures such as higher interest payments by the bank induce more loans. The variable *OffBalance/Assets*, included in the model to control for ability to raise funds, has a positive coefficient indicating that banks that with higher off balance sheet activities as a proportion of their assets are able to produce more loans. *Equity/*Asset has the expected positive, albeit insignificant effect on output. The coefficient on *Foreign*, a dummy variable taking the value of one when the bank is foreign owned has a negative coefficient indicating that these institutions do not produce loans as much as the non-foreign banks.

The coefficient of GDP Growth is negative and significant. This is not entirely unexpected given that *GDP Growth* has been on the downturn after reaching a peak growth rate of 8% in 1994. In 2000, the rate of real growth was zero percent. Hence, with falling GDP, banks invested in the most lucrative and safe available opportunity which is as presented above was the T-bills. As for the negative and significant coefficient of *Time*, the story may be slightly different; this variable was introduced in the stochastic production functions to account for technological change. The negative sign indicates that there were no significant technological advances in production of loans; instead there may have been significant developments in substituting away from the traditional loans and into not so traditional services encompassed in retail banking.

Table 5 presents the MLE for SCF for the same panel of commercial banks. In this model, the cost is expressed as a function of the disaggregated output. We include the three categories of loans separately to be able to capture the impact of each on the stochastic cost function. It is comforting to find that the coefficients of *LPLOANS*, *FCLOANS* and *T-Bills* are all positive and statistically significant indicating that increases in any and all kinds of output are

positively related to cost. The largest positive coefficient is the one associated with the *T-Bills* indicating may be that it is the most costly to produce. The coefficient of *Equity/Asset* is negative and highly significant; indicating that the more capitalized the bank is the lower the cost of production. *OffBalance/Asset* carries a negative and marginally significant coefficient. *P*_Labor, *P*_Interest, and *P*_*Capital* reverse their sign but maintain their significance, as expected. The coefficient on *Foreign* is positive and significant indicating that foreign banks have higher costs of operation than their local counterparts. Costs also increased significantly over time and with the growth in GDP.

The inefficiency effects are shown to be highly significant in the analysis of the value of the output and costs of the commercial banks. The null hypotheses specifying that the inefficiencies are absent from the models are strongly rejected using the generalized likelihood ratio test. The test does not imply that all the variables in the model have a significant impact on the inefficiency of the individual banks. It merely says that the presentation of the stochastic error term in the production and cost functions could not be rejected. In both models the time variable *Time* is negative and significant indicating that bank level inefficiencies are decreasing over time; banks are becoming both productive and cost efficient. On the other hand, the number of branches (*Branches)*, the number of employees per branch a bank (*Employee/Branch*), and the staff expenditures as a proportion of total operating expenses (*Staff/Operexp)* all have positive and significant coefficients indicating that increases in the levels of these variables increase the inefficiencies.

The estimated mean efficiency of commercial banks in production is 0.9017 indicating that the bank's actual production is around 90 percent of the efficient level of output given the resources. Individual banks have different efficiency scores over the ten year period of study.

While the most inefficient bank in our sample is observed in year 1994 with an efficiency score of about 0.25, the most efficient bank is observed in year 1995 with a score of 0.973.

The estimated mean technical efficiency of our sample banks in cost is 1.175 indicating that the bank's actual costs are on average 17.5 percent higher than the efficient level of costs. The most cost efficient bank is observed in year 1994 with costs 2.8 percent above the efficient level; the most cost inefficient bank is observed in year 2000 with a score of 7.11 or 611 percent higher than the efficient level of costs.

5. Conclusion

The study evaluated the key performance indicators of the banking sector in post war Lebanon to assess the production and cost efficiency of the sector in producing the conventional outputs. Using panel data for commercial banks from 1993 through 2002 and applying a model proposed by Battese and Coelli (1995), the study estimated simultaneously stochastic production and cost frontiers and firm specific inefficiency effects. While most of the conventional inputs in the production and cost frontier carry the expected signs and significances, it is notable that the hypotheses specifying that inefficiencies are absent from the production and cost models are strongly rejected. The findings indicate that firm level inefficiency effects in producing loans and in the cost of producing loans are increased with increases in number of branches, number of employees per branch, and ratio of staff to operating expenses. The findings also indicate that banks have become less inefficient over the period of study.

Table 1. Mean values and standard deviation of variables used (in millions of Lebanese pounds).

Variable	1993 (53)[a]	1994 (55)	1995 (55)	1996 (55)	1997 (53)	1998 (49)	1999 (48)	2000 (44)	2001 (41)	2002 (39)
Total Assets	331.1 (426.5)[b]	432.8 (564.5)	539.8 (731.7)	715.8 (1021.9)	929.3 (1372.3)	1207.5 (1663.8)	1352.3 (1798.7)	1577.5 (2057.8)	1803.3 (2315.4)	2153.4 (2691.7)
TotalEquity	7.2 (9.0)	11.4 (17.8)	30.3 (43.0)	43.3 (66.97)	63.6 (99.4)	81.5 (119.3)	89.3 (130.5)	103.7 (149.2)	115.3 (170.20)	145.1 (206.7)
LPdeposit	89.4 (120.1)	148.1 (208.3)	178.5 (254.5)	259.8 (364.5)	285.3 (427.9)	346.7 (472.2)	434.9 (575.6)	432.2 (569.7)	413.3 (517.9)	511.7 (641.9)
LPloans	7.7 (9.1)	13.5 (16.8)	19.2 (32.2)	26.1 (47.4)	33.4 (48.2)	33.5 (49.5)	39.8 (61.3)	44.3 (70.0)	51.6 (84.1)	62.4 (91.5)
FCdeposit	201.6 (274.6)	221.3 (299.7)	270.8 (364.6)	330.3 (486.7)	470.9 (705.2)	628.5 (885.9)	611.8 (874.3)	862.6 (1150.)7	1075.4 (1414)	1179.7 (1534.8)
FCloans	80.8 (109.2)	105.7 (147.2)	150.9 (211.6)	195.4 (287.4)	249.8 (381.6)	336.7 (474.6)	386.4 (535.0)	426.5 (584.0)	460.2 (623.8)	452.9 (573.9)
LPtbills	77.3 (106.5)	129.9 (190.2)	153.8 (234.4)	228.7 (332.2)	250.4 (390.88)	322.1 (472.2)	469.6 (696.8)	387.3 (547.3)	354.1 (467)	438.1 (566.2)
Off-balance[2]	35.1 (50.8)	51.8 (80.3)	67.3 (129.9)	90.0 (174.9)	106.7 (193.6)	137.9 (232.5)	147.6 (249.9)	148.6 (247.4)	270.2 (591.5)	470.9 (1231.0)
Profit	3.0 (6.0)	4.9 (8.1)	5.2 (8.1)	8.7 (13.3)	12.8 (20.9)	14.9 (23.9)	13.9 (24.4)	14.9 (25.4)	12.5 (27.6)	12.8 (36.4)
Number of Employees	253 (218)	261 (233)	259 (236)	281 (262)	291 (284)	319 (296)	320 (292)	321 (314)	364 (341)	394 (376)
Number of Branches	10 (9)	10 (10)	11 (10)	12 (12)	12 (12)	14 (14)	16 (16)	17 (18)	19 (19)	21 (20)
Interest Expenses	18525 (24445)	27573 (37164)	39326 (55424)	52994 (78517)	63346 (95294)	84423 (123620)	92729 (124462)	105714 (137701)	109063 (137104)	105686 (135493)
Interest Income	28358 (34665)	39765 (50622)	54713 (72628)	75311 (101731)	89705 (129159)	115243 (164170)	128373 (170281)	142593 (187061)	146395 (185082)	150687 (191234)
Staff expenses[1]	3837 (3792)	5474 (5578)	6891 (7076)	8886 (9880)	9967 (11819)	11300 (12930)	12846 (14200)	13385 (14810)	14967 (16700)	18260 (20327)
Operating[1] Expenses	7329 (7129)	9649 (9821)	12178 (12831)	15008 (16762)	16740 (19400)	20386 (24251)	23415 (26072)	22578 (25087)	25954 (27572)	31049 (33661)

[a] is the sample size; [b] is the standard deviation.

Table 2. Selected Mean Efficiency Ratios and Standard Deviations

Variable	1993 (53)[a]	1994 (55)	1995 (55)	1996 (55)	1997 (53)	1998 (49)	1999 (48)	2000 (44)	2001 (41)	2002 (39)
Return on Assets	0.006 (0.007)[b]	0.012 (0.013)	0.010 (0.009)	0.012 (0.012)	0.012 (0.010)	0.011 (0.008)	0.007 (0.008)	0.006 (0.010)	0.005 (0.010)	0.005 (0.016)
Equity/Assets	0.037 (0.039)	0.041 (0.038)	0.078 (0.055)	0.080 (0.052)	0.103 (0.084)	0.097 (0.072)	0.086 (0.059)	0.086 (0.061)	0.082 (0.064)	0.081 (0.062)
Off-balance sheet / Assets	0.108 (0.086)	0.105 (0.065)	0.104 (0.071)	0.093 (0.061)	0.096 (0.067)	0.096 (0.066)	0.086 (0.056)	0.077 (0.048)	0.092 (0.082)	0.121 (0.134)
Operating / Assets	0.035 (0.021)	0.033 (0.017)	0.033 (0.015)	0.030 (0.014)	0.026 (0.010)	0.023 (0.008)	0.023 (0.009)	0.019 (0.007)	0.018 (0.007)	0.019 (0.007)
Interest Exp / Assets	0.057 (0.021)	0.063 (0.019)	0.071 (0.017)	0.071 (0.017)	0.068 (0.015)	0.066 (0.016)	0.070 (0.016)	0.068 (0.014)	0.081 (0.012)	0.050 (0.016)
Interest Inc / assets	0.094 (0.028)	0.098 (0.022)	0.107 (0.020)	0.116 (0.069)	0.102 (0.024)	0.094 (0.016)	0.096 (0.016)	0.093 (0.013)	0.084 (0.012)	0.074 (0.015)
Staff Exp/ Operating Exp	0.522 (0.111)	0.574 (0.099)	0.577 (0.103)	0.617 (0.186)	0.595 (0.094)	0.572 (0.097)	0.551 (0.090)	0.612 (0.097)	0.603 (0.097)	0.594 (0.103)
Staff Exp / Employees	14.705 (5.176)	20.811 (12.377)	24.856 (7.745)	29.897 (10.728)	31.064 (10.686)	32.763 (11.444)	37.246 (11.461)	39.857 (12.266)	39.310 (12.472)	43.677 (18.020)

[a] is the sample size; [b] is the standard deviation.

TABLE 3. Comparisons of means

Variable	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Return on Assets (ROA)	0.008[a]	0.011	0.009	0.017	0.013	0.011	0.008	0.007	0.005	0.002
	0.004[b]	0.013	0.011	0.013	0.011	0.011	0.005	0.006	0.006	0.009
Total Equity / Total Assets	0.021	0.025	0.052	0.055	0.061	0.062	0.057	0.054	0.052	0.055
	0.053[1]	0.058[1]	0.104[1]	0.107[1]	0.148[1]	0.134[1]	0.116[1]	0.117[1]	0.114[1]	0.108[1]
Off-balance sheet / Total Assets[a]	0.104	0.119	.121	0.120	0.120	0.114	0.105	0.091	0.107	0.148
	0.111	0.090[3]	0.087[3]	0.067[1]	0.070[1]	0.078[2]	0.067[2]	0.065[2]	0.078	0.095
Operating Expenses / Total Assets	0.024	0.024	0.025	0.023	0.020	0.0177	0.018	0.015	0.016	0.016
	0.046[1]	0.042[1]	0.041[1]	0.038[1]	0.032[1]	0.028[1]	0.029[1]	0.023[1]	0.021[1]	0.022[2]
Interest Expenses / Total Assets	0.056	0.064	0.072	0.073	0.069	0.070	0.069	0.068	0.062	0.051
	0.057	0.062	0.070	0.069	0.066	0.062	0.070	0.067	0.060	0.049
Interest Income / Total assets	0.087	0.093	0.102	0.104	0.100	0.094	0.092	0.090	0.082	0.071
	0.102[3]	0.103[3]	0.113[2]	0.130	0.104	0.095	0.010	0.095	0.087	0.076
Staff / Operating Expenses	0.521	0.574	0.581	0.583	0.587	0.576	0.545	0.589	0.595	0.601
	0.524	0.575	0.572	0.652	0.602	0.569	0.558	0.636	0.610	0.588
Staff Expenses / Employees	16.003	21.76	27.76	32.09	34.40	37.51	41.85	43.72	43.77	51.41
	13.31[3]	19.80	21.85[1]	27.62	27.61[2]	28.01[1]	31.99[1]	36.34[2]	34.85[2]	36.76[2]

[a] Represents the mean of the sub-sample with assets > the median; [b] Represents the mean of the sub-sample with assets <the median; [1] Means are significantly different at the 0.01 level; [2] Means are significantly different at the 0.05 level; [3] Means are significantly different at the 0.10 level.

Table 4. Maximum Likelihood Estimates of the Stochastic Production Functions and the Inefficiency Effects for Total Loans

Variable	Parameter	Total Loans
Constant	α	29.98[1] (3.58)
ln(LPDEP)	β_1	0.067[1] (0.026)
ln(FCDEP)	β_2	-0.09[1] (0.025)
ln(COST)	β_3	1.04[1] (0.05)
P_LABOR	χ_1	-0.002[1] (0.001)
P_INTEREST	χ_2	-5.13[1] (0.63)
P_CAPITAL	χ_3	-16.11[1] (1.34)
OBSA/ASSETS	χ_4	0.517[1] (0.124)
Equity/Asset	χ_5	0.081 (0.16)
Foreign	χ_6	-0.032 (0.022)
Year	δ	-0.014[1] (0.002)
GDP Growth	ε	-1.98[1] (0.42)
Constant	ϕ_0	6.12[1] (2.79)
Branches	ϕ_1	3.729[1] (1.014)
Employees/Branch	ϕ_2	0.018[1] (0.008)
Staff/Operating Expense	ϕ_3	0.019[1] (0.007)
Year	ϕ_4	-0.006[1] (0.002)
Likelihood Ratio Test for H_0: $\phi_0=\phi_2=\ldots=\phi_4=0$	λ	69.87
Decision		**Reject H_0**
Mean Technical Efficiency		**0.9016**

[1] Significant at the 1% level; Standard errors in parentheses

Table 5. Maximum Likelihood Estimates of the Stochastic Cost Functions and the Inefficiency Effects

Variable	Parameter	Total Cost
Constant	α	16.41[1] (1.17)
ln(LPLOANS)	β_1	0.081[1] (0.008)
ln(FCLOANS)	β_2	0.357[1] (0.014)
ln(T-BILLS)	β_3	0.486[1] (0.015)
P_LABOR	χ_1	0.006[1] (0.001)
P_INTEREST	χ_2	2.642[1] (0.40)
P_CAPITAL	χ_3	10.94[1] (1.202)
OBSA/ASSETS	χ_4	-0.265[1] (0.123)
Equity/Asset	χ_5	-0.412[1] (0.162)
Foreign	χ_6	0.114[1] (0.022)
Year	δ	0.008[1] (0.001)
GDP Growth	ε	1.03[1] (0.42)
Constant	ϕ_0	6.12[1] (2.79)
Branches	ϕ_1	0.035[1] (0.008)
Employees/Branch	ϕ_2	0.03[1] (0.008)
Staff/Operating Expense	ϕ_3	3.162[1] (0.833)
Year	ϕ_4	-0.004[1] (0.001)
Likelihood Ratio Test for H_0: $\phi_0=\phi_2=\ldots=\phi_4=0$	λ	132.6
Decision		**Reject H_0**
Mean Technical Efficiency		**1.1755**

[1] Significant at the 1% level; Standard errors in parentheses

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