MEASURING TECHNICAL EFFICIENCY OF KUWAITI BANKS

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ABSTRACT

A stochastic cost frontier approach is used to estimate technical efficiency of Kuwaiti Banks. Using earning assets as output and fixed assets, labor and financial capital as inputs, I have found that banks produce earning assets at constant returns to scale and hence have less to gain from increasing scale of production notably, through merging with other banks, than from reducing their technical inefficiency. Except for the largest two banks, NBK and GB, there is large room for improving technical efficiency of most of the banks. In order to account for differences in technical inefficiency between banks, I have linked the adopted measure of inefficiency to some relevant variables. The results show that larger bank size, higher share of equity capital in assets and greater profitability are associated with better efficiency. In lights of the results, it is argued that the only way for banks to better meet the challenge of increased competitive pressure from more powerful banks and future foreign entry would be to increase technical efficiency. For this, banks ought to appoint skilled bankers and managers, improve, through continuous training, the skills of existing employees, de-link management from ownership, enlarge the share of equity in total assets and broaden the base of ownership. Privatization of banks could also improve corporate governance that leads to better efficiency through lower intermediation margins and spreads and a wider range of services.

1. INTRODUCTION

Banks in Kuwait are facing many challenges that are likely to affect their ability to grow and operate within a more competitive environment. The Kuwaiti economy continues to rely on oil as its major driving force. Oil represents more than 90 percent of its merchandise export earnings and 80 percent of budget revenue. In addition, its public sector dominates the economic sphere in terms of ownership and management of most activities. Even the performance of the private sector and non-oil related activities are linked to government intervention in terms of subsidized loans and input prices, equity injections, bailouts, and preferences in government procurements.

As a result of the over-dependence on oil and the public sectors, it was difficult to develop many profitable investment opportunities outside the limited scope of real estate, trade and stock market activities. This has translated into the concentration of bank lending into consumer loans, real estate, construction and trade finance at the expense of lending to the industrial sector. Some of these lending opportunities are even more restricted considering the large share of expatriate population whose access to bank credit is limited by virtue of many regulations including those related to real estate and corporate ownership.

This lack of business diversity coupled with excess liquidity resulting from substantial oil exports windfalls, have generated many speculative bubbles. The stock market crash in 1982, which was the result of the bust of one of the worst speculative bubbles in the history of Kuwait, has left the banking sector with a crippling portfolio of non-performing loans.

In their strive to expand the scope of their activities beyond the traditional banking services and into activities such as investment and insurance, local banks not only need the proper regulatory framework to play the role of universal banks, they also have to face a stiff competition from well established domestic investment and insurance companies. Local banks are also expected to face more competitive pressure when Kuwait opens up its domestic market to foreign banks by virtue of its membership in the World Trade Organization.

The ability of banks to meet the above challenges depends on how efficiently they are run. In this paper, I will provide estimates of the technical efficiency of banks in the sense of analyzing how optimally they use, physical capital, labor and financial resources to generate earning assets. This endeavor is relevant for policy purposes on several grounds. First, it allows decision makers to evaluate how banks will be affected by increased competitive pressure within their operating environment. It also helps highlight banks that need to merge with more efficient ones or exit the banking sector. Efficiency of banks is equally important for consumers to the extent that more efficient banks tend to have lower service charges, better loan and deposit rates and better quality services.

The next section presents a brief overview of the banking sector in Kuwait. Section 3 underlines the methodology and data used in the analysis. The empirical results are discussed in section 4 and section 5 concludes.

2. THE CHARACTERISTICS OF BANKS IN KUWAIT

The banking sector in Kuwait is mainly composed of, in addition to the central bank, eight conventional banks (six commercial and two specialized banks) and an Islamic bank. The structure of the banking sector is fairly concentrated. The National Bank of Kuwait (NBK) is more than twice the size of the next largest, the Gulf Bank (GB), in terms of assets and deposits. Together, they own around fifty percent of the assets of conventional banks and dispense around the same proportion of total banking credit. The same two banks have over the recent past had the best records in terms of profitability and financial positions. Table 1 through 3 give a brief overview of the main characteristics of the banking sector in Kuwait.

Table 1 shows the relative disparity of the Kuwaiti banks in terms of size. The latter seems to correlate perfectly with the date of establishment since older banks are larger in size. Table 2 shows that overall Kuwaiti banks maintain acceptable levels of financial risk whether in terms of the ratio of equity to assets or liability to assets. However, there are substantial differences among banks in terms of profitability. Table 3 shows that the asset structure of the most profitable banks is different from that of other banks. Banks, which have maintained a larger share of liquid assets and lower share of government bonds, tend to have higher profits.

In the aftermath of the most detrimental speculative bubbles in the history of Kuwait and the crash of the unofficial "Souk Al-Manakh" stock market, the banks were left with large portfolios of non-performing loans. The situation of the banking sector has worsened following the invasion of Kuwait by the Iraqi regime.

The government has then intervened to bailout the financial system through what has become to be known as the "Difficult Debt Settlement Program". Under this scheme, non-performing loans were swapped for government debt bonds for maturities ranging from ten to twenty years. Profitability of banks might have been affected by the fact that government debt bonds could not be traded or discounted. In addition, the debt settlement problem has increased banks' risk aversion to large lending operations and hence might have deprived them from profitable opportunities.

Another salient feature of Kuwaiti banks is the mixed nature of their ownership. Except for NBK, which is almost entirely owned by the private sector, the government is a shareholder in the rest of the banks. The percentage government shareholdings in Kuwait banks are as follows:[1]

National Bank of Kuwait (NBK)	1.67
Commercial Bank (CBK)	8.50
Al-Ahli Bank (ABK)	8.50
Gulf Bank (GB)	17.60
Kuwait Finance House (KFH)	32.58
Real Estate Bank (KREB)	33.68
Bank of Kuwait and the Middle East (BKME)	58.80
Burgan Bank (BB)	60.99

The joint ownership of banks and the reputation gained by the government as a "bailer of last resort", may have contributed to bank's propensity for imprudent behavior.

[1] These figures are reported in table 17, National Bank of Kuwait (1994), p.27.

3. METHODOLOGY AND DATA

The efficiency of financial institutions has been addressed in the literature either in terms of scale and scope or in terms of X-efficiency or both.[2] Scale efficiency addresses the question of whether the bank is operating at the minimum of its long-run average cost curve. Any deviation from this level of production could result in inefficiency in terms of scale of operation. The degree of scale economies is usually measured by the percentage change in costs due to proportionate increase in all outputs.

On the other hand, scope efficiency focuses on the relative cost of joint production with the cost of producing the same total output in different firms. It is measured by the difference between the cost of joint production and the sum of producing the different outputs individually.

X-efficiency measures the ability of banks to minimize costs and maximize revenues through the optimal use and allocation of resources. This ability can be decomposed into two types of efficiencies. The first one is technical efficiency. It refers to the extent banks could reduce input costs for a given level of output (input orientation) or expand output for given levels of inputs (output orientation). The distance to an optimal production or cost frontier measures technical efficiency. It could be deterministic or stochastic and gives the maximal output that can be attained for a given level of input, or the minimal cost for a given level of output and input prices.

[2] A good review of the literature could be found in Berger et al. (1993a).

The second component of X-efficiency is allocative efficiency. It refers to the possible reduction in cost resulting from using the different inputs in optimal proportions or equivalently to operate on the least cost expansion path. Early literature has focused on scale and scope efficiency. Issues of X-efficiency have increasingly been addressed in more recent work such as Mester (1993, 1994), Berger et al. (1993 a,b), English et al. (1993), Berger and Humphrey (1991) and Ferrier and Lovell (1990).

Although most of the literature dealing with bank efficiency has focused on American banks, there is a fairly wide consensus that X-efficiency differences across banks are relatively larger and tend to dominate scale and scope efficiency.[3] In other words, X-efficiency differences among banks account for the most part of the difference in their performance. In this paper, I will attempt to measure the X-efficiency of eight Kuwaiti banks using a stochastic cost frontier model. Focus will be placed on technical efficiency. Other forms of efficiencies in the case of Kuwaiti banks are left as areas for future research.

3.1. Measuring Banks' Technical Efficiency

In order to measure bank efficiency, I will use a stochastic cost frontier based on the concept of stochastic production frontier developed by Aigner et al. (1977) and Meeusen and van den Broeck (1977), and extended thereafter in different directions. Good reviews of the literature on stochastic production (cost) frontier and its use in measuring efficiency can be found, for instance, in Schmidt and Lovell (1979), Forsund et al. (1980), Schmidt (1986), Greene (1993), Battese and Coelli (1995) and Gstach (1998).

[3] See for instance, Berger et al. (1993a) and Berger and Humphrey (1991).

Stochastic frontier analysis has several advantages over other methods for estimating the frontier. The most important advantage in comparison with deterministic methods is that the stochastic approach takes into account the fact that deviation from the frontier could be due to a noise in the data or mis-specification errors and not necessarily to inefficiencies.

Cost frontier analysis has been increasingly used to measure bank efficiency. In this paper, I use a Cobb-Douglas cost frontier model to measure technical efficiency in Kuwaiti banks. The specification of the frontier is given as follows:

$$LnC_{it} = \beta_0 + \beta_1 LnY_{it} + \beta_2 LnW_{1it} + \beta_3 LnW_{2it} + \beta_4 LnW_{3it} + U_{it} + V_{it} \qquad (1)$$

where the subscripts i and t refer to the i^{th} bank and t^{th} period; LnC is the logarithm of the total cost; the V_{it}'s are random variables assumed to be independent and identically distributed with $N(0,\sigma_v^2)$ and independent of the U_{it}'s; U_{it}'s are non-negative random variables associated with cost inefficiency and distributed as truncated normal distributions $N(m_{it},\sigma_u^2)$; the rest of the right hand-side variables are the logarithms of the levels of output and input prices, respectively.

In the estimation process, the variances of the error terms in model (1) are reparameterized and expressed in terms of $\sigma^2 = \sigma_u^2 + \sigma_v^2$ and $\gamma = \sigma_u^2 / \sigma_u^2 + \sigma_v^2$.

In order to model inefficiency, I use the following auxiliary model:

$$U_{it} = Z_{it}\delta = \delta_0 + \delta_1 z_{1it} + \delta_2 z_{2it} + \delta_3 z_{3it} + W_{it} \qquad (2)$$

where W_{it} is the random variable defined by the truncation of the normal distribution of the efficiency error term with zero mean and truncated at $-Z_{it}\delta$; z1=total assets; z2=equity to assets ratio and z3=rate of return on assets.

The inclusion of total assets is intended to test the validity of the claim frequently found in the literature that larger banks tend to be more efficient. The equity to assets ratio is included to test whether the structure of capital affect bank efficiency. In principle, holding other things constant, higher values of this ratio should be associated with lower values of inefficiency and vice versa. The rate of return on assets as a profitability measure is included to test whether efficiency is correlated with profitability.

The estimation of models (1) and (2) is performed simultaneously using the iterative maximum likelihood procedure described in Coelli (1996) using the software developed by the same author.

The measure of inefficiency for any bank at any given time is given by:

$$INEFF_{it} = Exp(U_{it}) = Exp(Z_{it}\delta + W_{it}) \qquad (3)$$

The amount by which INEFF exceeds one is a measure of technical inefficiency.

Equivalently, the inverse of INEFF, which is less than or equal to one, could be used as a measure of efficiency. In this case, banks with scores closer to one are more efficient.

3.2 Data and Variables

The data used in the analysis were obtained for eight banks for the period 1994-1999 from various issues of the Financial Operating Report published by the research unit of the Institute of Banking Studies in Kuwait.

In order to measure technical efficiency of Kuwaiti banks, I adopt the intermediation approach to define bank output and input. According to this approach, banks in their role as financial intermediaries use capital, labor, deposits and other borrowed funds to produce earning assets.[4] For instance, Elyasiani and Mehdian (1990) give three advantages of the intermediation approach over other approaches. They argue that: a) it is more inclusive of the total banking cost as it does not exclude interest expenses on deposits and other liabilities; b) it appropriately categorizes deposits as inputs; and c) it has an edge over other definitions for data quality considerations.

In this paper, I consider one output: Y=earning assets; and three inputs: X1=fixed and unspecified assets; X2=number of bank employees; and X3=financial capital incorporating deposits, borrowings and any liabilities not classified under deposits or borrowings. The input prices W1, W2 and W3 are defined respectively as follows:

$$W1 = \frac{Operating\ \exp enses, depreciation\ and\ occupancy\ \exp enses}{X1}$$

$$W2 = \frac{Staff\ \exp enses}{X2}$$

$$W3 = \frac{Interest\ on\ deposits, debts\ and\ borrowings, provisions, fees\ and\ commissions}{X3}$$

[4] For a discussion and references on the debate over the definition of banking output see, for instance, Wang (2000), Cummins and Weiss (1998) and Mester (1994).

4. EMPIRICAL RESULTS

The parameter as well as efficiency estimates of models (1) and (2) are reported in tables 4 and 5, respectively. Table 4 reports the parameter estimates of the stochastic cost-frontier and inefficiency models. All estimates are significantly different from zero at the five percent level. The parameters of the cost function are holding the expected signs. The output coefficient in this function indicates the degree of scale economies. The point estimate of this coefficient is 1.07 and is insignificantly different from one. This indicates that banks in Kuwait operate on average at constant returns to scale making it difficult to obtain efficiency gains by increasing the scale of production. This result is strikingly similar to that obtained in many instances in the literature such as in Mester (1993, 1994).

The second half of table 4 reports the estimation results of model (2) linking the inefficiency measure to several characteristics of the Kuwaiti banks. The results seem to assert the positive (negative) link often found in the literature between bank size, measured by ASSETS, and the degree of technical efficiency (inefficiency). It is generally argued that larger banks tend to have a better managerial expertise that translates into better efficiency. The negative relation between inefficiency and the share of assets financed by shareholders, EQUAS, shows that, other things being equal, banks with greater contribution from, and possibly a wider base of, shareholders tend to be more efficient. This is in line with the predictions of moral hazard theory. Shareholders would apply stricter monitoring on banks management since the stakes are high. The negative sign of the ROA coefficient in the efficiency model means that higher inefficiency is correlated with lower profitability.

The estimate of γ is significantly different from zero indicating the presence of inefficiency in production. It also indicates that the proportion of the one-sided error component in the total variance of the error terms in model (1) is around 96 percent. Therefore, technical inefficiency is the main source of random error in the model.

Table 5 shows the efficiency scores, defined as the inverse of INEFF, of the eight banks included in the analysis for the period 1994-1999. Except for the largest two banks, NBK and GB, which operate very close to the cost frontier, there is much more room for improvement for the rest of the banks. The estimates show that banks such as BKME and KREB could save up to 14 percent in terms of fixed capital, labor and financial capital costs for producing the same levels of earning assets.

5. CONCLUSION

In this paper, I have used a stochastic frontier approach to estimate technical efficiency of Kuwaiti Banks. Using earning assets as output and fixed assets, labor and financial capital as inputs, I have found that banks produce earning assets at constant returns to scale and hence have less to gain from increasing scale of production notably, through merging with other banks, than from reducing their technical inefficiency. Except for the largest two banks, NBK and GB, there is large room for improving technical efficiency of most of the banks. Therefore, the only way to better meet the challenge of increased competitive pressure from more powerful banks and future foreign entry would be to increase technical efficiency.

In order to account for differences in technical inefficiency between banks, I have linked the adopted measure of inefficiency to some relevant variables. The results show that larger bank size, higher share of equity capital in assets and greater profitability are associated with better efficiency. Although these results provide information on correlation rather than causality, the links between inefficiency and the rest of the variables are quite informative from a policy perspective. To the extent that larger size is a good proxy for better management, banks ought to appoint professional bankers and managers in order to adopt the appropriate policies leading to a better use of their resources. De-linking management from ownership in the case of Kuwaiti banks is a good step in that direction. Continuous development of human resources through training is also necessary in order to keep up with the productivity-improving, cost-saving and rapid changes in techniques, financial instruments and technological developments in banking. On the other hand, enlarging the share of equity in total assets and broadening the base of ownership is another step toward improving bank efficiency. Finally, privatization could improve corporate governance and lead to better efficiency through lower intermediation margins and spreads and a wider range of services.

In this paper, I have not attempted to address the determinants of bank efficiency other than the characteristics of the banks themselves. The external environment in which the banks operate in Kuwait is also an important factor affecting their performance. The impact of excessive government intervention in the economy in general and in the banking sector in particular in the form of administrative control, subsidized loans, equity injections and bail-outs on efficiency and performance of the banking sector, is a research avenue worth pursuing in that regard.

In addition, given that banks are multi-output firms, the definition of output followed in this paper could be extended and disaggregated to take into account the variety of services and earning assets produced by banks. In this case scope efficiency, could be assessed along with other forms of efficiencies.

Finally, the stochastic frontier analysis used in this paper could be combined with an array of alternative methods of estimating the frontier.[5] This should testify to the robustness of the results against alternative estimation methods.

[5] For a typology of alternative methods of measuring technical efficiency see for instance, Coelli and Perelman (1999), Gstach (1998), Fare et al. (1993) and the other references cited in this paper.

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APPENDIX

Table 1
Kuwaiti Banks Classified By Size
(Yearly Averages over the Period 1994-1999, in million of Kuwaiti Dinars)

Bank (Date of Establishment)	Assets	Deposits	Loans
National Bank of Kuwait (NBK) 1952	3918.4	3379.9	1399.9
Gulf Bank (GB) 1960	1637.2	1415.0	546.3
Commercial Bank of Kuwait (CBK)1960	1236.2	1015.0	368.9
Al-Ahli Bank of Kuwait (ABK) 1967	1185.7	1013.2	364.5
Burgan Bank (BB) 1976	1031.4	861.9	312.9
Bank of Kuwait and the Middle East (BKME) 1971	907.1	786.3	285.8
Kuwait Real Estate Bank (KREB) 1973	422.2	283.4	235.0
Industrial Bank of Kuwait (IBK) 1973	350.2	74.9	66.0

Source: Computed by author based on various issues of the financial Operating Reports published by the Research Unit of the Institute of Banking Studies-Kuwait.

Table 2
Structural and Profitability Measures of Kuwaiti Banks
(Yearly over the Period 1994-1999)

Bank	Equity/Assets (%)	Liability/Assets (%)	ROA (%)	ROE (%)
NBK	9.9	90.1	1.8	18.3
GB	10.8	89.2	1.7	15.8
CBK	12.0	88.1	0.9	7.0
ABK	10.7	89.3	0.5	4.9
BB	14.4	85.6	0.8	5.4
BKME	11.1	88.9	0.8	6.8
KREB	18.3	81.7	1.1	5.7
IBK	25.7	74.3	3.3	13.0

Source: Same as above.

Table 3
Financial Position of Kuwaiti Banks
(Average % Shares of Assets Components over the Period 1994-1999)

Bank	Liquid Assets	Loans	Investment	Government Debt Bonds	Fixed Assets
NBK	33.5	35.7	17.1	11.0	2.7
GB	32.8	32.9	11.2	22.1	1.0
CBK	21.3	28.8	10.8	37.4	1.7
ABK	12.3	30.6	10.4	44.0	2.8
BB	24.6	29.4	14.2	27.8	3.9
BKME	13.7	31.4	18.3	34.7	1.9
KREB	11.9	52.3	13.3	20.3	2.2
IBK	33.4	18.7	18.8	26.0	3.1

Source: Same as above.

Table 4
Stochastic Cost-Frontier and Inefficiency Models
(Maximum Likelihood Estimates)

Variable	Coefficient	t-ratio
Dependent Variable: Ln(cost)		
Constant	-0.60	-6.83
Ln(Y)	1.07	200.62
Ln(W1)	0.03	3.60
Ln(W2)	0.10	6.47
Ln(W3)	0.81	77.20
Dependent Variable: Ineff		
Constant	0.28	9.68
Assets	-0.01E-2	-7.95
Equas	-0.36E-2	-2.42
ROA	-0.02	-3.93
Sigma-squared	0.06E-2	3.96
Gamma	0.96	51.81

Table 5
Efficiency Measures of Kuwaiti Banks
$(INEFF)^{-1}$

BANK	1994	1995	1996	1997	1998	1999	Average
ABK	0.861	0.883	0.886	0.893	0.891	0.897	0.885
BKME	0.839	0.864	0.856	0.887	0.899	0.859	0.867
BB	0.855	0.876	0.881	0.918	0.888	0.867	0.881
CBK	0.870	0.842	0.935	0.942	0.911	0.926	0.904
GB	0.977	0.973	0.979	0.987	0.981	0.989	0.981
NBK	0.999	0.997	0.996	0.997	0.998	0.997	0.997
KREB	0.873	0.864	0.861	0.875	0.840	0.867	0.863
IBK	0.840	0.863	0.900	0.911	0.976	0.956	0.908