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Efficiency effect of direct lending controls: an empirical study of the Gulf Cooperation Council countries

Abstract

Managing assets and liabilities of banks requires giving adequate attention to profitability, risk, and liquidity. Hence, should the central bank attempt to regulate the quantity of bank loans by means of direct control? The current study is an attempt to provide a systematic, quantitative measure of the efficiency effect of direct lending controls in the commercial banking industry of the Gulf region. This issue is relevant and timely since it is expected that central banks in the Gulf region may follow the central bank of Kuwait in introducing new financial measures to control lending. Moreover, the use of the general composite model and utilization of the deterministic and the stochastic functions make this analysis the most complete and sophisticated testing available for researching the impact of direct lending controls. The empirical findings confirm the necessity of direct lending controls to ensure the efficient functioning of the banking sector in the Gulf region. The results suggest that banks that have loans-to-deposits ratios greater than 80% sacrifice approximately 46% of their technically efficiency as a result of reaching the point of diminishing returns on loan accounts.

Keywords: central banks and loans; bank safety; optimal bank management; asset liability and banking; debt equity and banking; asset liability and liquidity; capital structure and risk.
JEL Classification: G3.

Introduction

As profit-maximizing firms, commercial banks can increase profits by investing more of their asset portfolios in higher-yielding but riskier investments or loans. However, higher profits must not be achieved at the expense of bank safety. Bank safety means maintaining the bank as a going concern or staying in business. Accordingly, optimal bank management is a continuous struggle of maintaining a balance between liquidity, profitability and risk. Banks need liquidity because such a large portion of their liabilities are payable on demand, but typically as an asset becomes more liquid, it has a lower yield. Therefore, the decision to choose one combination of assets over another, given the liability size and capital accounts of a bank, would have a direct and significant effect on bank profitability, liquidity, and risk.

Additionally, bank regulators are concerned about bank safety. If the bank's management actions are not consistent with what the regulators believe to be prudent practices, they may intervene in the management, or in an extreme case, revoke the bank's license. Hence, should commercial bank asset liability composition be used as only indicator of macroeconomic and monetary trends, or should it also be an instrument of central bank policy? In particular, should the central bank attempt to control the quantity of bank loans by means of direct control? This is the question addressed in this paper. This question is relevant and timely since it is expected that central banks in the Gulf region will follow the central bank of Kuwait in introducing new financial measures to control lending. Obviously, this issue is not only empirically interesting, but it also has profound policy implications.

The paper is organized as follows. The literature review and information about how this paper contributes to the body of research are presented in Section 1. The background of GCC economies is presented in Section 2. The econometric methodology used is described in Section 3. A discussion of the data and variables employd is presented in Section 4 followed by Section 5 where empirical findings are reported. The summary and conclusion are presented in the last section.

1. Literature review

The aggregate efficacy of controls on lenders and a broad range of questions relating to whether banks should employ selective credit policy have been examined with renewed interest in the last two decades. Good introductions to this topic are provided by Hodgman (1972) and Kaminow and O'Brien (1975). Lending control has received more than academic interest in the United States. U.S. public law 91-151 (Credit Control Act of 1969), described by Hodgman (1972, p. 343), gives the Federal Reserve Board sweeping power to control bank loans when the president authorizes it to do so. It should be noted that "all financial programs supported by the International Monetary Fund have included control over credit expansion by domestic banks by means of credit ceilings" (Brau, 1971, p. 473). The U.K., among other developed countries, has had extensive experience with direct control of bank lending. Recently, the central bank of Kuwait enforced some financial directives aimed at restricting lending. Other central banks in the Gulf Cooperation

Council (GCC) countries are expected to follow. Those regulations and directives were used as microeconomic tools to stabilize the economy and/or as a means to ensure the proper functioning of the financial sector.

Operational decisions concerning bank liquidity also have a significant impact on the proper functioning of financial institutions. Bank liquidity refers to the bank's ability to accommodate deposit withdrawals and pay off other liabilities as they become due. Under normal conditions and with appropriate planning, net deposit withdrawals or the exercise of loan commitments poses few liquidity problems for banks because borrowed funds availability or excess cash reserves are adequate to meet anticipated needs. Major liquidity problems can arise, however, if deposit drains are abnormally large and unexpected. Moreover, a widening financial gap[1] can warn of future liquidity problems for a bank since it may indicate increased deposit withdrawals and increasing loans due to the greater exercise of loan commitments. A bank manager facing this situation has two options: (1) to utilize the bank's liquid assets account, and (2) to resort to money market borrowings if the liquid assets account is insufficient to offset the financial gap. If a bank borrows often, sophisticated lenders in the money market may be concerned about the bank's creditworthiness. They react by imposing higher risk premiums on borrowed funds or establishing stricter credit limits by not rolling over funds loaned to the bank. If the bank's financing requirements dramatically exceed such limits, it may become technically insolvent[2].

Most of the previous empirical work in this area has addressed the macro economic impact of credit controls. Studies in this area by Anderson (1969) and Silber (1969) analyzed the effectiveness of lending control on countercyclical policy. They presented alternative tests that support the view that bank loans are associated with a higher income velocity of money than non-loan bank assets. Anderson regressed GNP on loan money and bill money, where loan money is bank loans and bill money is bank-held Treasury bills. He found the estimated coefficient of the loan money variable to be positive, significant, and consistently larger than that of the bill money variable. Silber regressed velocity on an interest rate and several measures of bank portfolio composition, including the ratios of commercial and industrial loans to total assets, total loans to total assets, and government bond holdings to total assets. The loan variables showed a positive and significant relationship with velocity, while the government bond variable reflected a negative and significant relationship. He concluded that these results suggest that bank portfolio composition is a determinant of velocity. Both Anderson and Silber indicated that their empirical results suggest that direct control of bank loans may be an effective instrument of countercyclical policy.

In contrast to many previous empirical studies involving the macroeconomic impact of loan controls on countercyclical policy, this paper adds to the existing literature and circumvents the limitations of previous empirical tests in the following ways. First the study examines the impact of lending controls on the efficient allocation of banks' financial resources. Thus, the study investigates the impact of lending controls at the industry level. Second, this empirical study provides comprehensive quantitative and more relevant measures of the impact of lending controls than previously estimated. This is because the study employs the most recent advancements in efficiency estimation. It analyzes the efficiency effect of lending controls by estimating a production function representing optimal output levels given input use. In addition, it measures economic performance using the productive efficiency of reaching optimal output levels. Accordingly, technical efficiency is derived from frontier functions utilizing the general composite indirect profit function. Consequently, technical inefficiency arises when the observed inputs exceed the minimum inputs required to produce the scale-efficient output with the cost-minimizing input ratio. The general model is used in Berger, Humphrey, and Pulley (1996) and Humphrey and Pulley (1997). Third, to the best of our knowledge, this is the first empirical test on the impact of lending controls on efficiency in the commercial banking industry. Thus, the present study has been motivated by the empirical nature of the issue at hand. The article attempts to establish the relationship between lending controls and efficiency utilizing financial data from 58 commercial banks across 6 emerging markets in the Gulf Cooperation Council countries.

2. Background on the GCC economies

The Gulf Cooperation Council (GCC) was established in 1981 as an economic block and also as a means for political and military collaborations. The GCC block is composed of six oil-rich Arab countries: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia,

[1] Financing gap is the difference between a bank's average loans and average (Core) deposits. Core deposits are those that are stable over short periods of time and act as long-term sources of funds.

[2] Technical insolvency occurs when a bank is unable to pay its liabilities as they become due. When a bank is technically insolvent, its assets are still greater that its liabilities, but it is confronted with a liquidity crisis. If some of its assets can be converted into cash within a reasonable period, the bank may be able to escape complete failure.

and the United Arab Emirates (U.A.E). Saudi Arabia has the largest GDP (315.760 in billions of U.S. dollars) and Bahrain has the smallest GDP (13.377 in billions of U.S. dollars). The largest banking sector is found in Saudi Arabia (167.890 in billions of U.S. dollars), while Oman has the smallest banking sector (12.706 in billions of U.S. dollars; see Table 1). There are large similarities between the GCC economies. These economies are characterized by a large share of oil production and dependency on oil exports. The six member countries had a combined gross domestic product of 750.215 in billions of U.S. dollars in 2005. The combined size of the financial industry in the GCC countries was 519.697 in billions of U.S. dollars in 2005. Consequently, the total invested assets in the financial sector equals approximately 70% of the combined GDP in the GCC countries (Table 1).

Driven by relatively high dependency on non-renewable oil revenues, all GCC countries are aiming to diversify their economies. The financial sector is considered to be one of the most economically viable diversification options. Hence, decision makers in these countries are aiming to transform their economies into international financial and trade centers. Thus, employing appropriate economic and financial policies to improve the efficiency of the financial sector is considered a prime objective of the GCC countries.

3. Methodology

The work on analyzing productive efficiency dates back to Farrel (1957). Over time, two broad approaches have been used in production frontier estimations: deterministic methods and stochastic techniques. The Aigner and Chu (1968) deterministic frontier is estimated by minimizing the sum of the residuals. Under the assumption that all measurement errors are negligible, the one sided error term strictly captures technical inefficiency differences and is computed from the vector of residuals. The main advantage of the deterministic method is that few or no restrictions are imposed on the production technology, but the disadvantage is the inability to disentangle white noise from the inefficiency measures. In the stochastic method technique, random shocks are incorporated that account for some of the deviations from the production frontier. Following Aigner et al. (1977), Huang (1984), and Battese and Coelli (1992, 1995), the error term is assumed to be normally distributed, while only one part of the error may actually be deterministic, and the other part of the error may be truly stochastic. The error term may be of the form $e = u + v$, where u is a one-sided disturbance term representing the degree of technical inefficiency, and v is a symmetric, normally distributed random influence. Both measures of inefficiency are estimated, and comparative results are provided.

This empirical study estimates the general composite indirect profit function of Pulley and Braunstein (1992) and Pulley and Humphrey (1993). This method is also adopted by Berger, Humphrey, and Pulley (1996), Humphrey and Pulley (1997), and Al-Obaidan (1999). The advantage of using the general composite indirect profit function is that it does not restrict the values of the elasticity of substitution at any point in input space. Moreover, separability is not imposed.

The general composite indirect profit function combines a quadratic structure for output (γ) with a log quadratic structure for input prices (r). The general model is:

$$\pi^{(\phi)} = \{[\alpha_0 + \sum \alpha_i y_i + \frac{1}{2}\sum\sum \alpha_{ij} y_i y_j + \sum\sum \delta_{ik} y_i \ln r_k] \cdot$$

$$\cdot \exp[\sum \beta_k \ln r_k + \frac{1}{2}\sum\sum \beta_k \cdot l \cdot \ln r_k \cdot \ln \eta]\}^{(\phi)} + u$$

where (π) represents profits and the superscript (ϕ) refers to the Box-Cox transformation and represents an application of the "transform-both-sides" approach of Carroll and Rupert (1984, 1988) to increase the flexibility of the model. Moreover, α, β, δ are parameters. Separability is not imposed since the output quantity and the input price structures are linked through interaction terms. For more detail, see Berger, Humphrey, and Pulley (1996), and Humphrey and Pulley (1997).

The right-hand side of Equation 1 contains (γ_i , γ_i , r_k). These factors represent a bank's resources. The non-negative u term that depicts the deviation from the optimal (best practice) outcome is assumed to be independently distributed from the factor of resources employed by the bank. Hence, technical inefficiency is the loss of profit to netputs falling short of the desired levels-inputs (too large) or output (too small). Accordingly, the effect of an increase in the productivity of the resources mentioned on the right-hand side of Equation 1 depends on how they are utilized in the bank. For equal rates of used resources, banks that adopt appropriate loans to total deposits ratio will enhance the productivity of their resources. One or more of the banks described by the general composite indirect profit function above will have values of output greater than other banks with similar values of utilized resources. These banks are the most technically efficient at transforming inputs into output. Designate the efficient bank as $_{\pi}^{*}$, the efficiency frontier. Banks can be compared to the efficiency frontier, and a measure of technical efficiency (TE) is defined as TE = π /π*, with 0 < TE ≤ 1. For more details, see Berger, Hancock, and Humphrey (1993).

4. Data and variables

The cross-country and time-series data employed in this study come from the *GCC Banks: Financial Report* published by the Research Unit of the Institute of Banking Studies (Kuwait). This report provides financial data (in millions of U.S. dollars) on liquid assets, investments, loans, fixed assets, other assets, total assets, deposits, debts/borrowings, other liabilities, external liabilities, equity, and net income (see Table 2).

Commercial banks in the sample differ in the composition of their adopted asset and liabilities. Since the aim of this study is to analyze the impact of lending controls on banks' efficiency, the asset and liability composition of the banks' financial resources must be measured. This is accomplished by defining and introducing the following variables into the empirical analysis (all calculations expressed in U.S. dollars):

1. Loans-to-Deposits Ratio – A bank's total loans / total deposits.
2. Liquidity Ratio – A bank's total liquid assets / total deposits.

Clearly, a total deposits account (classified as external liabilities) consists of deposits obtained by the bank from individual customers, other banks, other organizations and agencies, and other certificates of deposits. A loan account (classified as an asset) includes all types of loans, advances, discounts, and overdrafts provided to others by the bank. The loans-to-deposits ratio reflects the loans and advances given as a percentage of deposits in the bank. Obviously, the higher the loans ratio, the higher the proportion of components in the loan account relative to the bank's total deposits. Moreover, a liquid assets account includes cash on hand and readily available bank balances such as demand deposits, current account balances (cash and equivalent), and other assets that can be quickly converted into cash. The liquidity ratio represents the liquid assets of a bank as a percentage of total deposits obtained by the bank. Logically, the higher the liquidity ratio, the higher is the proportion of components in a liquid assets account relative to the bank's total deposits.

Many decision-makers and central bank governors in the Gulf region believe that some control on loans provided by commercial banks ensures proper functioning of the banking sector. A good example is the recent adoption of a restrictive financial directive by the central bank of Kuwait that aims to control lending. This restriction requires commercial banks to maintain a loans-to-deposits ratio not less than 80%. Hence, this indicator is utilized to analyze the impact of lending controls on banks' efficiency. Consequently, loans-to-deposits ratios greater than 80% are considered to be relatively high ratios.

All of the empirical relationships presented below were estimated using the most recent and complete financial data from commercial banks in the GCC countries. Accordingly, the study utilized a pooled cross-section and time-series data sample for the period of 1996-2005 (see Table 3). The sample included 58 commercial banks and 510 observations. Approximately 28% of the observations involve high loans-to-deposits ratios, and approximately 72% of the observations involve moderate loans-to-deposits ratios (a ratio that is less than or equal to 80%). Naturally, during the study period, a small number of recently opened commercial banks were added to the sample.

5. Empirical results

The frontier function criterion is utilized in this study. This criterion associates the output of a firm with its inputs. The calculated economic efficiencies are measured in terms of deviations from the best performance in a representative peer group. Thus, economic performance is evaluated on a relative rather than an absolute basis (see the functional specification section presented in Section 3 of this paper).

The estimated general composite model functions applicable to the deterministic frontier and the stochastic frontier appear in Table 4. The general model assumes that banks produce two categories of financial services. The first category (γ_1) contains payment liquidity and safekeeping, and is measured by the value of the core deposits (demand deposits plus savings and time deposits in millions of U.S. dollars). The second category (γ_2) includes all types of loans, advances, discounts, and overdrafts in millions of U.S. dollars provided to others by the bank. A proxy of "other assets" is also included in the general model. The factor includes various forms of assets other than liquid assets, investments and deposits, loans, and fixed assets in millions of U.S. dollars. Three input prices are specified. First, the input price of labor (r_1) is measured by the number of employees. Second, following Berger et al. (1996), a proxy of the price of the funds' input (r_2) is measured by core deposits plus debts/borrowings and other liabilities in millions of U.S. dollars. Third, the price of the physical capital (r_3) is measured by the book value of the physical assets in millions of U.S. dollars. Finally, net income (π) in millions of U.S. dollars is used as a measure of profits. The test statistics suggest that the estimated general composite function is statistically highly significant.

The frontier functions in Table 4 are the basis for the estimates of technical efficiency. Technical efficiency is the dependent variable in the test of the efficiency effect of lending controls in Table 5. The independent variable in Table 5 is a dummy variable that represents the lending controls factor. The dummy variable is equal to unity (1) for banks that have moderate loans-to-deposits ratios (loans-to-deposits ratios equal to or less than 80%), and (0) for banks that have high loans-to-deposits ratios (loans-to-deposits ratios greater than 80%). The lending controls coefficients for both the deterministic and the stochastic frontiers in Table 5 are positive and statistically significant at the 1% level.

The empirical results confirm the correlation between lending controls and technical efficiency in the commercial banking industry of GCC emerging markets. The results suggest that technical efficiency is 0.110 points higher for banks that have moderate loans-to-deposits ratios than banks that have high loans-to-deposits ratios for the deterministic frontier and 0.107 higher for the stochastic frontier. A comparison of the average technical efficiency of the banks that have high loans-to-deposits ratios with banks that have moderate loans-to-deposits ratios reveals that banks that have moderate loans-to-deposits ratios are approximately 146% as technically efficient as banks that have high loans-to-deposits ratios [(0.234 + 0.110)/(0.234) * 100 = 147%; (0.235 + 0.107)/(0.235) = 145%]. Alternatively, all other things being equal, firms in the banking industry sacrifice approximately 46% of their technical efficiency as a result of reaching the point of diminishing returns on loans accounts.

The results clearly demonstrate that banks that have loans-to-deposits ratios greater than 80% incur additional expenses, which in turn significantly reduces their returns on loan accounts. The liquidity test provides a partial explanation of such expenses. Liquid assets-to-deposits ratio is the dependent variable in the liquidity test in Table 6. Again, the independent variable in Table 6 is a dummy variable that represents the lending controls factor. The dummy variable is equal to unity (1) for banks that have moderate loans-to-deposits ratios (loans-to-deposits ratios equal to or less than 80%), and (0) for banks the have high loans-to-deposits ratios (loans-to-deposits ratios greater than 80%). The lending controls coefficient in Table 6 is negative and statistically significant at the 1% level. The empirical results suggest that the liquidity ratio is 0.021 points lower for banks that have moderate loans-to-deposits ratios than those having high loans-to-deposits ratios. A comparison of the average liquidity ratio of banks that have high loans-to-deposits ratios with banks that have moderate loans-to-deposits ratios reveals that banks that have moderate loan ratios are approximately 84% as liquid as banks that have high loan ratios [(0.128 - 0.021)/(0.128) * 100 = 84%]. Alternatively, all other things being equal, firms that have high loans-to-deposits ratios in the banking industry allocate approximately 16% more of their financial resources to the liquid assets account than banks with moderate loans-to-deposits ratios. Typically, an asset becomes more liquid the less it yields. Consequently, banks that have loans-to-deposits ratios greater than 80% incur additional expenses, which in turn significantly reduce their returns on loan accounts.

There is an explanation for the allocation of proportionately more financial resources to liquid assets accounts by banks that have high loans-to- deposits ratios. Banks that have high loan ratios also have a high propensity to take extra precautionary measures to counter the potential of developing financial gaps. By and large, the financial gap may in turn lead to technical insolvency.

Summary and conclusion

A vital issue in strategic bank planning is assets and liabilities management. The management of both assets and liabilities of banks requires that adequate attention be given to profitability, risk, and liquidity. As profit-maximizing firms, commercial banks can increase profits by investing more of their asset portfolios in higher-yielding but riskier investments or loans. However, higher profits must not be achieved at the expense of bank safety.

Accordingly, asset and liability managers must strike a balance in their handling of these key but conflicting bank objectives. Questions arise about whether commercial bank asset liability composition should be used as only indicator of macroeconomic and monetary trends or whether it should be an instrument of central bank policy as well. In particular, should the central bank attempt to control the quantity of bank loans by means of direct control? The empirical findings confirm the necessity of direct lending controls to ensure the efficient functioning of the banking sector in the Gulf region. The results suggest that banks that have loans-to-deposits ratios greater than 80% sacrifice approximately 46% of their technical efficiency when they reach the point of diminishing returns on loan accounts.

The empirical results found here support the view that lending controls affect the economic efficiency of commercial banks. This study provides some insight for legislators and regulators on the issue of

economic efficiency and lending controls. The results presented are particularly important, given the growing trend of adopting new financial directives to control lending in the Gulf region. The study suggests that the adopted assets liability measures must be designed with the caveat that employing inappropriate loans-to-deposits ratios could lead to operational inefficiencies in the form of technical inefficiency.

Finally, to our knowledge, this is the first empirical study that presents systematic and comprehensive empirical estimates of the impact of lending controls on economic efficiency at the industry level in the commercial banking industry. Therefore, we close with the suggestion that the empirical results of this study should be compared with fundings obtained in future research that utilizes samples of banks from other developed and emerging markets.

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Appendix

Table 1. Comparative economic and financial data for the Gulf Cooperation Council countries, 2005

Country	Gross domestic product*[a]	Total assets* of banks	Total assets* of Islamic financial institutions
Bahrain	13,377	64,408	6,216
Kuwait	80,780	61,250	17,156
Oman	30,835	12,706	0.000
Qatar	42,463	25,726	4,364
Saudi Arabia	315,760	167,890	25,375
United Arab Emirates	133,000	114,112	20,492
GCC	750,215	446,094	73,603

Note: * numbers are in millions of U.S. dollars. [a] Gross domestic product in current prices.
Sources: Commercial banks and financial institutions: Research Unit – Institute of Banking Studies (Kuwait); Gross domestic product: International Monetary Fund, World Economic Outlook Database, October 2007.

Table 2. Selected comparative financial data for the combined GCC banks, 2005

Countries	Bahrain*	Kuwait*	Oman*	Qatar*	Saudi Arabia*	UAE*	All* GCC
Liquid assets	1,452.64	4,752.25	1,185.65	1,176.01	7,649.15	7,987.79	24,203.50
Investment	36,662.57	21,111.62	2,242.65	8,527.22	60,518.25	32,018.13	161,080.43
Loans	24,321.59	34,043.26	8,746.74	15,399.58	95,162.27	70,469.47	248,142.90
Fixed assets	372.10	624.92	93.28	268.40	1,405.07	749.90	3,513.67
Other assets	1,599.27	718.28	437.67	355.26	3,155.69	2,887.11	9,153.28
Total assets	64,408.17	61,250.32	12,705.99	25,726.47	167,890.43	114,112.39	446,093.78
Deposits	44,884.28	48,463.09	9,087.09	19,252.54	137,333.90	85,811	344,832.37
Debts/borrowings	10,834.62	2,575.68	924.42	604.95	3,519.34	7,170.59	25,648.61
Other liabilities	2,125.49	1,440.37	624.61	962.28	6,185.28	4,096.15	15,434.20
External liabilities	57,844.39	52,479.14	10,655.13	20,819.77	147,038.52	97,078.22	385,915.18
Share capital	3,278.06	2,390.81	833.62	816.05	7,470.33	4,539.40	19,328.27
Net income	6,563.78	8,771.18	2,050.87	4,906.69	20,851.91	17,034.17	60,178.60

Note: * numbers are in millions of U.S. dollars.
Source: Research unit – Institute of Banking Studies, 2005 (Kuwait).

Table 3. GCC commercial banks, 1996-2005

Number	Bank name	Country
1	Ahli United Bank	Bahrain
2	Arab Banking Corporation	Bahrain
3	Bahrain Saudi Bank	Bahrain
4	Bank of Bahrain and Kuwait	Bahrain
5	Gulf International Bank	Bahrain
6	National Bank of Bahrain	Bahrain
7	United Gulf Bank	Bahrain
8	Bahrain International Bank	Bahrain
9	Bahrain Middle East Bank	Bahrain
10	Al-Ahli Commercial Bank	Bahrain
11	Gulf Riyad Bank	Bahrain
12	AlAhli Bank of Kuwait	Kuwait
13	Bank of Kuwait and the Middle East	Kuwait
14	Burgan Bank	Kuwait
15	Commercial Bank of Kuwait	Kuwait
16	Gulf Bank	Kuwait
17	Kuwait Real Estate Bank	Kuwait
18	National Bank of Kuwait	Kuwait
19	Bank of Dhofar	Oman
20	Bank of Muscat	Oman
21	National Bank of Oman	Oman
22	Oman Arab Bank	Oman
23	Oman International Bank	Oman
24	Commercial Bank of Oman	Oman
25	Bank of Oman Bahrain and Kuwait	Oman
26	Ahli Bank	Qatar
27	Doha Bank	Qatar
28	Qatar National Bank	Qatar

Table 3 (cont.). GCC commercial banks, 1996-2005

Number	Bank name	Country
29	Commercial Bank of Qatar	Qatar
30	Arab National Bank	Saudi Arabia
31	Bank Al-Jazira	Saudi Arabia
32	Banque Saudi Fransi	Saudi Arabia
33	National Commercial Bank	Saudi Arabia
34	Riyad Bank	Saudi Arabia
35	Samba Finacial Group	Saudi Arabia
36	Saudi British Bank	Saudi Arabia
37	Saudi Holland Bank	Saudi Arabia
38	Saudi Investment Bank	Saudi Arabia
39	Saudi American Bank	Saudi Arabia
40	Saudi Cairo Bank	Saudi Arabia
41	Abu Dhabi Commercial Bank	United Arab Emirates
42	Arab Bank for Investment and Foreign Trade	United Arab Emirates
43	Bank of Sharjeh	United Arab Emirates
44	Commercial Bank of Dubai	United Arab Emirates
45	Commercial Bank International	United Arab Emirates
46	First Gulf Bank	United Arab Emirates
47	Invest Bank	United Arab Emirates
48	Mashreq Bank	United Arab Emirates
49	National Bank of Abu Dhabi	United Arab Emirates
50	Naitonal Bank of Dubai	United Arab Emirates
51	National Bank of Fujairah	United Arab Emirates
52	National Bank of Ras Al Khaimah	United Arab Emirates
53	National Bank of Sharja	United Arab Emirates
54	National Bank of Umm AlQaiwain	United Arab Emirates
55	Union National Bank	United Arab Emirates
56	United Arab Bank	United Arab Emirates
57	Emirates Bank International	United Arab Emirates
58	Middle East Bank	United Arab Emirates

Source: Research unit – Institute of Banking Studies, 2005 (Kuwait).

Table 4. Estimated frontiers utilizing the general composite model

Stochastic frontier	Deterministic frontier	Independent variables
23.067 (1.536)	26.07 (1.660)	Constant
-0.006 -(0.582)	-0.006 -(0.567)	Other assets
-0.082 -(0.336)	-0.647 -(5.344)	Deposits
-0.002 -(0.001)	0.984 (6.065)	Loans
1.70E-005 (2.111)	3.96E-005 (0.460)	Deposits2
5.72E-005 (2.376)	1.60E-005 (2.608)	Loans2
-0.001 -(2.334)	-4.62E-005 -(1.219)	Deposits x Loans
0.210 (5.588)	0.194 (5.115)	Deposits x Ln (P Labor)

Table 4. Estimated frontiers utilizing the general composite model

Stochastic frontier	Deterministic frontier	Independent variables
-0.174 -(2.734)	-0.010 -(0.691)	Deposits x Ln (P Interest)
0.015 (0.552)	0.020 (0.736)	Deposits x Ln (P Capital)
-0.247 -(4.583)	-0.206 -(3.901)	Loans x Ln (P Labor)
0.291 (2.644)	0.281 (2.598)	Loans x Ln (P Interest)
-0.091 -(2.308)	-0.097 (-2.390)	Loans x Ln (P Capital)
-7.700 -(2.295)	-12.668 -(4.453)	Ln (P Labor)
-0.455 -(0.100)	1.993 (0.444)	Ln (P Interest)
6.080 (3.228)	6.232 (3.233)	Ln (P Capital)
	0.800	Adj. R2
	134.991	F-value
133.403		Scale

Note: * the statistics in parentheses are t-values.

Table 5. Estimates of the efficiency effect of lending controls

Summary Dependent variable	Constant (t-statistics)	Lending controls (t-statistics)	F-value
Deterministic frontier			
TE	0.234 (14.357)	0.110 (5.696)	32.433
Stochastic frontier			
TE	0.235 (14.486)	0.107 (5.585)	31.192

Note: * the statistics in parentheses are t-values.

Table 6. Liquidity test

Summary Dependent variable	Constant (t-statistics)	Lending controls (t-statistics)	F-value
Liquid assets to deposits ratio	0.128 (17.996)	-0.021 (-2.540)	6.451

Note: * the statistics in parentheses are t-values.