Islam and Muslim Societies
– a social science journal

Measuring MENA Islamic Banks Efficiency: Does Country Income Level Have an Impact?

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Islamic banks today exist in all parts of the world, and are looked upon as a viable alternative system which has many things to offer. While it was initially developed to fulfill the needs of Muslims, Islamic banking has now gained universal acceptance. Islamic banking is recognized as one of the fastest growing areas in banking and finance. Since the opening of the first Islamic bank in Egypt in 1963, Islamic banking has grown rapidly all over the world. So in comparison, Islamic banking is relatively new phenomenon as the first Islamic bank, Mit Ghamr Local Savings Bank of Egypt, was only established in 1963. Even then, the real growth of Islamic finance did not begin until the 1980s when Middle East countries experienced a large growth in surplus funds. Since then Muslim investment has spread throughout Europe and Asia, and Islamic finance is still expanding. Direct Islamic financing methods, such as with Islamic bonds, are gaining popularity in the West as is Islamic based funds management.

The number of Islamic financial institutions worldwide has risen to over 300 today in more than 75 countries concentrated mainly in the Middle East and Southeast Asia (with Bahrain and Malaysia the biggest hubs), but are also appearing in Europe and the United States. The Islamic banking total assets worldwide are estimated to have exceed $250 billion and are growing at an estimated pace of 15 percent a year. Zaher and Hassan (2001) suggested that Islamic banks are set to control some 40-50 percent of Muslim savings by 2009/10. Saleh and Zeitun (2007) found that interesting development of Islamic banking globally. This sector has not only grown in the Muslim world, but has also gained significant attention in the Western world, with over 250 Islamic banks worldwide controlling approximately US$400 billion in assets and client money. The growth of these banks is proof of their success, and an indication that these banks continue to grow in number and size worldwide.

Islamic banking operations started out as a mere deposit taking and lending facility and has since transformed into all aspects of banking, money and capital market operations, including fully fledged stock exchanges. The Islamic resurgence in the late 1960's and 1970's, further intensified by the 1975 oil price boom, which introduced a huge amount of capital inflows to Islamic countries has initiated the call for a financial system that allows Muslim to transact in a system that is in line with their religious beliefs. Before the re-emergence of the Islamic financial system, Muslims throughout the world has only conventional financial system to fulfill their financial needs.

Islamic financial products are aimed at investors who want to comply with the Islamic laws (*syaria'*) that govern a Muslim's daily life. *Syaria'* law forbids the giving or receiving of *riba'*[1] (because

1 *Riba'* the English translation of which is *usury* is prohibited in Islam and is acknowledged by all Muslims. The prohibition of *riba'* is clearly mentioned in the Quran, the Islam's holy book and the traditions of Prophet Muhammad *(sunnah).* The Quran states: "Believers! Do not consume *riba',* doubling and redoubling…" (3.130); "God has made buying and selling lawful and *riba'* unlawful… (2:274).

earning profit from an exchange of money for money is considered immoral); mandate that all financial transactions be based on real economic activity; and prohibit investment in sectors such as tobacco, alcohol, gambling, and armaments. Despite that, Islamic financial institutions are providing an increasingly broad range of financial services, such as fund mobilization, asset allocation, payment and exchange settlement services, and risk transformation and mitigation.

Among other reasons which attributed to the rapid growth of the Islamic banking and finance industry are the growing oil wealth, with demand for suitable investments soaring in the Gulf region and the competitiveness of many of the products, attracting strong demand from Muslim and non-Muslim investors. Despite the growing interest and the rapid growth of the Islamic banking and finance industry, analysis of Islamic banking at a cross-country level is still at its infancy. This could partly be due to the unavailability of data, as most of the Islamic financial institutions are not publicly traded.

The aim of this paper is to fill a demanding gap in the literature by providing the empirical evidence on the performance of Islamic banks in 15 MENA countries during the period 2003 to 2009. The efficiency estimate of each Islamic bank is computed by using the non-parametric Data Envelopment Analysis (DEA) method. The method allows us to distinguish between three different types of efficiency measures, namely technical, pure technical, and scale. Unlike the previous analysis of Islamic bank efficiency, we have constructed and analyzed the results derived from dynamic panels, which is critical in a dynamic business environment as a bank may be the most efficient in one year but may not be in the following year (s). A dynamic panel analysis will also highlight any significant changes taking place in the Islamic banking sector during the period of study.

Since the countries of coverage are span across 15 countries, we will also study the efficiency result base on the Islamic bank country operated. The countries are diversified in term of the economy activity; we divided the classification by using 2003 Gross National Income (GNI) published by World Bank. According to 2003 GNI per capita, calculated using the *World Bank Atlas method*[2]. The income groups are: low income, $765 or less; middle income, $766 - $9,385 and high income, $9,386 or more.

Based on 2003 GNI report, some high income countries may also be developing countries. Our samples in the paper will include this particular country and study the differences of country background into the efficiency of it Islamic Banks. The GCC (Persian Gulf States) countries, for example, are classified as developing high income countries. This paper unfolds as follows. Section 2 provides an overview of the related studies in the literature, followed by a section that outlines the method used and choice of input and output variables for the efficiency model. Section 4 reports the empirical findings. Section 5 concludes and offers avenues for future research.

Review of Literature

2 Atlas conversion factor, Calculating gross national income (GNI—formerly referred to as GNP) and GNI per capita in U.S. dollars for certain operational purposes, the World Bank uses the Atlas conversion factor. The purpose of the Atlas conversion factor is to reduce the impact of exchange rate fluctuations in the cross-country comparison of national incomes.

While there has been extensive literature examining the efficiency features of the contemporary banking sector, particularly the U.S. and European banking markets, the work on Islamic banking is still in its infancy. Typically, studies on Islamic bank efficiency have focused on theoretical issues and the empirical work has relied mainly on the analysis of descriptive statistics rather than rigorous statistical estimation (El-Gamal and Inanoglu, 2004). However, this is gradually changing as a number of recent studies have sought to apply various frontier techniques to estimate the efficiency of Islamic banks.

Hassan and Hussein (2003) examined the efficiency of the Sudanese banking system during the period of 1992 and 2000. They employed a variety of parametric (cost and profit efficiencies) and non-parametric DEA techniques to a panel of 17 Sudanese banks. They found that the average cost and profit efficiencies under the parametric were 55% and 50% respectively, while it was 23% under the non-parametric approach. During the period of study, they found that the Sudanese banking system have exhibited 37% allocative efficiency and 60% technical efficiency, suggesting that the overall cost inefficiency of the Sudanese Islamic banks were mainly due to technical (managerially related) rather than allocative (regulatory).

Yudistira (2004), for example, with a global sample of 18 Islamic banks, found Islamic banks to be more efficient than conventional banks. In contrast, Hassan (2006) in a larger study of 43 Islamic banks found them somewhat less cost efficient than conventional banks. Mokhtar et al., (2006), similarly, in a study of Malaysian Islamic banks found that while Islamic banks had grown faster, their overall efficiency was lower than the conventional banks.

Saleh and Zeitun (2007) analyzed the performance and efficiency of Jordan Islamic Banks for 1998 to 2003 period. The contribution of the paper is the measures show the ability and the efficiency of both Islamic banks to increase their income and reduce expenses. Viverita et al. (2007), of their study of Islamic bank in Asia, Africa and Middle East found the average Middle East bank size was some US $2 billion with Asia Islamic banks averaging US $900 million and African banks just US $151 million. The other finding is the age of each bank was correlated against the various efficiency results. It could be expected that newer banks may have had a chance to implement newer technologies. In this case, technical efficiency results were not correlated with the bank's age.

Hussein (2003) provides an analysis of the cost efficiency features of Islamic banks in Sudan between 1990 and 2000. Using the stochastic cost frontier approach, he estimates cost efficiency for a sample of 17 banks over the period. The interesting contribution of this paper is that specific definitions of Islamic financial products are used as outputs. In addition, the analysis is also novel as Sudan has a banking system based entirely on Islamic banking principles. The results show large variations in the cost efficiency of Sudanese banks with the foreign owned banks being the most efficient. State owned banks are the most cost inefficient.

Samad (1999) was among the first to investigate the efficiency of the Malaysian Islamic banking sector. In his paper, he investigates the relative performance of the full-fledged Malaysian Islamic bank compared to its conventional bank peers. During the period of 1992 to 1996 he found that the managerial efficiency of the conventional banks was higher than that of the full-fledged Islamic bank. On the other hand, the measures of productive efficiency revealed mixed results. He suggests that the average utilization rate of the Islamic bank is lower than that of the conventional banks. Similarly, he found that

profits earned by the full-fledged Islamic bank either through the use of deposit or loan able funds, or used funds are also lower than the conventional banks, reflecting the weaker efficiency position of the full-fledged Islamic bank. In contrast, the productivity test by loan recovery criterion indicate that the efficiency position of the full-fledged Islamic bank seems to be higher and bad debts as a percentage of equity, loans, and deposits also show a clear superiority over the conventional bank peers.

More recently, (Sufian et al. 2008) examined the efficiency of the Malaysian Islamic banking sector during the period 2001-2006 by using the non-parametric Data Envelopment Analysis (DEA) method. The empirical findings suggest that during the period of study, pure technical inefficiency outweighs scale inefficiency in the Islamic banking sector implying that the Islamic banks have been managerially inefficient in exploiting their resources to the fullest extent. The empirical findings seem to suggest that the MENA Islamic banks have exhibited higher technical efficiency compared to their Asian Islamic banks counterparts. During the period of study he fined that pure technical inefficiency has greater influence in determining the total technical inefficiency of the MENA and the Asian Islamic banking sectors.

Methodology

A non-parametric Data Envelopment Analysis (DEA) is employed with variable return to scale assumption to measure input-oriented technical efficiency of MENA Islamic banking sectors. DEA involves constructing a non-parametric production frontier based on the actual input-output observations in the sample relative to which efficiency of each firm in the sample is measured (Coelli, 1996). Let us give a short description of the Data Envelopment Analysis[3]. Assume that there is data on K inputs and M outputs for each N bank. For ith bank these are represented by the vectors x_i and y_i respectively. Let us call the K x N input matrix – X and the M x N output matrix – Y. To measure the efficiency for each bank we calculate a ratio of all inputs, such as $(u'y_i/v'x_i)$ where u is an M x 1 vector of output weights and v is a K x 1 vector of input weights. To select optimal weights we specify the following mathematical programming problem:

$$\min_{u,v} (u'y_i / v'x_i),$$

$$u'y_i / v'x_i \leq 1, \quad j = 1, 2, \ldots, N,$$
$$u, v \geq 0 \qquad (1)$$

The above formulation has a problem of infinite solutions and therefore we impose the constraint $v'x_i = 1$, which leads to:

$$\min_{\mu,\varphi} (\mu'y_i),$$

$$\varphi'x_i = 1$$

3 Good reference books on efficiency measures are Thanassoulis (2001), Cooper et al. (2000), and Avkiran (2002).

$$\mu' y_i - \varphi' x_j \leq 0 \qquad j = 1, 2, \ldots, N,$$
$$\mu, \varphi \geq 0 \qquad (2)$$

where we change notation from u and v to μ and φ, respectively, in order to reflect transformations. Using the duality in linear programming, an equivalent envelopment form of this problem can be derived:

$$\min_{\theta, \lambda} \theta,$$
$$y_i + Y\lambda \geq 0$$
$$\theta x_i - X\lambda \geq 0$$
$$\lambda \geq 0 \qquad (3)$$

where θ is a scalar representing the value of the efficiency score for the ith decision-making unit which will range between 0 and 1. λ is a vector of N x 1 constants. The linear programming has to be solved N times, once for each decision-making unit in the sample. In order to calculate efficiency under the assumption of variable returns to scale, the convexity constraint ($N1'\lambda = 1$) will be added to ensure that an inefficient firm is only compared against firms of similar size, and therefore provides the basis for measuring economies of scale within the DEA concept. The convexity constraint determines how closely the production frontier envelops the observed input-output combinations and is not imposed in the constant returns to scale case. The variable returns to scale technique therefore forms a convex hull which envelops the data more tightly than the constant returns to scale, and thus provides efficiency scores that are greater than or equal to those obtained from the constant returns to scale model.

Data Sample, Inputs-Outputs Definition, and the Choice of Variables

It is commonly acknowledged that the choice of variables in efficiency studies significantly affects the results. The problem is compounded by the fact that variable selection is often constrained by the paucity of data on relevant variables. The cost and output measurements in banking are especially difficult because many of the financial services are jointly produced and prices are typically assigned to a bundle of financial services. Two approaches dominate the banking theory literature: the production and intermediation approaches (Sealey and Lindley, 1977).

Under the production approach, pioneered by Benston (1965), the banks are primarily viewed as providers of services to customers. The input set under this approach includes physical variables (e.g. labour, material) or their associated costs, since only physical inputs are needed to perform transactions, process financial documents, or provide counseling and advisory services to customers. The output under this approach represents the services provided to customers and is best measured by the number and type of transactions, documents processed or specialized services provided over a given time period. This approach has primarily been employed in studying the efficiency of bank branches.

Under the intermediation approach, financial institutions are viewed as intermediating funds between savers and investors. In our case, Islamic banks produce intermediation services through the

collection of deposits and other liabilities and in turn these funds are invested in productive sectors of the economy, yielding returns uncontaminated by usury (*riba'*). This approach regard deposits, labour and physical capital as inputs, while loans and investments are treated as output variables.

Following among others, Hassan (2005), and Sufian (2006), a variation of the intermediation approach or asset approach originally developed by Sealey and Lindley (1977) will be adopted in the definition of inputs and outputs used in this study. Furthermore, as at most times bank branches are engaged in the processing of customer documents and bank funding, the production approach might be more suitable for branch efficiency studies (Berger and Humphrey, 1997).

Due to entry and exit factor, the efficiency frontier is constructed by using an unbalanced sample of 44 Islamic banks operating in the World during the period 2003-2009 (see Appendix 1) yielding 167 bank year observations. We are able to collect data on three outputs and three inputs variables. Data for the empirical analysis is sourced from individual bank's annual balance sheet and income statements and BankScope database by IBCA. The BankScope database converts the data to common international standards to facilitate comparisons and all financial information is reported both in local currency and in US dollar. We use US dollar data which makes the comparison across country consistent. The Islamic banks are modeled as multi-product firms producing three outputs namely, *Total Loans* (*y1*), which include loans to customers and other banks, *Income* (*y2*), which include income derived from investment of depositors' funds and other income from Islamic banking operations, and *Other Earning Asset* (*y3*), which include investment securities held for trading, investment securities available for sale (AFS), and investment securities held to maturity, by engaging three inputs namely, *Total Deposits* (*x1*), which include deposits from customers and other banks, *Labor cost (X2)* and *Total Assets* (*x3*). All variables are measured in millions of US Dollars (US$) and are deflated against the respective countries inflation rates. For 2009, the data is same since only single bank available, this lead to no data for standard deviation.

Results

In this section, we will discuss the technical efficiency change (TE) of the MENA Islamic banking sectors, measured by the DEA method and its decomposition into pure technical efficiency (PTE) and scale efficiency (SE) components. In the event of the existence of scale inefficiency, we will attempt to provide evidence on the nature of the returns to scale of each Islamic bank. The Islamic banks' efficiency is examined for each year under investigation.

As suggested by Bauer et al. (1998), DeYoung and Hasan (1998), and Isik and Hassan (2002), constructing an annual frontier specific to each year is more flexible and thus more appropriate than estimating a single multiyear frontier for the banks in the sample. Following the earlier studies, for the purpose of the study, we prefer to estimate separate annual efficiency frontier for each year. In other words, there were six separate frontiers constructed for the study. Isik and Hassan (2002) contended that the principal advantage of having panel data is the ability to observe each bank more than once over a period of time. The issue is also critical in a continuously changing business environment because the technology of a bank that is most efficient in one period may not be the most efficient in another. Furthermore, by doing so, we alleviate, at least to an extent, the problems related to the lack of random

error in DEA by allowing an efficient bank in one period to be inefficient in another, assuming that the errors owing to luck or data problems are not consistent over time (Isik and Hassan, 2002).

Efficiency of the MENA Islamic Banking Sectors

Table 2 presents the results of the MENA Islamic banks. It is clear that the MENA Islamic banks' efficiency was on a declining trend from the years 2005 to 2008, increased in year 2004 and 2009. The results seem to suggest that the MENA Islamic banks have exhibited mean technical efficiency of 31.19%, suggesting mean input waste of 68.81%. This implies that the Islamic banks in the MENA countries could have produced the same amount of outputs by only using 31.19% of the amount of inputs it employed. From Table 3 it is also clear that pure technical inefficiency outweighs scale inefficiency in determining the total technical efficiency of the MENA Islamic banks during the period of study.

During the period of study, we find that banks from Saudi Arabia were the most efficient from the MENA region, exhibiting a mean efficiency score of 85.58, followed by banks from Kuwait and Qatar with a mean efficiency score of 84.84% and 78.18% respectively. The result is similar with Sufian et al 2008 finding which study during the period 2001-2006 with smaller sample size. He found that the most efficient start with Iran followed by Bahrain and Qatar. Our finding and this is consistent specifically for Qatar maintaining the top three efficient Islamic banks in MENA region.

Although that Kuwait and Qatar were categorized as high income country, it seem that it does not necessary that higher income country will led to efficiency level. Saudi Arabia that fall under middle income country was the most efficient during the study period. Base on the result, it stated majority of the efficiency bank over the years was dominating from high income country, namely Kuwait and Qatar in MENA banking sectors.

On the other hand, the results seem to suggest that the Gambia banking sector were the least efficient, recording a mean efficiency of 41.3%, followed by Palestine, and Sudan banks with a mean efficiency levels of 45.73% and 48.97% respectively. The result specifically for Sudan consistent with Sufian et al that found the last 3 non efficient were Kuwait, Yemen and Sudan. It is interesting to note that comparing with Sufian et al 2008 finding, Kuwait Islamic bank have climb to become top three efficient from the lowest level.

Composition of the Efficiency Frontier

While the results above highlight the sources of technical inefficiency of the Islamic banks, we next turn to discuss the sources of the scale inefficiency of the Islamic banks. As have been mentioned earlier, a bank can operate at CRS or VRS where CRS signifies that an increase in inputs results in a proportionate increase in outputs and VRS means a rise in inputs results in a disproportionate rise in outputs. Further, a bank operating at VRS can be at increasing returns to scale (IRS) or decreasing returns to scale (DRS). Hence, IRS means that an increase in inputs results in a higher increase in outputs, while DRS indicate that an increase in inputs results in lesser output increases.

To identify the nature of returns to scale, first the CRS scores (obtained with the CCR model) is compared with VRS (using BCC model) scores. For a given bank, if the VRS score equals to its CRS score, the bank is said to be operating at constant returns to scale (CRS). On the other hand, if the scores are not equal, a further step is needed to establish whether the bank is operating at IRS or DRS. To do this, the DEA model is used under the non-increasing returns to scale assumptions (NIRS). If the score under VRS equals the NIRS score, then the bank is said to be operating at DRS. Alternatively, if the score under VRS is different from the NIRS score, than the bank is said to be operating at IRS (Coelli et al., 1998).

During the period of study, there is four MENA Islamic banks seem to have leaded the efficiency frontier, while eighteen MENA Islamic banks have failed to appear at least once on the frontier. It is also clear from the results that four MENA Islamic banks namely, Arcapita Bank B.S.C of Bahrain, Qatar International Islamic Bank, Al Baraka Sudan and Shamil Bank, Bahrain were the MENA leaders by appearing the most times on the efficiency frontier.

In general, the table indicates that while the small banks tend to operate at CRS or IRS, the large banks tend to operate at CRS or DRS, the findings which are similar to the earlier studies by among others McAllister and McManus (1993) and Noulas et al. (1990). To recap, McAllister and McManus (1993) have suggested that while the small banks have generally exhibited IRS, the large banks on the other hand tend to exhibit DRS and at best CRS. As it appears, the small Islamic banks have experienced increasing returns to scale (IRS) in their operations during the period of the study. One implication is that for the small Islamic banks, a proportionate increase in inputs would result in more than a proportional increase in outputs. Hence, the small Islamic banks which have been operating at IRS could achieve significant cost savings and efficiency gains by increasing its scale of operations. In other words, substantial gains can be obtained from altering the scale via internal growth or further consolidation in the sector. In fact, in a perfectly competitive and contestable market, the efficient banks should absorb the scale inefficient banks, in order to exploit cost advantages. Thus, the banks that experience IRS should either eliminate their scale inefficiency or be ready to become a prime target for acquiring banks, which can create value from underperforming banks by streamlining their operations and eliminating their redundancies and inefficiencies (Evanoff and Israelvich, 1991). On the other hand, the results seem to suggest that further increase in size would only result in a smaller increase of outputs for every proportionate increase in inputs of the large banks, resulting from the fact that the large banks have been operating at declining returns to scale (DRS) during the period. Hence, decision-makers ought to be more cautious in promoting mergers among the large banks as a means to enjoying efficiency gains.

Conclusions and directions for future research

In this paper, we examine the performance of the MENA Islamic banks that consist of 15 Middle East and North Africa (MENA) countries namely Bahrain, Egypt, Gambia, Iran, Iraq, Jordan, Kuwait, Mauritania, Palestine, Saudi Arabia, Syria, United Arab Emirates, Qatar, Sudan and Yemen during the period of 2003-2009. The efficiency estimates of individual banks are evaluated using the non-parametric Data Envelopment Analysis (DEA) approach.

The empirical findings suggest that during the period of study, pure technical inefficiency outweighs scale inefficiency in the Islamic banking sector implying that the Islamic banks have been managerially inefficient in exploiting their resources to the fullest extent. The empirical findings seem to suggest that the MENA Islamic banks have exhibited high technical efficiency. During the period of study we find that pure technical inefficiency has greater influence in determining the total technical inefficiency of the MENA Islamic banking sectors. Furthermore, base on the result, it stated majority of the efficiency bank over the years was dominating from high income country, namely Kuwait and Qatar in MENA banking sectors. But it does not necessary that higher income country will lead to efficiency level. Saudi Arabia that fall under middle income country was the most efficient during the study period.

Due to its limitations, the paper could be extended in a variety of ways. Firstly, the scope of this study could be further extended to investigate changes in cost, allocative, and technical efficiencies over time. Secondly, it is suggested that further analysis into the investigation of the Islamic banking sector efficiency to consider risk exposure factors. Finally, future research into the efficiency of the Islamic banking sector efficiency could also consider the production function along with the intermediation function.

Despite these limitations, the findings of this study are expected to contribute significantly to the existing knowledge on the operating performance of the Islamic banking industry in the MENA countries. Nevertheless, the study have also provide further insight to bank specific management as well as the policymakers with regard to attaining optimal utilization of capacities, improvement in managerial expertise, efficient allocation of scarce resources and most productive scale of operation of the banks in the industry. This may also facilitate directions for sustainable competitiveness of Islamic banking operations in the future.

REFERENCES

Avkiran, N.K. (2002) *Productivity Analysis in the Service Sector with Data Envelopment Analysis*. Camira: N.K. Avkiran.

Batchelor and Wadud (2004) Technical and Scale Efficiency of Islamic Banking Operations in Malaysia: An Empirical Investigation with Longitudinal Perspective: *Labuan Bulletin of International Business & Finance 2(1), 2004, 51-69*

Benston, G.J. (1965) Branch Banking and Economies of Scale, *Journal of Finance* 20 (2), 312-331.

Bauer, P.W., Berger, A.N., Ferrier, G. D. and Humphrey, D.B. (1998), Consistency Conditions for Regulatory Analysis of Financial Institutions: A Comparison of Frontier Efficiency Methods, *Journal of Economics and Business* 50 (2), 85-114.

Berger, A.N. and Humphrey, D.B. (1997) Efficiency of Financial Institutions: International Survey and Directions for Future Research, *European Journal of Operational Research* 98 (2), 175-212.

Coelli, T. (1996) A Guide to DEAP Version 2.1: A Data Envelopment Analysis (Computer Program), *Working Paper*, CEPA, University of New England, Armidale.

Coelli, T., Rao, D.S.P. and Batesse, G.E. (1998) *An Introduction to Efficiency and Productivity Analysis*. Boston, MA: Kluwer Academic Publishers.

Cooper, W.W., Seiford, L. M. and Tone, K. (2000) *Data Envelopment Analysis.* Boston: Kluwer Academic Publishers.

DeYoung, R. and Hasan, I. (1998), The Performance of De Novo Commercial Banks: A Profit Efficiency Approach, *Journal of Banking and Finance* 22 (5), 565-587.

El-Gamal and Inanoglu (2004) Islamic Banking in Turkey: Boon or Bane for the Financial Sector, *Proceedings of the Fifth Harvard University Forum on Islamic Finance*, Cambridge: Center for Middle Eastern Studies, Harvard University.

Evanoff. D.D. and Israelvich, P.R. (1991) Productive Efficiency in Banking, *Economic Perspectives* Federal Reserve Bank of Chicago (July/August), 11-32.

Hassan, M.K. (2005) The Cost, Profit and X-Efficiency of Islamic Banks, Paper Presented at the 12th ERF Annual Conference, 19th-21st December, Egypt.

Hassan, M.K and Hussein, K.A. (2003) Static and Dynamic Efficiency in the Sudanese Banking System, *Review of Islamic Economics* 14, 5-48.

Hussein, K.A. (2003) Operational Efficiency in Islamic Banking: The Sudanese Experience, *Working Paper No. 1*, Islamic Research and Training Institute (IRTI), Islamic Development Bank.

Isik, I. and Hassan, M.K. (2002), Technical, Scale and Allocative Efficiencies of Turkish Banking Industry, *Journal of Banking and Finance* 26 (4), 719-766.

Katib, M.N. (1999) Technical efficiency of commercial banks in Malaysia. *Banker's Journal Malaysia*, 111, 40-53.

McAllister, P.H. and McManus, D.A. (1993) Resolving the Scale Efficiencies Puzzle in Banking, *Journal of Banking and Finance* 17 (2-3), 389-405.

Mokhtar, H., N. Abdullah and S. Al-Habshi (2006), Efficiency of Islamic banking in Malaysia: A stochastic frontier approach, *Journal of Economic Cooperation*, *1*8(1): 5-22.

Noulas, A.G. Ray, S.C. and Miller, S.M. (1990) Returns to Scale and Input Substitution for Large U.S. Banks, *Journal of Money, Credit and Banking* 22 (1), 94-108.

Saleh, A.S and Zeitun, R (2007) Islamic Banks in Jordan: Performance and Efficiency Analysis, *Review of Islamic Economics* 11 (1), 41-62.

Samad, A. (1999) Comparative Efficiency of the Islamic Bank vis-à-vis Conventional Banks in Malaysia, *IIUM Journal of Economics and Management* 7 (1), 1-25.

Sealey, C. and Lindley, J.T. (1977) Inputs, Outputs and a Theory of Production and Cost at Depository Financial Institutions, *Journal of Finance* 32 (4), 1251-1266.

Sufian, F., Noor, M.A.M. and Abdul, M.M.Z,(2008) The Efficiency of Islamic Banks: Empirical Evidence from the MENA and Asian Countries Islamic Banking Sectors. *The Middle East Business and Economic Review,* Vol.20, No.1

Thanassoulis, E. (2001) *Introduction to the Theory and Application of Data Envelopment Analysis: A Foundation Text with Integrated Software*. Boston: Kluwer Academic Publishers.

Yudistira, D. (2004), *Efficiency in Islamic Banking: An empirical analysis of eighteen banks*, Islamic Economic Studies, 12(1): 1-19.

Viverita, Brown,K. and Skully, M. (2007) Efficiency Analysis of Islamic Banks in Africa, Asia, and the Middle East, *Review of Islamic Economics* 11 (2), 5-16

Zaher, T.S. and Hassan, M.K. (2001) A Comparative Literature Survey of Islamic Finance and Banking, *Financial Markets, Institutions & Instruments* 10 (4), 155-199.

Table 1: Summary Statistics of the Variables Employed in the DEA Model (in million of USD)

	Outputs	Mean	Min	Max	Std. Dev.
2003	Loan/ Advances (y1)	582.26	100.00	5,327.74	1,114.82
	Income (y2)	261.34	102.71	1,202.67	284.46
	Other Earning Asset (y3)	290.51	100.00	924.00	269.41
2004	Loan/ Advances (y1)	582.26	100.00	6,004.76	1,307.26
	Income (y2)	261.34	102.67	1,484.27	337.50
	Other Earning Asset (y3)	290.51	100.00	2,948.77	605.30
2005	Loan/ Advances (y1)	586.43	100.00	7,812.78	1,349.82
	Income (y2)	353.68	101.11	2,230.19	485.41
	Other Earning Asset (y3)	370.27	100.00	2,792.07	529.29
2006	Loan/ Advances (y1)	1,662.75	100.00	36,187.49	6,226.53
	Income (y2)	84,023.70	100.00	2,112,488.00	378,952.02

	Other Earning Asset (y3)	1,093.58	100.00	20,379.23	3,535.11
2007	Loan/ Advances (y1)	1028.55	0.40	11,044.90	2,260.24
	Income (y2)	291.89	0.06	4,841.30	974.45
	Other Earning Asset (y3)	3,249.57	0.22	58,728.30	11,726.22
2008	Loan/ Advances (y1)	2,372.04	0.00	14,348.50	3,527.15
	Income (y2)	197.53	3.05	1,136.19	277.80
	Other Earning Asset (y3)	1,308.04	69.43	6,458.56	11,726.22
2009	Loan/ Advances (y1)	537.30	537.30	537.30	#DIV/0!
	Income (y2)	4.30	4.30	4.30	#DIV/0!
	Other Earning Asset (y3)	2,563.10	2,563.10	2,563.10	#DIV/0!
	Inputs	**Mean**	**Min**	**Max**	**Std. Dev.**
2003	Deposits (x1)	2,239.93	100.20	14,534.00	3,827.49
	Labour (x2)	128.15	100.00	266.93	44.11
	Fixed Asset (x3)	130.04	100.00	664.86	103.70
2004	Deposits (x1)	2,039.43	101.13	16,343.47	3,523.97
	Labour (x2)	128.15	100.00	266.93	44.11
	Fixed Asset (x3)	111.05	100.00	289.95	33.49
2005	Deposits (x1)	2,688.86	101.80	19,153.49	4,629.46
	Labour (x2)	154.09	100.00	802.36	128.07
	Fixed Asset (x3)	111.38	100.00	209.48	24.97
2006	Deposits (x1)	781,916.45	101.10	22,000,100.00	3,797,391.29
	Labour (x2)	3,077.37	100.00	102,030.89	17,219.09
	Fixed Asset (x3)	123.08	100.00	342.00	52.74
2007	Deposits (x1)	5,869.75	1.10	115,155.10	23,046.11
	Labour (x2)	45.63	0.01	484.13	105.58
	Fixed Asset (x3)	133.89	0.00	2,534.00	503.45
2008	Deposits (x1)	2,587.74	58.75	18,100.05	4,346.80
	Labour (x2)	49.56	1.13	240.46	63.17
	Fixed Asset (x3)	74.78	5.10	371.93	99.83
2009	Deposits (x1)	232.30	232.30	232.30	#DIV/0!
	Labour (x2)	75.10	75.10	75.10	#DIV/0!
	Fixed Asset (x3)	32.90	32.90	32.90	#DIV/0!
Source: Banks Annual Reports & Bankscope database compiled by IBCA.					

Table 2: Summary Statistics of Efficiency Scores

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The table presents mean, minimum, maximum, and standard deviation of the MENA Islamic banks technical efficiency (TE), and its mutually exhaustive pure technical efficiency (PTE) and scale efficiency (SE) components derived from the DEA. Panel A, B, C, D, E, F, G and H shows the mean, minimum, maximum and standard deviation of TE, PTE, and SE of the Islamic banks for the years 2003, 2004, 2005, 2006, 2007, 2008 and 2009 respectively. Panel H presents the MENA Islamic banks mean, minimum, maximum, and standard deviation of TE, PTE, and SE scores for all years. The TE, PTE, and SE scores are bounded between a minimum of 0 and a maximum of 1.

Banks	Mean	Minimum	Maximum	Std. Dev.
Panel A: MENA Banks 2003				
Technical Efficiency	0.3070	0.7513	1.0000	0.2504
Pure Technical Efficiency	0.5570	0.9387	1.0000	0.1017
Scale Efficiency	0.4650	0.7929	1.0000	0.2287
Panel B: MENA Banks 2004				
Technical Efficiency	0.3700	0.7647	1.0000	0.2091
Pure Technical Efficiency	0.5790	0.9692	1.0000	0.0975
Scale Efficiency	0.5320	0.7881	1.0000	0.1954
Panel C: MENA Banks 2005				
Technical Efficiency	0.3320	0.6116	1.0000	0.2406
Pure Technical Efficiency	0.8970	0.9875	1.0000	0.0254
Scale Efficiency	0.3320	0.6186	1.0000	0.2400
Panel D: MENA Banks 2006				
Technical Efficiency	0.1490	0.5595	1.0000	0.2831
Pure Technical Efficiency	0.0000	0.9505	1.0000	0.1719
Scale Efficiency	0.1660	0.5719	1.0000	0.2879
Panel E: MENA Banks 2007				
Technical Efficiency	0.0070	0.5096	1.0000	0.3653
Pure Technical Efficiency	0.0070	0.6471	1.0000	0.3855
Scale Efficiency	0.0930	0.7940	1.0000	0.2704
Panel F: MENA Banks 2008				
Technical Efficiency	0.0180	0.6189	1.0000	0.3347
Pure Technical Efficiency	0.0240	0.7232	1.0000	0.3413
Scale Efficiency	0.3850	0.8550	1.0000	0.1904
Panel G: MENA Banks 2009				
Technical Efficiency	1.0000	1.0000	1.0000	1.0000
Pure Technical Efficiency	1.0000	1.0000	1.0000	1.0000
Scale Efficiency	1.0000	1.0000	1.0000	1.0000
Panel H: MENA Banks All Years				
Technical Efficiency	0.3119	0.6879	1.0000	0.3833
Pure Technical Efficiency	0.4377	0.8880	1.0000	0.3033
Scale Efficiency	0.4247	0.7744	1.0000	0.3447

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Note: Detailed results are available from the authors upon request

Table 3: Composition of Production Frontiers

	Financial Institutions	Country of Origin	2003	2004	2005	2006	2007	2008	2009	Count Bank
1	ABC Islamic Bank	Bahrain			IRS	IRS	CRS	IRS		1
2	Al Amin Bank	Bahrain		IRS	IRS	IRS				0
3	Al Baraka Islamic Bank	Bahrain	CRS	IRS	IRS	IRS	DRS	DRS		1
4	Arab Banking Corporation	Bahrain	IRS	CRS	IRS	IRS				1
5	Arcapita Bank B.S.C.	Bahrain	IRS	CRS	CRS	CRS	CRS	IRS	CRS	5
6	Arab Islamic Bank	Bahrain								0
7	Bahrain Islamic Bank	Bahrain	IRS	IRS	IRS	IRS	DRS			0
8	Gulf Finance House	Bahrain	IRS	IRS	IRS	IRS				0
9	Al Salam Bank	Bahrain				IRS				0
10	Shamil Bank	Bahrain	CRS	CRS	CRS	IRS	DRS	CRS		4
11	Taib Bank	Bahrain	IRS	IRS	IRS	IRS				0
12	Ithmaar Bank	Bahrain			IRS	IRS				0
13	Faisal Islamic Bank	Egypt	IRS	CRS	IRS			CRS		2
14	Arab Gambian Islamic Bank	Gambia		IRS	IRS	IRS				0
15	Bank Mellat	Iran			IRS	CRS	DRS			1
16	Bank Refah	Iran			IRS					0
17	Al Bilad Islamic Bank	Iraq				IRS		IRS		0
18	Jordan Islamic Bank	Jordan	CRS	CRS	IRS					2
19	Arab Islamic Bank	Jordan				IRS	DRS			0
20	Islamic International Arab Bank	Jordan	IRS	IRS	IRS	IRS	IRS			2
21	Jordan Dubai Islamic Bank	Jordan	IRS	IRS	IRS	CRS				1
22	Kuwait Finance House	Kuwait	CRS	DRS	CRS		CRS			3
23	BAMIS-Banque Al Wava Mauritanienne Islamique	Mauritania	IRS	IRS		CRS	DRS			1
31	Arab Islamic Bank	Palestine	IRS	IRS	IRS					0
32	Al Rajhi Banking	Saudi Arabia	CRS	CRS		IRS				2
33	Bank AlJazira	Saudi Arabia	CRS		CRS					2
34	EG Saudi Finance Bank	Saudi Arabia		IRS	IRS	IRS	CRS			1
35	Syria International Islamic Bank	Syria					DRS	DRS		0
36	Abu Dhabi Islamic Bank	UAE	CRS	IRS		CRS	IRS	DRS		2
37	Dubai Islamic Bank	UAE	CRS	CRS	CRS	IRS		DRS		3
38	Mashreq Bank	UAE	CRS	IRS	IRS	IRS				1
39	Emirates Islamic Bank	UAE		IRS	IRS	IRS	CRS	DRS		1
40	Sharjah Islamic Bank	UAE	CRS		IRS	IRS	CRS	DRS		2
41	Noor Islamic Bank	UAE						CRS		1
42	Qatar Islamic Bank	Qatar	IRS	CRS	IRS	CRS	IRS	IRS		2
43	Qatar International Islamic Bank	Qatar	CRS	CRS	CRS	CRS	DRS	CRS		5

44	Islamic Bank of Yemen	Yemen	IRS	IRS	IRS					0
45	Tadhamon International Islamic Bank	Yemen	IRS	IRS	IRS	IRS	DRS	CRS		1
46	Saba Islamic Bank	Yemen	IRS	IRS	IRS	IRS	DRS	CRS		1
47	Al Baraka Sudan	Sudan	CRS	CRS	CRS	IRS				4
48	Al Shamal Islamic Bank	Sudan	CRS				DRS	IRS		1
49	Faisal Islamic Bank	Sudan		IRS	IRS	IRS	DRS	IRS		0
50	Islamic Co-operative Development Bank	Sudan	IRS	IRS	IRS	IRS	DRS	IRS		0
51	Sudanese Islamic Bank	Sudan	IRS	IRS	IRS	IRS	DRS			0
52	Tadamon Islamic Bank	Sudan	IRS	IRS		IRS	DRS	IRS		0
		Count Year	**13**	**10**	**7**	**7**	**6**	**6**	1	
	Total Countries		**15**							

Note: CRS – (Constant Returns to Scale); DRS – (Decreasing Returns to Scale); IRS – (Increasing Returns to Scale).

The banks corresponds to the shaded regions have not been efficient in any year in the sample period (2001-2006) compared to the other banks in the sample.

'Count Year' denotes the number of banks appearing on the efficiency frontier during the year.

'Count Bank' denotes the number of times a bank has appeared on the efficiency frontier during the period of study.

APPENDIX 1

	Financial Institutions	**Country of Origin**		**Classification countries**	**2009**	**2008**	**2007**	**2006**	**2005**	**2004**	**2003**
1	ABC Islamic Bank	Bahrain	MENA	High income country		1	1	1	1	1	
2	Al Amin Bank	Bahrain							1	1	
3	Al Baraka Islamic Bank	Bahrain				1	1	1	1	1	1
4	Arab Banking Corporation	Bahrain							1	1	1
5	Arcapita Bank B.S.C.	Bahrain			1	1	1	1	1	1	1
6	Bahrain Islamic Bank	Bahrain				1	1	1	1	1	1
7	Gulf Finance House	Bahrain							1	1	1
8	Shamil Bank	Bahrain				1	1	1	1	1	1
9	Taib Bank	Bahrain							1	1	1
10	Ithmaar Bank	Bahrain							1		
11	Faisal Islamic Bank	Egypt	MENA	Middle income country		1			1	1	1
12	Arab Gambian Islamic Bank	Gambia	MENA	Low income country				1	1		
13	Bank Mellat	Iran	MENA	Middle income country					1		
14	Bank Refah	Iran							1		
15	Bank Tejarat	Iran					1				
16	Al Bilad Islamic Bank	Iraq	MENA	Middle income		1	1	1			

				country							
17	Jordan Islamic Bank	Jordan	MENA	Middle income country					1	1	1
18	Arab Islamic Bank	Jordan				1	1	1			
19	Islamic International Arab Bank	Jordan					1	1	1	1	1
20	Jordan Dubai Islamic Bank	Jordan							1	1	1
21	Kuwait Finance House	Kuwait	MENA	High income country			1	1	1	1	1
22	BAMIS-Banque Al Wava Mauritanienne Islamique	Mauritania	MENA	Low income country			1	1		1	1
23	Arab Islamic Bank	Palestine	MENA	Low income country					1	1	1
24	Al Rajhi Banking	Saudi Arabia	MENA	Middle income country						1	1
25	Bank AlJazira	Saudi Arabia							1		1
26	EG Saudi Finance Bank	Saudi Arabia					1	1	1		
27	Syria International Islamic Bank	Syria	MENA	Middle income country		1	1				
28	Abu Dhabi Islamic Bank	UAE	MENA	High income country		1	1	1	1	1	1
29	Dubai Islamic Bank	UAE				1			1	1	1
30	Mashreq Bank	UAE							1	1	1
31	Emirates Islamic Bank	UAE				1	1	1	1	1	
32	Sharjah Islamic Bank	UAE				1	1	1	1	1	1
33	Noor Islamic Bank	UAE				1					
34	Qatar Islamic Bank	Qatar	MENA	High income country		1	1	1	1	1	1
35	Qatar International Islamic Bank	Qatar				1	1	1	1	1	1
36	Islamic Bank of Yemen	Yemen	MENA	Low income country					1	1	1
37	Tadhamon International Islamic Bank	Yemen				1	1	1	1	1	1
38	Saba Islamic Bank	Yemen				1	1	1	1	1	1
39	Al Baraka Sudan	Sudan	MENA	Low income country					1		1
40	Al Shamal Islamic Bank	Sudan				1	1				1
41	Faisal Islamic Bank	Sudan				1	1	1	1		
42	Islamic Co-operative Development Bank	Sudan				1	1	1	1	1	1
43	Sudanese Islamic Bank	Sudan					1	1	1	1	1
44	Tadamon Islamic Bank	Sudan				1	1	1	1	1	1
		TOTAL			1	22	25	23	36	30	30
		GRAND TOTAL			**167**						

Total Countries **15**

Total Banks **44**

Economies are classified by GNI per capita in 2003, calculated using the World Bank Atlas method. The groups are low income, $765 or less; middle income, $766–9,385; and high income, $9,386 or more.

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