

# **Efficiency in Islamic Banking during a Financial Crisis-an Empirical Analysis of Forty-Seven Banks**

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## **Abstract**

The present paper measured the efficiency of Islamic banks during economic troubles of 2006-2009 to address the question if Islamic banks were efficient and stable. This paper addresses this question by measuring efficiency through employing the on-parametric technique, Data Envelopment Analysis (DEA) and *t* test was used to test the hypotheses. This study extends research, which suggests that large Islamic banks showed an increase in efficiency during 2006 to 2008 and decline during 2009. However, small to medium Islamic bank sample started at a lower level of efficiency. In addition, the results showed that the efficiency of Islamic banks operates in Middle Eastern and non-Middle Eastern Counties have increased during an economic crisis.

**JEL classification numbers:** G01, G21, G24, G29

**Keywords:** Islamic Banks, Data Envelopment Analysis, Financial Crisis, Middle Eastern.

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## 1 Introduction

The first sign of an Islamic banking system appeared in the early 1970s. The Dubai Islamic Bank (DIB) in the United Arab Emirates was the first Islamic bank followed by the establishment of the International Islamic Development Bank (IDB) in Jeddah, Saudi Arabia. Thereafter, many private and semi-private commercial Islamic banks were created in Egypt, Sudan, Kuwait, and Bahrain after 2005 Iqbal, & Molyneux, [29]. At the same time, Islamic banking started to spread widely in such other Islamic countries as Iran, Pakistan, and Bangladesh. Islamic bank in Iran had to establish maximum and the minimum rates of return for different industries. In this way, Islamic banks were able to finance their operations and even turn a profit while still observing the Shariah requirement of charging no interest.

Islamic banking can accommodate the sharing of profit and loss through several approaches. The first is partnership (*Musharaka*), or the sharing of investments by the bank without being part of the management teams. Then there is *Mudrabah*, which is based on the mark-up for a resale or leasing contract, called *ijara*, which in Western banks works on interest Bellalah & Ellouz [11].

Operating a bank in this manner actually increases the stability of the banking system because it encourages banks to diversify their investments to minimize risk and increase profits. This procedure in turn tends to attract more investors and thereby helps banks operate more efficiently. The Shariah banking practices operate through four different business laws. The first is the principle of the lender and borrower sharing in the latter is profit and loss. The second is fix charges established beforehand. The third is assessing no interest, and the fourth is lender-borrower collaboration.

Again in the matter of profit-and-loss sharing there are two principles at work. The first, *Mudrabah*, can be defined as an agreement between any two groups. In the case of banking, one group would be the supplier of funds, while the second would be the business using them. In the case that a profit is made, the

user of the loan would give the supplier a portion of the profit, based on a pre-agreed formula. In the case of a loss as a result of a normal operation, the lender (i.e., the bank) would bear the entire financial loss, while the user would lose his time and effort. This transaction would be similar to profit venture in the Western banks, where one party would provide the fund and the other party would provide their experiences Bellalah & Ellouz [11].

The second principle is *Musharaka*, as described earlier, a partnership between two parties to participate in projects. In the case of Islamic banking, the bank provides the capital and the business the project management. In the case of a profit, both parties would divide it according to prior agreement. Meanwhile, should a loss occur, both would bear their share, again as agreed on beforehand Bellalah & Ellouz [11]. This type of transaction is similar to joint venture in Western banks where the profit and loss would be divided according to prior agreement.

The next Islamic banking principle is the practice of fixed bank charges versus interest. The concept, called *Murabaha* in Arabic, is based on adding a fixed finance cost to the costs of the goods or services in question. *Murabaha* is actually the contract where the sales person let the buyer know the cost of the goods or services and then discusses the profit margin of that contract. This type of transaction is similar to rent-to-own arrangements in Western banks. The next tool is *Bai-Mua'jjal*, a deferred- payment sale without any extra charges. This transaction is equal to deferred payment sale in the Western banks where both parties agreed on deferred payment for example no money down or 120 days good as cash Bellalah & Ellouz [11]. *Ijara* (leasing) is the contract for this activity, whereby the owner of the goods makes them available for use by another party. By the time of payment, the client now owns the goods. This concept is similar to Western practice of leasing with an option to buy.

Also in the charge-free category is the *Qurad*. Here the borrower returns only the principal amount to the lender without any additional money. Other

principle categories are including *Wadiah* (trusteeship) and the *Rhan* (pledge), which are similar to saving accounts in Western banks. In the case of savings and investment deposits, Islamic banking follows the Mudaraba principle. The depositor has no knowledge about what that investment will yield beyond the ratio of profit sharing, to which both lender and borrower have agreed. A repayment will only be made to the Islamic bank in the case of profit obviously, the higher the agreed-upon rate of profit to the bank, the lower the profit to the depositor Bellalah & Ellouz, [11].

The bank applies the profit loss sharing principle through the two tools; the first tool would be the *Mushararka*. Here both the bank and the business contribute capital and agree on a specific profit ratio Bellalah & Ellouz, [11]. Many of these investments are high-risk ventures, where bankers would be well advised to use caution. Meanwhile, Islamic banks have to compete with Western-style banks in trying to fund less risky projects Dar & Presley [18].

Interest on a loan was prohibited in Islam because it would create capital without a corresponding effort. An increase in income must come from investment, labor, or other activities, not simply from the use of an investor's money by a borrower rather, than the relationship between creditor and debtor is primary, not the creditor's bottom line. In practice, then, both parties share the risk and the profit, if any, at a pre-agreed rate instead of a fixed one as in Western banking Bellalah & Ellouz [11].

The Islamic banks assess a fix charge or commission for services rendered, including the processing of the loan. In this way, beyond the sharing of any profits, banks will defray costs and enhance profits. In general, Islamic banks contract for a greater proportion of the profits than the borrowers since the former are taking a greater risk. In long-term loans, the investors will need to maintain their funds available to the borrower until the end of the contract period. This feature exposes Islamic banks to high liquidity risk should the investment fail Bellalah & Ellouz [11].

In recent years, Islamic banks were in constant growth. According to International Monetary Fund [28], the number of Islamic banking in whole world increased from 75 institutions to about 300 institutions in 2005. In 2007 the total asset of the Islamic bank industry were about \$250billion, while the growth rate was about 15% per year, which is about three time the growth rates in the traditional Western banking system Parker [39].

According to Parker [39] & Arnold [9] the growth of assets in Islamic banks during 2007 was between 25-40%, and there were about 300 Islamic financial institutions in the world had least \$500 billion in assets during 2007.

According to the Sharia Calling [46], assets in Islamic banks have increased by 29% during 2009. During 2009 the Islamic banks assets were valued to be about US\$882 billion. According to Little [10], assets in Islamic banks worldwide will be reaching \$4 trillion by 2015.

## **2 Research Question and Hypotheses**

Are Islamic banks stable and efficient during a financial crisis?

H1<sub>O</sub>: There is no difference in the efficiency between Islamic banks operate in Middle Eastern and non-Middle Eastern Counties during an economic crisis.

H1<sub>a</sub>: There is difference in the efficiency between Islamic banks operate in Middle Eastern and non-Middle Eastern Counties during an economic crisis.

H2<sub>O</sub>: There is no difference in the efficiency between small and large Islamic banks during an economic crisis.

H2<sub>a</sub>: There is a difference in the efficiency between small and large Islamic banks during an economic crisis.

### 3 Literature Review

There have been few studies of efficiency in the Islamic banking system. This fact contrasts with the plethora of such studies for Western-style banks. Samad and Hassan [43] tried to measure profitability, liquidity, risk, and solvency in the Islamic banking community. The authors' hypotheses were that (a) Islamic banks' liquidity ratios would be higher in the early stages of their operations and (b) the growth of Islamic banks would depend on increased public awareness about such banks and their financial tools.

M.K. Hassan [23] used two different periods (1984 to 1989 and 1990 to 1997) for purposes of comparison and employed accounting ratios divided into profitability, liquidity, risk, and solvency. M.K. Hassan [23] also measured the sample institutions' commitment to the Islamic community and showed that Islamic banks tended to have more liquidity than Western banks, at least in terms of cash deposits. Islamic banks had a cash-deposit ratio of .02 compared to .01 for Western banks. M. K. Hassan [23] indicated that risk increased in the Islamic banks in the latter phases of their development, yet Islamic banks were found to be less risky overall than Western banks with performance in serving the community approximately the same as that of the sample of Western banks.

Yudistira [53] examined the efficiency of the Islamic banking system with 18 Islamic banks over 3 years, from 1997 to 2000. Yudistira used the DEA as a comparative measure of the various banks' efficiency. Yudistira found that banks could be scored between zero and one, "with a completely efficient bank having an efficiency score of one. In DEA, the most efficient bank (with a score of one) does not necessarily generate the maximum level of output from the given inputs" (p. 4).

Yudistira [53] collected data from nonconsolidated income and balance-sheet statements, both of which were available from the London-based International Bank Credit Analysis, Ltd. The period considered was 1998 to 1999, a time of global financial crisis. All the variables were converted to U.S. dollars

and deflated by the consumer price index of each country to allow for economic changes. Three inputs and three outputs were examined. The outputs were total loans, other income, and liquid assets, and the inputs were staff costs, fixed assets, and total deposits Yudistira [53]. The Islamic institutions analyzed were found to be less efficient between 1998 and 1999 as compared with 1997 to 2000. The inefficiency in 1998 turned out to be more attributable to pure technical inefficiency than scale efficiency Yudistira [53].

Yudistira [53] also found that Islamic banks in the Middle East were less efficient than Islamic financial institutions in other parts of the world. An important finding for this dissertation suggested that Islamic banks were still about 10% more efficient than Western banks during the same period. Furthermore, the purpose of the study results was to show that the Islamic financial system performed very well during other periods. Yudistira's data suggested the importance of mergers and acquisitions for the small and medium-sized Islamic banks in the sample. Lastly, the market in the Middle East was not shown to have had a significant impact on the efficiency of the Islamic banks examined Yudistira [53].

Samad [44] measured the performance of the Islamic banking sector in contrast to that of the Western system in Bahrain. Specifically, Samad collected data for six Islamic and 15 traditional Western banks from 1991 to 2001. Samad examined income statements and balance sheets for these banks by using a set of ratios to measure their respective profitability, liquidity, and credit-risk performance.

Samad [44] showed there were no significant differences between the Islamic and the Western banking systems in Bahrain with regard to profitability and deposit risk. According to Samad, the Islamic banks had higher equity ratios than the Western banks. The finding suggested that the Islamic banks in the study exercised more caution when making loans than their Western counterparts did. Moreover, the purpose of the ratios in this study was to indicate that Islamic banks

tended to have more liquidity than Western banks; a finding that suggested the Islamic financial institutions had lower liquidity risk than the comparison group of Western banks.

In a study by Ariff et al. [7], 80 banks were evaluated. Forty-three were Islamic, and the other 37 were Western. The data in this study were collected between 1990 and 2005, a sufficiently long period for making a solid comparison. The study helped demonstrate how the Islamic banking sector reacted during the 1990 financial crisis. The purpose of the results was also to indicate past trends that could be used to extrapolate likely future behavior for both banking systems. The data were converted to U.S. dollars and adjusted for inflation.

Ariff et al. [7] used the DEA since the benefit of this approach was there were no functional or distributional forms needed. The relationship employed to measure efficiency was efficiency equals the weighted sum of the inputs. The results were that Islamic and Western banks were equally efficient in using their resources in proportion to their capability for creating profit. The management teams of both groups exercised control of their resources while having less control over such outside factors as governmental rules and regulations, the GDP, and competition.

Ariff et al. [7] suggested that the small Islamic banking system was more efficient in performance compared with the conventional banking system because of their respective capital structure. The second reason was that smaller traditional banks had more competition, with negative consequences on their revenue. At the same time, these findings suggested the need for Islamic banks to pay more attention to the use of their resources to stay at least as efficient as Western banks. It was also established that the cost and profit efficiency of older Western banks was better than that of older Islamic banks because Western banks had learned more from their business experience over a longer period of time Ariff et al [7].



Ariff et al. [7] also showed that newer Islamic banks were less efficient than older ones, and the older Western banks were better in cost and revenue efficiency than the newer ones. The reasons for these findings seemed to derive from the relative size of the banks' assets as well as the greater experience of the older banks. The smaller Western banks were found to have higher average profits and cost efficiency than their larger counterparts. Ariff et al. [7] further identified that both smaller and larger Islamic banks needed to pay more attention to cost and profit efficiency if they wished to stay competitive.

Finally, Ariff et al. [7] investigated bank efficiency and its relationship to geographical region. The author showed, for example, that in Africa, Western banks outperformed Islamic ones. However, in Asia, Western banks did better in cost and revenue but not in profits when compared with Islamic banks. Islamic banking performed better than Western banking in cost, revenue, and profits in Turkey and the Middle East Ariff et al. [7].

Al-Tamimi [6] investigated the factors that might have affected Islamic and conventional banks in the United Arab Emirates during 1996 to 2008. Al-Tamimi [6] used the regression, ROA and ROE as dependent variables, and the independent factors were GDP per capita, size, financial development indicators (FDI), liquidity, concentration, cost, and number of branches. The purpose of the results was to show that liquidity and concentration were the most significant determinants of the conventional national banks' performance; cost and number of branches were the most significant determinants of the Islamic banks' performance.

Other researchers pointed out those Islamic banks faced the same risks as non-Islamic ones. Ariffin, Archer, and Karim [8] surveyed 28 Islamic banks in 14 countries by asking risk management teams for these banks about the risks that Islamic banks faced compared to banks in the traditional banking system. Ariffin et al. showed that Islamic banks faced the same risks as Western banks but used

less technically advanced risk measurement techniques than their Western counterparts.

According to Srairi [47], Islamic banks usually took on more risk than Western ones because of lack of experience and unfamiliarity with all the financial tools that could assist them. As a result, Islamic banks required more capital to manage this level of risk.

Johnes, Izzeldin, and Pappas [33] measured the efficiency of Islamic versus Western banks through the Cooperation Council of the Arab States within the Gulf GCC area. Two tools were used to measure the efficiency, the financial ratios analysis, and the DEA. Data were collected for six banks in the GCC area for 2004 to 2007. Leaders of Islamic banks were less cost efficient but more revenue and profit efficient than Western banks.

The return on the average for assets was higher in the Islamic banks studied than in the Western banks. The reason was that the Islamic banks were more invested in assets and less involved in debt contracts while the return on the average equity was the same for both bank systems. The revenue ratios, other operating income, net interest margin, and return on investment were higher in the Islamic banks than in the conventional banking system. The reason for the higher investing ratios was the rapid development in the Gulf area at the time. The purpose of the DEA analysis was to show that the average efficiency was significantly lower in the Islamic than the traditional Western banking system Johnes et al. [33].

M. K. Hassan and Bashir [25] collected data from 43 Islamic banks operating worldwide from 1994 to 2001 and used different variables to show the effect on the profitability and efficiency of the banks examined during that period. Financial ratios were used to measure performance. The result of the study demonstrated that higher capital-and-loan-to-asset ratios led to higher profitability, with a very strong relationship between profitability and overhead in the Islamic banks.

The first instrument used to analyze the data was financial ratio analysis (FRA). Considered a simple tool, FRA provided the opportunity to make comparisons between banks in terms of cost, revenue, and profit Hassan & Bashir [25]. The disadvantage of using FRA is that it could not capture all the data needed given the complexity of banking institutions Hassan & Bashir [25]. In any event, the purpose of the results of this study was to indicate that Islamic banks' cost-to-income were higher than in the Western banks used for comparison.

The higher cost in the Islamic banking system was derived from needing to have and pay the Shariah compliance board to oversee compliance with all relevant Islamic laws. This requirement brought with it additional salaries, legal costs, and expensive, complex financial products to keep these banks competitive with the Western banks. Srairi [48] used the stochastic frontier approach to measure the cost and profit efficiencies for 71 Islamic and Western banks in the Gulf Cooperation Council countries, over the period of 1999 to 2007. Srairi found that the Western banks were more efficient in profit and cost than the Islamic banks.

Omar, Majid, and Rulindo [38] studied the efficiencies of private banks in Indonesia during 2002 to 2004, using the DEA to analyze data collected from 21 private banks. In this sample, two banks were Islamic, and the rest were Western banks. The study suggested the two Islamic banks were operating above the average cost and profit efficiency of the Western banks.

Safiullah [41] compared the performance of Islamic banks to Western banks by using financial ratios. The data for the study were obtained from four Islamic and four Western banks from 2004 to 2008. The results suggested that Islamic banks performed better in business development, profitability, liquidity, and solvency than the Western banks.

Alkassim [3] compared the Islamic banking system with the conventional banking system. The study included 16 Islamic banks and 18 traditional banks and used regression analysis with eight variables. The data for the study covered

the period of 1997 to 2004. Regression analysis was used on three dependent variables: return on assets, return on equity, and net interest margin.

Alkassim [3] showed a positive relationship between total assets and profitability in the Islamic banks, and the conventional banks had a negative relationship between total assets and profitability. The total equity had a positive relationship to profitability in the Islamic banks, and it had a negative relationship to profitability in the Western banking system. Finally, lending showed a positive relationship with profitability in both the Western and Islamic banks.

Al Khathlan and Malik [4] employed the DEA to measure the efficiency of Islamic banks in Saudi Arabia. Al Khathlan and Malik [4] collected data from ten Islamic banks from the banks' individual websites from 2003 through 2008. An increase in efficiency of managing financial resources over time was shown as the primary outcome of the study.

Kashani and Obay [35] analyzed the productivity of UAE banks' efficiency and operation compared with GCC banks. The study covered the period of 2000 to 2005 and used the DEA model to measure efficiency. The data study sample included 56 banks (41 Western and 15 Islamic).

Kashani and Obay [35] showed that UAE banks were more efficient than other GCC banks. Leaders of Islamic and conventional banks in the UAE showed an increase in technical and pure efficiency but losses in scale efficiency. The purpose of the study was to reveal no significant differences between the performance of the Islamic and conventional banks in UAE.

Kamaruddin, Safa, and Mohd [34] investigated profit and cost efficiency of Islamic banks and Islamic windows at commercial (non-Islamic) banks. In this study, the DEA was used to measure cost and profit efficiency. The study included 14 commercial banks in Malaysia between 1998 and 2004. Two were Islamic banks, and 12 were Islamic windows at commercial banks. The comparison in this study was based on financial ratios taken from the balance sheets and income statements of the institutions in the sample.

Kamaruddin et al. [34] showed that the Islamic banks achieved technical efficiency through using technology such as ATMs, Internet banking, smart cards, and wireless banking. For cost efficiency, the Islamic banks used about 30% of their resources to produce outputs, a figure indicating waste. The purpose of the study results further was to show that the Islamic banks were twice as inefficient as conventional banks in Malaysia during that period. Islamic windows and foreign Islamic banks operated more efficiently on the cost side than the profit side. Their average operating profit efficiency was comparable to the Western banking system.

Al-Jarrah and Molyneux [1] measured the efficiency of banks in several Arabian countries with data collected from 1992 through 2000. The tool used to measure efficiency was the SFA. The Islamic banks were found to be more cost and profit efficient than the Western-style investment banks were. Moreover, the larger Islamic financial institutions in terms of assets were more efficient in cost and profit than their Western counterparts were.

Sufian and Akbar [50] measured the efficiency and performance of Islamic banks in 16 countries in the Middle East, North Africa, and Asia. The sample consisted of 37 banks and data were collected over the period of 2001 to 2006. Sufian and Akbar [50] used the DEA. The results suggested a positive relationship between efficiency and loan intensity, size, capitalization, and profitability.

Sufian [49] investigated the efficiency of Islamic banks operating in Malaysia during the years 2001 through 2005. Sufian used the DEA program to analyze the data. In Malaysia, there was an economic decline in 2002 and modest recovery in 2003 and 2004. Sufian [49] suggested that Islamic banks were more efficient than Western-style banks. Another finding was that bank size and market share had negative effect on Malaysian Islamic banks' efficiency, and the more efficient the bank was, the more profitable it became. Finally, the Western banks analyzed had more managerial efficiency to control costs than Islamic banks.

Mokhtar, Abdullah, and Alhabshi [36] investigated the efficiency of Islamic banks, Islamic windows, and Western banks in Malaysia. Mokhtar et al. obtained their data from the banks' financial statements and looked at 20 Islamic windows, 2 Islamic banks, and 20 conventional banks for the period of 1997 to 2003. Mokhtar et al [36] used the DEA model to measure the comparative efficiency of these banks. The results suggested that Islamic banks were more efficient than banks with Islamic windows, but the efficiency level of Islamic banking proved less than Western banks.

Hassan, Mohamad, and Bader [26] examined the efficiency between Islamic and Western banks. T. Hassan et al. obtained data from the financial statements of 40 banks, including 18 Western and 22 Islamic banks. The SFA model and t tests were used to measure the efficiency between the institutions. The results suggested that no significant difference existed in cost and profit efficiency between Islamic and Western banks. Finally, T. Hassan et al. [26] suggested that both banking systems were more profit efficient and less cost efficient.

Čihák and Hesse [16] compared the efficiency of a large sample of Islamic and Western banks. The data came from 520 observations for 77 Islamic banks and 3,248 for 397 commercial banks between 1993 and 2004. Čihák and Hesse [16] tried to capture the importance of bank size for institutional stability in the Islamic banks compared with the commercial ones. Regression analysis was used to measure the efficiency of the respective banking sectors. The results suggested that Western banks were more efficient than Islamic banks and that Islamic banks were relatively more stable when operating on a small scale and less so when operating on a larger one.

M. K. Hassan [24] examined the efficiency of Islamic banks. The data of the study included income statements and balance sheets of 43 Islamic banks in 21 countries for the period of 1995 to 2001. M. K. Hassan [24] used the parametric and nonparametric approach to examine banking efficiency. Cost, allocation,

technical, pure technical and scale efficiency were measured. The results suggested that, on average, the Islamic banks were less efficient than Western banks in other parts of the world.

El Moussawi and Obeid [20] measured the efficiency of Islamic banks that operated in the Gulf Cooperation Council (GCC) area for the period of 2005 through 2008. El Moussawi and Obeid [20] used the DEA model to measure the efficiency of 23 Islamic banks. El Moussawi and Obeid [20] found that, on average, during the 3-year period, technical inefficiency increased by 14% and allocated inefficiency by 29% in the sample's Islamic banks.

Hamilton, Qasrawi, and Al-Jarrah [22] examined the efficiency in Jordanian Western and Islamic banks. Hamilton et al. [22] analyzed cost and profit efficiency in the sample institutions for the period of 1993 to 2006. The SFA was used to measure bank efficiency. The purpose of the results was to indicate that the Islamic banks were less cost efficient than their Western counterparts. Hamilton et al. also showed that the Western banks had higher profit efficiency than the Islamic banks.

Shahid, Rehman, and Niazi [45] compared the efficiency of Islamic and Western banks in Pakistan. The study covered five Islamic and five conventional Western banks for the period of 2005 to 2009. Shahid et al. used the DEA model and t tests to measure the efficiency for both banking sectors. Shahid et al. [45] suggested no significant difference existed in mean efficiency scores between the Islamic and Western banks.

Beck, Demirgüç-Kunt, and Merrouche [12] measured the relative efficiency of selected Islamic and Western banks. The large, geographically wide sample involved 141 countries and 2,956 banks. Of the latter, 99 were Islamic banks. Data were collected for the period of 1995 through 2007. Ratios and regression analysis were employed to compare the efficiency of the two banking sectors. The purpose of the findings was to show no significant differences in efficiency between the Islamic and the conventional banks.

#### **4 Efficiency Differences Based on Size**

The purpose of the next set of studies was to show the effect of size on a bank's efficiency. Darrat, Topuz, and Yousef [19] examined the efficiency of banks in Kuwait, using the DEA. The balance sheets and income statements of eight banks were examined over the period of 1994 to 1997. The three inputs included were labor, capital, and deposits, and the outputs were loans and investments.

The purpose of the results was to indicate that about 47% of the resources of the banks were not used correctly to generate profit. The small banks were found to be more efficient than the larger ones. Finally, there seemed to be a positive relationship between the profitability, capitalization, and efficiency in the Kuwaiti banking system Darrat et al. [19].

Mostafa [37] examined the efficiency of 100 Arab banks using the DEA for evaluation of their work in 2005. Institutional size apparently had an influence on their efficiency. Only eight banks were shown to be efficient, and most of them were large international banks, not small domestic banks. Mostafa recommended that these banks could improve their operations and become more efficient by reducing waste and increasing savings.

Between 1988 and 1996, Isik and Hassan [31] examined the relative efficiency of Turkish banks, including the impact of specific variables on their operations. The variables were size, international conditions, ownership, and control of profits. Isik and Hassan found that efficiency decreased. A major negative factor proved to be the banks' technical inefficiency.

Isik and Hassan [32] also showed a very low correlation between profit and cost efficiency in the Turkish banking system. Banks with lower profits were more cost efficient. A positive relationship between bank size and profitability was found in Turkey (i.e., the larger the banks, the more profit they made).

Taleb and Al-Shubiri [51] measured the efficiency of Jordanian banks listed on the Amman Stock Exchange (ASE) for 2004 to 2007. Taleb and Al-



Shubiri [51] used financial ratios and regression analysis to measure the efficiency and performance of the banks. The purpose of the results was to show that institutional size influenced the positive financial performance of the banks.

Isik, Gunduz, and Omran [30] showed that banking inefficiency was not the product of increased rules and regulations but of managerial inefficiency. Isik et al. measured the efficiency of Jordanian banks from 1996 to 2001 and showed that large banks were more efficient than small ones, with increases in assets leading to increases in efficiency. A nonparametric approach was used to measure banking efficiency.

Akhtar (2010) showed the importance of efficiency in the Pakistani banking system from 2001 to 2006 with the DEA model. The purpose of the results was to show that Pakistani banks had a lower efficiency rate than other banks in the region. Small banks in Pakistan failed to be efficient because of their administrative costs coupled with high-risk investment tools. Small banks offered fewer services than Western banks. Akhtar [2] suggested that the Pakistani system could improve its efficiency by utilizing labor and capital in better ways. Recommendations included (a) diversification of investments to reduce risk and increase return and (b) the development of merger and acquisition plans so that, as larger entities, they might adopt a global outlook and become more competitive.

Burki and Ahmad [14] investigated the efficiency and performance of the banking system in Pakistan. The sample consisted of 46 institutions, and the SFA and inefficiency cost analysis were used to examine the impact of their transformation from state-owned to foreign and private banks during 1991 to 2005. The newly transformed private banks were found to be the most cost efficient, followed by foreign and state-owned banks. The small banks tended to engage in mergers and acquisitions as a way to increase their efficiency. Burki and Ahmad [14] found that the banks continued to improve their performance during the financial reform period.

Al Shamsi, Aly, and El-Bassiouni [5] measured the efficiency of the Western banking system in the United Arab Emirates, using the DEA to analyze the data. Inefficiencies were found to stem from poor allocation of resources. Another finding was that the sample banks became more efficient by increasing their size.

## **5 Methodology**

### **5.1 Research Design**

The quantitative design selected for the paper was non-experimental. In experimental designs, researchers measure the influence of a variable on another variable through the application of a treatment (i.e., experiment) Creswell [17]. According to Herzinger and Campbell [27], the experimental design involves determining causation between variables. A quantitative design that does not involve the determination of influence of a treatment is non-experimental Belli [13]. The experimental design was rejected for the paper because the purpose was not to introduce a change in the settings or participants. The non-experimental design aligned with the objectives of the paper.

### **5.2 Data Envelopment Analysis**

The DEA model was the instrument used to measure efficiency. The DEA is a linear programming system designed to show whether a specific decision-making unit (DMU), or bank, is efficient or not efficient. The DEA system created a standard set by the efficient banks for comparison with inefficient peers. In this system, banks received scores of either 0 or 1.

Efficient banks had a score of one, meaning that they had optimal output levels in contrast to other banks in the sample. Charnes et al. [15] developed the

DEA model based on constant return to scale (CRS). The researchers intentionally created a system that would generalize the single-input, single-output measure of a decision-making unit (DMU) to a multiple-input, multiple-outputs setting. Banker, Charnes, and Cooper (1984) extended the DEA system to include variable return to scale (VRS). According to Farrell [21], the following formula is the simplest way to measure efficiency:

$$\text{Efficiency} = \text{input/output.}$$

Farrell [21] further suggested that a bank could produce multiple outputs using multiple inputs. The technique sets a standard for the most efficient DMU in contrast to the less efficient banks by examining multiple outputs and inputs. Farrell [21] posited the following formula:

$$\text{Efficiency} = \frac{\text{the weighted sum of inputs}}{\text{the weighted sum of outputs}}$$

The Yudistira [53] DEA analysis methodology studied the  $N$  DMUs in the banking industry with all the inputs in a sample being represented by  $n$ , and the outputs represented by  $m$ . Therefore, the efficiency of banks would be computed with the following equation where:

$$e_s = \frac{\sum_{i=1}^m u_i y_{is}}{\sum_{j=1}^n v_j x_{js}}, \quad i = 1, \dots, m, \quad j = 1, \dots, n \quad (1)$$

$i$  = output

$j$  = input

$y_{is}$  = amount of the  $i$  (output) produced

$s$  = bank

$x_{js}$  = amount of the  $j$  (input) used by the bank

$u_i$  = output weight

$v_j$  = input weight

According to Yudistira [53], this efficiency ratio ( $e_s$ ) was then maximized to select optimal weights as follows:

$$\frac{\sum_{i=1}^m u_i y_{ir}}{\sum_{j=1}^n v_j x_{jr}} \leq 1, \quad r = 1, \dots, N, \quad u_i, v_j \geq 0 \quad (2)$$

According to Charnes et al. [15], this fractional linear system can be changed

$$\text{Maximize } e_s = \sum_{i=1}^m u_i y_{is}$$

into an ordinary linear system in this way:

Similarly, the system can be changed into the dual problem:

$$\text{minimize } \xi_s$$

$$\sum_{i=1}^m u_i y_{ir} - \sum_{j=1}^n v_j x_{jr} \leq 0, \quad r = 1, \dots, N, \quad \text{and } 0 \leq \xi_s \leq 1 \quad (3)$$

$\xi_s$  = overall technical efficiency score of bank with a value of 1 indicates the point on the frontier.

$$\sum_{r=1}^N \phi_r y_{ir} \geq y_{is}, \quad i = 1, \dots, m$$

$$\xi_s x_{js} - \sum_{r=1}^N \phi_r x_{ir} \geq 0, \quad j = 1, \dots, n; \quad \phi_r \geq 0 \quad (4)$$

The efficiency frontier is defined as the maximum number of outputs that can be created for a given number of inputs.

The DEA is constructed with the best production function solely based on observed data, so statistical tests for significance of the parameters are not necessary. Several DEA models exist. The researcher employed the VRS model by following Yudistira [53] and uses an output-oriented model where DMUs are considered optimal when they produce the highest possible output from a given amount of input.

The researcher employed the VRS Model to measure the relative efficiency of its Islamic banks for the period of 2006 to 2009. Separate measures

were calculated for each year. The researcher used the DEA Excel Solver developed by Zhu [54], and all the variables were measured in U.S. dollars. Islamic banks tend to issue reports in the currency of their country of operations. The researcher thus followed Pastor, Pérez, and Quesada [40] by converting the Islamic banks' local currencies into U.S. dollars by using the exchange rate on the first date of the study implementation.

After measuring efficiency with the DEA, tool for each bank from the year of 2006 to 2009. A  $t$  test at the .05 level of significance facilitated the identification of statistically significant differences in efficiency for the Islamic banks. The choice of the  $t$  testing method was based on the goal of the research. The analyzed data were interpreted to answer the research question (i.e., Are Islamic banks stable and efficient during a financial crisis?) and to determine whether to reject or fail to reject the null hypotheses about the efficiency of Islamic banking systems. The null and alternate statements of hypothesis are as follows:

H1<sub>0</sub>: There is no difference in the efficiency between Islamic banks operate in Middle Eastern and non-Middle Eastern Counties during an economic crisis.

H1<sub>a</sub>: There is difference in the efficiency between Islamic banks operate in Middle Eastern and non-Middle Eastern Counties during an economic crisis.

H2<sub>0</sub>: There is no difference in the efficiency between small and large Islamic banks during an economic crisis.

H2<sub>a</sub>: There is a difference in the efficiency between small and large Islamic banks during an economic crisis.

### **5.3 Definition of Variables**

The researcher used the intermediation approach to measure efficiency in Islamic banking using the DEA model because Islamic bank is considered an equity based model. The input of the model was labor cost, fixed assets, and total

deposits, and the output of the model was total loans, liquid assets, and other income.

## **5.4 Data**

All data for the study were collected from the end-of-year balance sheets and income statements for the individual years 2006 to 2009, which are made available by the Islamic Banks and Financial Institutions Information database. Based on Yudistira's [53] research, the researcher assumed that the selected banks for the study were operating at an optimal level. In addition, these Islamic banks were grouped by regional area, which consist of Middle East Counties and Non Middle East Counties. Also the study examines the size efficiency correlation; Islamic banks were sample are grouped by total assets therefore banks with more than \$600 million of assets were considered to be large size and banks below this level are categorized as small-to medium size.

## **6 Presentation of the Findings**

The purpose of this quantitative research study was to determine the impact of the financial crisis of 2006–2009 on efficiency measures of four separate bank structures, including (a) Non Middle Eastern Islamic Banks, (b) Middle Eastern Islamic Banks, and (c) Large size Islamic banks (d) Small to medium Islamic banks. The purpose of the results is to suggest that leaders of Non Middle Eastern Islamic banks were able to sustain a level of efficiency during the economic crisis better than leaders of Middle Eastern Islamic Banks. Medium to small Size Islamic banks were able to sustain better level of efficiency than Large Islamic banks during the financial crisis of 2006-2009. Both officials of large and small to Medium Islamic banks organizations saw an increase in

efficiency during the financial crisis. In addition, Middle Eastern and Non Middle Eastern banks saw an increase in efficiency during the financial crisis during the same period.

## **6.1 Sample Summary**

The study sample consisted of 47 banks. The sample contained 21 non Middle Eastern Islamic banks, 26 Middle Eastern Islamic Banks, and the same sample was used to compare 24 large Islamic Banks to 23 small to medium size Islamic banks.

In order to provide baseline information about the samples, Table 1, 2, and 3 presents a summary of Total Assets for the periods.

Table 4, 5, 6, and 7 summarizes the DEA mean, median, and standard deviation for each sample during the period of 2006 through 2009.

Table 1: Total Assets

Islamic Banks	2006	2007	2008	2009
Sample Size	47	47	47	47
Mean	\$ 4,966,895,488	\$6,462,764,357	\$7,205,820,298	\$7,809,139,556
Median	\$873,451,000	\$871,594,000	\$1,246,454,003	\$929,893,797
Standard deviations	\$13,457,222,061	\$15,834,384,402	\$16,420,080,388	\$18,146,143,172

Table 2: Total Assets

Middle Eastern Islamic Banks	2006	2007	2008	2009
Sample Size	26	26	26	26
Mean	\$1,411,500,050	\$2,780,944,405	\$3,518,729,979	\$3,712,822,443
Median	\$27,687,769	\$37,788,083	\$71,808,889	\$198,674,860
Standard deviations	\$2,548,045,653	\$5,373,789,027	\$6,046,519,594	\$6,245,599,215

Table 3: Total Assets

Non Middle Eastern Islamic Banks	2006	2007	2008	2009
Sample Size	21	21	21	21
Mean	\$ 9,368,813,649	\$11,021,208,108	\$11,770,789,264	\$12,880,770,266
Median	\$ 1,326,099,018	\$ 2,048,241,500	\$ 2,031,496,124	\$ 2,184,174,884
Standard deviations	\$19,277,660,975	\$22,386,063,733	\$23,127,243,212	\$25,685,971,321



Table 4: Data Envelopment Analysis

Middle Eastern Islamic Banks	2006	2007	2008	2009
Sample Size	26.00	26.00	26.00	26.00
Mean	0.57	0.72	0.79	0.79
Median	0.50	0.75	0.85	0.96
Standard deviations	0.26	0.24	0.25	0.27

Table 5: Data Envelopment Analysis

Non Middle Eastern Islamic Banks	2006	2007	2008	2009
Sample Size	21.00	21.00	21.00	21.00
Mean	0.78	0.79	0.81	0.79
Median	0.94	1.00	1.00	1.00
Standard deviations	0.30	0.29	0.31	0.32

Table 6: Data Envelopment Analysis

Large Islamic Banks	2006	2007	2008	2009
Sample Size	24.00	24.00	24.00	24.00
Mean	0.71	0.79	0.79	0.76
Median	0.90	0.97	1.00	1.00
Standard deviations	0.33	0.28	0.30	0.32

Table 7: Data Envelopment Analysis

Small to Medium Islamic banks	2006	2007	2008	2009
Sample Size	23.00	23.00	23.00	23.00
Mean	0.62	0.72	0.81	0.81
Median	0.53	0.71	0.98	1.00
Standard deviations	0.25	0.23	0.24	0.26

## 6.2 Hypotheses 1

The research question asked are Islamic banks stable and efficient during a during the financial crisis beginning in 2006. The first hypothesis addressed the comparison in efficiency between Islamic banks operate in Middle Eastern and non-Middle Eastern Counties during an economic crisis. The first null hypothesis predicted that, for both samples, there is no differences in the in efficiency between Islamic banks operate in Middle Eastern and non-Middle Eastern Counties during an economic crisis. To address this hypothesis, the researcher measured the differences in efficiency for each of the four years. Table 8 displays the results of the *t* test result of the different in the efficiency. No significant difference in efficiency was determined for the period during 2006. The P value, which measures the significance of change, was .194, .396, and .476 for 2007, 2008, and 2009 respectively, which provide support to acceptance  $H_{10}$ . The results showed that the efficiency of Islamic banks operates in Middle Eastern and non-Middle Eastern Counties have increased during an economic crisis. In addition, non-Middle Eastern Islamic banks showed a better efficiency score than Middle Eastern Islamic Banks during 2008.

Table 8: t-Test Results: Hypothesis 1

		2006	2007	2008	2009
Middle Eastern Islamic Banks	Mean	0.57	0.72	0.79	0.79
Non Middle Eastern Islamic Banks	Mean	0.78	0.79	0.81	0.79
Differences					
T Value		2.501	0.871	0.264	0.061
p Value		0.008	0.194	0.396	0.476

Note: \* $p < 0.05$

### 6.3 Hypotheses 2

The research question asked are Islamic banks stable and efficient during a during the financial crisis beginning in 2006. The second hypothesis addressed the comparison between large Islamic and small to medium Islamic banks. The second null hypothesis predicted that, for the both samples, no difference existed in the in efficiency between large Islamic and small to medium Islamic banks during an economic crisis. To address this hypothesis, the purpose of Table 9 is to display the results of the  $t$  test result of the different in the efficiency. The comparison of the efficiency for the years 2006, 2007, 2008, and 2009 were statistically significant. The P values for the efficiency were .0.150, .165, .401 and .281, respectively, which provided support to acceptance  $H_2O$ . Large Islamic banks showed an increase in efficiency during 2006 to 2008 and decline during 2009. However, as Table 9 shows, small to medium Islamic bank sample started at a lower level of efficiency.

Table 9: t-Test Results: Hypothesis 2

		2006	2007	2008	2009
Large Islamic Banks	Mean	0.71	0.79	0.79	0.76
Small to Medium Islamic banks	Mean	0.62	0.72	0.81	0.81
Difference					
T Value		1.046	0.984	0.253	0.584
p Value		0.150	0.165	0.401	0.281

Note: \* $p < 0.05$

## 6.4 Recommendations for Further Study

The study is one of the few studies with a focus on the measurement of the efficiency for Islamic banks with different size and region during a financial crisis. The purpose of the research was to reveal the deference in the efficiency in Islamic banks. In addition, the study results were intended to show that size and region of an Islamic bank could influence the efficiency of that bank during financial troubles. Researchers of forthcoming studies could consider other factors that may affect the efficiency. Such studies would add to the literature and increase the understanding of Islamic banks size and the region of an Islamic bank, as well as the effect these variables has on the efficiency of an Islamic bank during a financial crisis.

## 7 Summary and Study Conclusions

The purpose of this study was to increase the understanding of the efficiency of Islamic banks different sizes and regions during a financial crisis.

The researcher compared Islamic banking system in Middle Eastern and non-Middle Eastern countries, with the relationship between efficiency of banks during the poor economic period of 2006 through 2009. The researcher of used the DEA model to measure the efficiency of these Islamic banks. The study results answered the research question: Are Islamic banks stable and efficient during a financial crisis? Two null hypotheses were tested:

H<sub>20</sub>: There is no difference in the efficiency between Islamic banks operate in Middle Eastern and non-Middle Eastern Counties during an economic crisis.

H<sub>2a</sub>: There is difference in the efficiency between Islamic banks operate in Middle Eastern and non-Middle Eastern Counties during an economic crisis.

H<sub>20</sub>: There is no difference in the efficiency between small and large Islamic banks during an economic crisis.

H<sub>1a</sub>: There is a difference in the efficiency between small and large Islamic banks during an economic crisis.

The purpose of the results of the study was to show that Islamic banks experience difference in efficiency due the size and region of that bank during a financial crisis. In addition, the objective of the study results was to illustrate that the size of a bank would affect the efficiency during financial troubles. Large Islamic banks showed an increase in efficiency during 2006 to 2008 and decline during 2009. However, small to medium Islamic bank sample started at a lower level of efficiency. In addition, the results showed that the efficiency of Islamic banks operates in Middle Eastern and non-Middle Eastern Counties have increased during an economic crisis.

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