Efficiency Analysis in Islamic Banks: A Study for Malaysia and Turkey

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Abstract

In this paper, a comparison of scale efficiency, efficiency changes and total factor productivity change were conducted using the set of indicators composed of balance sheet data of 22 Islamic banks. For the period of 2009-2011, data of four banks operating in Turkey and 18 banks operating in Malaysia were used. Data Envelopment Analysis is used in the study for measuring efficiency, and Malmquist Total Factor Productivity Index is used for measuring efficiency changes and total factor productivity changes. It was determined that banks in Turkey had scale efficiency averages higher than those in Malaysia in 2009, and lower than those in Malaysia in 2010 and 2011. The change in the total factor productivities of banks in the period 2010-2011, compared to the period 2009-2010, has resulted as a decrease for Turkey and an increase for the banks in Malaysia except for 3 banks.

Key Words: *Islamic Banking, Data Envelopment Analysis, Scale Efficiency, Malmquist Total Factor Productivity Index, Malaysia, Turkey.*

JEL Classification: *G14, G21*

Özet - İslami Bankaların Etkinlik Analizi: Malezya ve Türkiye Örneklerinin İncelenmesi

Bu çalışmada; İslami bankalardan oluşan 22 bankanın bilanço verilerinden oluşturulmuş göstergeler seti kullanılarak ölçek etkinliği, etkinlik değişimleri ve toplam faktör verimlilik değişimi karşılaştırılması yapılmıştır. 2009-2011 dönemi için, Türkiye'de faaliyet gösteren 4 ve Malezya'da faaliyet gösteren 18 İslami bankanın verilerinden yararlanılmıştır. Etkinliğin ölçülmesinde Veri Zarflama Analizi; etkinlik değişimleri ve toplam faktör verimlilik değişimi ölçümünde ise Malmquist Toplam Faktör Verimlilik Endeksi kullanılmıştır. 2009 yılında Türkiye bankalarının, Malezya'daki bankalara göre ölçek etkinlik ortalamalarının yüksek, 2010 ve 2011 yıllarında ise düşük olduğu sonucuna ulaşılmıştır. 2009-2010 döneminden 2010-2011 dönemine göre bankaların toplam faktör verimliliklerindeki değişim ise Türkiye için düşüş, Malezya için 3 banka dışındaki diğer bankalarda artış ile sonuçlanmıştır.

Anahtar Kelimeler: *İslami Bankacılık, Veri Zarflama Analizi, Ölçek Etkinliği, Malmquist Toplam Faktör Verimlilik Endeksi, Malezya, Türkiye.*

JEL Sınıflandırması : *G14, G21*

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1. Introduction

Islamic banking, which emerged in the 1970s and spent its infancy in the 1980s, evolved in the 1990s into a rapidly developing system. Today, it continues to exhibit a rapid development in terms of its instruments and its currency. One of the most interesting points in this rapid development is that the system attracts considerable attention in countries with low Muslim populations. Another striking point is that Islamic banks are more resistant to crises than other conventional (commercial) banks. Not only is this a fact demonstrated by studies, it is also a common opinion the reason of which is investigated by international institutions. These two points provide clues about the future development of Islamic banking in the medium and long term. While Islamic banking is referred to in the world as interest-free banking, it is called participation banking in Turkey.

In the study, using BCC input-oriented DEA (Data Envelopment Analysis) and Malmquist TFP (Malmquist Total Factor Productivity Index), it was aimed to compare the efficiencies and productivities of Islamic banks operating in Turkey and Malaysia for the period of 2009-2011. First, the Malaysian version of Islamic banking is one of the most developed banking systems in the world today. Malaysia is a pioneering country in terms of the volume of Islamic funds, fund management, sukuk and interest-free insurance operations. In these issues, Turkey takes Malaysia as a model. In 2012, a memorandum of understanding was signed between The Participation Banks Association of Turkey and the Islamic Banks Association of Malaysia, and the cooperation in interest-free banking has started between the two countries. Another important motive is to compare the efficiency and productivity of Islamic banking in Turkey with a prominent country in terms of Islamic banking. In the literature review, no study was found with the specific purpose of comparing the efficiencies of Turkish Islamic banks with Islamic banks in other countries. Therefore, our study will be an original contribution to the literature.

For these purposes, the study firstly presents a literature review on efficiencies and productivities of Islamic banks along with the history and development of Islamic banking in these two countries. Then, the DEA method is explained. The application, according to DEA, is examined under two subheadings. In the first one, scale efficiency results for the input-oriented variable-yield returns to scale BCC model were obtained. In the second, change results were found through Malmquist TFP method. Finally, analysis results were evaluated and interpreted.

2. Islamic Banking in Malaysia and Turkey

"Islamic banking" keeps finding itself a wider sphere of practice in the world every passing year. Today, nearly 300 Islamic banks in 80 countries of 5 continents serve savers and entrepreneurs. Of these banks, 40% operate in Arabic countries including the Gulf region. This high interest in Islamic banking increases the volume of interest-free finance by more than 20% every year (http://www.tkbb.org.tr).

Some households' abstention from the financial system due to religious concerns over interest renders their savings idle. For this reason, the Islamic banking system was formed in order to bring these idle savings into the economy. Although there are differences in terms of the execution of Islamic banking between countries and banks, interest is strictly forbidden. Other pillars of the system are that business and commercial activities are based on fair and legitimate profit, and that monopolism and hoarding are forbidden.

Researches demonstrate that interest-free banking dates back to Hammurabi, who ruled in Babylon 2123–2081 B.C. However, first Islamic banks that operate on the basis of profit and loss sharing in the modern sense emerged in the 1970s. The first Islamic bank in the world started to operate in Egypt in 1971. The purpose of Islamic banks is to apply Islamic principles to the economic life, to establish a balanced financing system and thus to make profits (Güney, 2011).

The only country in the world whose banking system is shaped exclusively on an interest-free basis is Iran. In other countries a hybrid system is applied and the traditional banking system is operated together with the no interest financial system. The general opinion of Islamic banks in the world is that one of the most important aims of Islamic banking is to equally distribute socioeconomic welfare and income. Moreover, among other purposes of the system are rendering money a reliable unit of account and attaining stability in its value. It is seen that purposes and functions of Islamic banking are similar to those of conventional banks. However, Islamic banks use the funds they collect for various activities that are permissible in the Islamic law and that have been used for centuries. Besides, Islamic banks argue that their distinction lies in their emphasis on spiritual values and socioeconomic justice.

After Pilgrims Fund Board (Tabung Haji) was established in 1963 and the Bank Islam Malaysia Berhad (BIMB) was founded in 1983, the era of Islamic banking began in Malaysia. The model, which was initially created as an alternative to conventional banking in order to meet the country's financial needs, eventually became a complementary to the system. There are 24 Islamic banks in Malaysia (10

domestic banks, 2 development financial institutions, 9 locally incorporated foreign banks operating and 3 International Financial Institutions) (http://aibim.com).

Malaysia's Islamic banking experience did not only influence its neighbouring countries. Turkey is among the countries which have been influenced by this trend in other geographies.

The development of Islamic banking in Turkey started after 1983. In 1985, private financial institutions were opened in Turkey. The word "private" meant that these institutions' capitals were private rather than public, whereas the word "finance" meant that these institutions were intermediaries of financial markets. With the Banking Law enacted in 2005, these institutions were given the umbrella name of participation banks. Today, four participation banks operate in Turkey, of which two are based on domestic capital and the other two have majority of foreign capital (Polat, 2011).

In Malaysia, the share of Islamic banking within the entire banking system is around 18%. In this respect, Malaysia is the country with the largest volume of Islamic banking in the Far East. In Turkey, on the other hand, the share of Islamic banking is around 5% (http://www.tkbb.org.tr). The number of Islamic banks in Turkey is expected to rise in the short run. The statements given by policy-makers are formalizing the expectations in this regard. The statements are given because public banks shall start providing Islamic banking services with a license obtained from Banking Regulation and Supervision Agency (www.dunya.com, www.finansgundem.com, www.finansalgelisim.com).

3. Literature Review

In the literature, we see studies comprising comparisons regarding the efficiencies of Islamic banks in two separate types. Either Islamic banks from different countries are analyzed (e.g. Viverita and Skully, 2007) or the efficiencies of commercial banks and Islamic banks in the same country or different countries and regions are compared (e.g. Masruki et al., 2010; Bader et al., 2008). Behind the inter-country results, differences in the economic and social structure of the countries as well as differences in the methods the banking industries are operated by are in question. While these differences affect the results of the analysis, the input and output variables taken as well as the selection for the method used become important. DEA aims to compare the efficiencies of decision making units (DMU) in the same field of activity. To that end, DEA models assume that DMUs are similar. As Islamic banks must follow the same Islamic Principles regardless of location, this is a reasonable

assumption. Regarding the comparison results of commercial and Islamic banks, the differences in the operation and balance sheet items, provision of funds, investment fashion and development process of banks may affect the results and reliability of the analysis. Consequently, these possible effects may also come into question both in the comparison of banks from different countries and different types of banks in the same country.

There exist studies in Turkey on the efficiency and productivity of Islamic banks. These studies, in general, compare efficiencies of interest-free banks and conventional banks. Arslan and Ergeç (2010) measured the efficiencies of four Islamic banks and 26 conventional banks in Turkey using DEA. In their study which covered the period of 2006-2009, they found that the Islamic banks performed better. Parlakkaya and Çürük (2011) investigated whether a distinction between Islamic and conventional banks in Turkey is possible on the basis of their financial characteristics using 23 financial ratios. In this study, in which they used the Logit analysis method, they found that both types of banks have different operational activities. Er and Uysal (2012) comparatively analyzed Islamic and conventional banks for the period of 2005-2010. Efficiency levels of four Islamic and 26 conventional banks were measured through DEA. They found that the total efficiency score of Islamic banks were higher in the selected period. Yayar and Baykara (2012), on the other hand, measured the efficiencies and productivities of four Islamic banks in Turkey using the TOPSIS method. They determined that Albaraka Türk is the most efficient bank, whereas Bank Asya is the most productive one.

There are studies aiming to measure the efficiencies and productivities of the banks working on the principle of no interest in Malaysia and other Islamic countries, just like the studies conducted for Turkey. In these studies comparisons are made either with the traditional banks within a country or with the Islamic banks in other countries. These international studies are reviewed below.

Samad (1999) is one of the first researchers who investigated the efficiency of the Malaysian Islamic banking industry. In the study, Samad examined the relative performances of full-fledged Malaysian Islamic banks by comparing them with those of conventional banks. He used the weighted ratio analysis approach, and found that the administrative efficiencies of conventional banks for the period of 1992-1996 were higher than those of Islamic banks. He also found that profits obtained from Islamic banks either through the utilization of deposits or funds on credit were lower. His administrative test results showed that administrative efficiencies of conventional banks were higher than those of Islamic ones.

Samad and Hassan (1999) examined the performance of Islam Malaysia Berhad Bank for the period of 1984-1997 through financial ratio analysis. It was found, when compared to eight conventional banks, that Islam Malaysia Berhad Bank was more liquid and less risky. In their analyses based on primary data, they attempted to determine why credits provided under profit sharing and joint venture profit sharing were not popular in Malaysia. They found that the main reason of the slow growth of the credits was the incompetency of bankers who are experts in selecting, evaluating and managing profitable projects. They also found that Islamic banks performed better than conventional ones in terms of liquidity and riskiness.

Hussein (2003) analyzed the cost efficiencies of Sudanese Islamic banks between 1990 and 2000. Using stochastic cost frontier approach, he estimated operational efficiencies of 17 sample banks, and found that small banks in Sudan were more productive than bigger ones. He also found that foreign banks, despite their smaller scales, were more efficient than public banks and joint-ownership banks. He determined that the Islamic banks in Sudan do not create inefficiency themselves.

Yudistra (2004) examined the technical and scale efficiencies of 18 Islamic banks for the period of 1997-2000 using DEA and the intermediation approach while determining input-output variables. Yudistra found that although Islamic banks experienced a slight inefficiency during the 1998-1999 global crisis, they performed very well after the crisis. He argued that the Middle Eastern Islamic banks are less efficient when compared to their counterparts outside the region. Besides, it was found that the market power which is widespread in the Middle East does not seriously affect efficiency, because of the facts that Islamic banks outside the Middle East are relatively new and they are largely supported by their respective regulatory authorities. In this respect, he found that the main source of difference between banks is factors specific to countries. Another finding is that publicly-held Islamic banks are less efficient than other Islamic banks.

Viverita and Skully (2007) examined territorial and regional efficiency variances of Islamic banks operating in Africa, Asia and the Middle East using the Malmquist DEA method for 1998-2002 period. While Indonesia and Yemen were found to be the most developed countries, Asia was found to be the most developed region. United Arab Emirates and the Middle East were found to be the country and the region, which utilize input and output resources most efficiently for efficiency change. In the end, it was determined that Indonesian banks are the most technically efficient banks, Asia is the most efficient region, and banks in Africa show lower performances compared to banks in other regions.

Sufian (2007) examined the efficiency of the Malaysian Islamic banking industry for the period of 2001-2005 using the non-parametric DEA method. He used two different approaches in order to show how efficiency scores differed through changes in inputs and outputs. In order to examine the impact of the risk factor upon the efficiencies of Islamic banks, he included the management of problematic credits in the analysis as a nondiscretionary input. One of his findings is that scale efficiency in the Malaysian Islamic banking industry is of higher importance than pure technical efficiency. Another one is that foreign Islamic banks show higher technical efficiency than domestic Islamic banks.

Bader et al. (2008) collected data from 43 Islamic and 37 conventional banks in 21 countries for the period of 1990-2005 in order to measure and compare their cost, revenue and profit efficiency using DEA. Using static and dynamic panels, they evaluated these banks' average and over time efficiencies in terms of scale, age and region. They determined that the productive use of resources is insufficient for both types of bank and thus resource efficiency should be improved. Another important finding of theirs is that there exists no significant difference between the general efficiency values of Islamic and conventional banks. They focused on the period of 1996-2005, in which significant transformations occurred in the banking system. For this reason, they emphasized on the importance of the findings obtained about efficiency changes in the banking system and efficiency analyses on different scales, ages and regions for the given period. They underlined that these findings provide important inputs for rendering the banking industry globally more competitive and for reviewing the necessary guiding principles.

Siraj and Sudarsanan Piillai (2012) compared the efficiencies and effectiveness of Islamic and conventional banks in the GCC (Gulf Cooperation Countries) region for the period of 2005-2010. They found that Islamic banks are financed by more equity capital. Conventional banks increased their revenues during the given period; however, they failed to attain an increasing profitability in higher collateral accounts for credit and impairment losses. Financial crisis, on the other hand, affected Islamic banks in the addressed countries less than their conventional counterparts. It affected Islamic banks especially in the period of 2008-2009, whereas its influence on conventional banks was seen starting from 2007. Although a decline was observed in the revenues and selected indicators of Islamic banks during the crisis, it was minimal when compared to conventional banks.

Said (2013) examined the efficiency of Islamic banks in the MENA (Middle East and North Africa) region for the period of 2006-2009 through the non-parametric

DEA method. Risk analysis was performed and the Pearson Correlation Coefficients were used. According to the results, credit risk and operational risk are negatively correlated with efficiency. On the other hand, liquidity risk shows a non-significant correlation with efficiency.

Beck et al. (2013), using a data set composed of balance sheet and income statement data of Islamic and conventional banks from 22 countries, compared the business models, efficiency, asset qualities and stabilities of conventional and Islamic banks for the period of 1995-2009. They found that Islamic banks were less efficient, but they had higher intermediation ratios and asset qualities. Moreover, Islamic banks are better capitalized than conventional ones. Without ignoring differences among countries, they also found that Islamic banks performed better than conventional ones in crisis times in terms of capitalization and asset quality.

4. Methods

DEA is a method through which performance is measured. The main purpose of performance measurement is to increase efficiency. Performance measurement provides organizations with information regarding what additional improvements should be made in order to attain the best performance in efficiency (Thanassoulis, 2003).

DEA is a typical non-parametric method for measuring efficiency by evaluating all the input and output combinations of the companies in the sample and generating efficiency frontiers (Luhnen, 2009: 488). DEA is a comparative efficiency measurement method used for homogeneous groups. It measures comparative efficiency by comparing each unit's efficiency (Thanassoulis, 2003). DEA compares the efficiencies of similar decision units that operate in the same field. It develops the efficiency frontier by weighting inputs and outputs. Efficiency takes a value between 0 and 1. Efficiency is expressed as 1 in the efficiency threshold of decision units. A higher value means a higher efficiency (Chhikara and Rani, 2012).

The method, firstly employed in 1978 by Charnes, Cooper and Rhodes. Inspired from the first letters of the researchers' names, it is called the CCR model and it works under the assumption of constant returns to scale. The model aims to detect the efficiencies of DMUs with multi-inputs and multi-outputs. CCR Model comprehends technical and scale efficiency through optimum values in the ratio form obtained directly from the data and/or the relationships between the input and output being expressly characterized functionally without a need for possible explanations of the weights (Charnes et al., 1978; Banker et al., 1984).

The variable returns to scale model developed by Banker, Charnes and Cooper (1984) has taken the names of the researchers and appears in the literature as the BCC model. In the studies conducted by Banker, Charnes and Cooper (1984), a differentiation between technical efficiency and scale efficiency is established by the model developed without last conditions of change for the usage of DEA directly on the observation data. To obtain the best possible output level, technical inefficiency is defined as failures and/or excessive usage of outputs (Banker et al., 1984).

CCR method can't find the DMUs efficient because it can't provide scale efficiency while measuring the total efficiency under constant returns to scale. Compared to the CCR model, BCC model can find the DMUs efficient because it can measure the technical efficiency and scale efficiency scores independently under variable returns to scale. For a DMU to be efficient in constant returns to scale, it should have technical efficiency and scale efficiency (Sufian, 2007). In constant returns to scale, the efficiency may be found to be lower. Therefore, variable returns to scale BCC model is used in the study. Moreover, BCC model may be applied in two different ways, as input or output driven. If there is little or no control over the inputs, the output driven model, and if there is little or no control over the outputs, the input driven model should be preferred. In banking, focus is given on the expenses and principally there is a tendency for determining the outputs (Sufian, 2007; Özden, 2008). For this reason, the input driven BCC model is used in the study because banks have more control over the inputs selected.

Dual formation of this model is as follows (Banker et al., 2004):

$$\max \sum_{r=1}^{s} u_r y_{ro} - u_o \qquad\qquad (1)$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} - u_o \leq 0$$

$$j=1,.....,n,$$

$$\sum_{i=1}^{m} v_i x_{io} = 1$$

$$u_r \geq \varepsilon, v_i \geq \varepsilon; u_o \, free$$

expressions in the equation number (1);

max: maximization

u_r : weight assigned to the rth output by the decision unit o ,

v_i : weight assigned to the ith input by the decision unit o,

y_{ro} : the rth output produced by the decision unit o,

x_{io} : the ith input used by the decision unit o,

y_{rj} : the rth output produced by the decision unit j,

x_{ij} : the ith input produced by the decision unit j,

ε : positive small value

Efficiency is obtaining the desired amount of output with the least amount of input possible. Productivity is the relationship between products and services rendered within a certain period and resources utilized for rendering these outputs within the same period. Productivity is efficient utilization of the outputs utilized in the production process. Technical efficiency is the capacity and willingness of an economic unit for producing the highest output possible with data input technology basket. Scale efficiency may be defined as closeness to the most efficient scale size. Scale efficiency shows the achievement of a bank in rendering services on the appropriate scale. The portion of the total efficiency resulting from technical efficiency and the portion resulting from scale efficiency is calculated by the scale efficiency scores. Scale efficiency is calculated by the ratio of the value of technical efficiency (CCR) to pure technical efficiency (BCC). The change in scale efficiency yields the degree of achievement in reaching the most efficient production amount (Keskin Benli, 2006; Bozdağ, 2008; Behdioğlu and Özcan, 2009; Keçek, 2010).

The Malmquist TFP index method measures the variations in inputs and outputs. It is one of the methods frequently used in productivity changes. The method is used to distinguish productivity changes within technical efficiency changes. Malmquist total factor productivity (TFP) index measures the change in total factor productivity between two data points by calculating the ratios of the differences in each data point according to the common technology.

The formula of the method is as follows (Fare, 1988; Fare et al., 1994):

$$M_0(x^{t+1}, y^{t+1}, x^t, y^t) = \sqrt{\left[\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \times \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^t, y^t)} \right]}$$

(2)

The equation number (2) symbolize the productivity point relative to the production point and it is geometric mean of two TFP indices. $D_0^t(x, y)$ expresses the difference of observation in period t+1 from the technology in period t.

If the unit has a higher M value, it means that a positive TFP growth is observed from t to t+1. Otherwise, if M is lower than 1, it means that TFP has declined. If M is equal to 1, it means that TFP has remained constant (Grifell-Tatje and Lovell, 1995; Raphael, 2013).

This equation may be expressed as follows (Fare et al., 1994):

$$M_0(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \sqrt{\left[\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \times \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right]}$$

(3)

The ratio within the square root is the scale of the change in output driven technical efficiency between period t and period t+1. The expression in the square root is a scale of technological change. It expresses the change in technology between two periods.

5. Data

There are 4 banks in Turkey that operate on the basis of Islamic principles. In Malaysia, on the other hand, there are 10 domestic banks, 2 development financial institutions and 9 locally incorporated foreign banks operating and 3 International Financial Institutions. The BNP Paribas Malaysia Merhad, which is among locally incorporated foreign banks, was opened in 2011, which is why it was not included in the sample. In the study, 10 domestic bank ve 8 locally incorporated foreign banks were included in the sample. Financial institutions were not included so as not to harm homogeneity. Table 1 shows the banks that constitute the sample.

Table 1: Sample of Study

Turkey	Malaysia (Domestic Banks)	Malaysia (Locally Incorporated Foreign Banks)
- Albaraka Türk - Bank Asya - Kuveyt Türk - Türkiye Finans	-Affin Islamic Bank Berhad -CIMB Islamic Bank Berhad -Hong Leong Islamic Bank Berhad -Alliance Islamic Bank Berhad -Bank Islam Malaysia Berhad -Public Islamic Bank Berhad -Maybank Islamic Berhad -Bank Muamalat Malaysia Berhad -AmIslamic Bank Berhad -RHB Islamic Bank Berhad	-Asian Finance Bank Berhad -Standard Chartered Saadiq Berhad -OCBC Al-Amin Bank Berhad -Al Rajhi Banking & Investment Corpn. Berhad -Bank of Tokyo-Mitsubishi UFJ (Malaysia) Berhad -Citibank Berhad -HSBC Amanah Malaysia Berhad -Kuwait Finance House (Malaysia) Berhad

In the study, the BBC model input-oriented DEA method was used to measure efficiency. The DEAP-XP software was used in the execution of the method. Data regarding inputs and outputs were collected from operational reports and balance sheets published by the banks. In the analysis, scale efficiencies of sampled banks were determined for the period of 2009-2011. Total assets and equities constituted the inputs of the study; whereas total deposits and period net income/loss were the outputs. While the inputs and outputs selected are used based on the literature [Siraj and Sudarsanan Pillai (2012), Sufian (2007), Viverita and Skully (2007)], they are important items for banking of a subjective nature. Because balance sheet structures of the Islamic banks in Turkey and Malaysia are different, providing a common structure in the inputs and outputs is intended by taking the main items. Different results may be achieved by diversifying the input and output variables used and expanding the period analyzed.

Table 2: Data Used in the Study

Period	Inputs	Outputs	Methods
2009-2011	-Total assets -Total equity	-Total deposits -Period net income/loss	- The BBC model input-oriented DEA

The variables are converted into US dollars using yearly avarega rates. Deflated by the Consumer Price Index of each country in order to take account of macroeconomic differences across countries. 2003 was taken as the base year for both countries in Consumer Price Index.

Asian Finance Bank Berhad declared losses in 2010 and Kuwait Finance House (Malaysia) Berhad declared losses in 2009-2011. Since negative values cannot be subjected to analysis in DEA, periodical net profit/loss variables were normalized using the following formula (Budak, 2011):

$$\frac{X_{j} - X_{j\min}}{X_{j\max} - X_{j\min}} \tag{4}$$

expressions in the equation number 4;

X_{j} : rth output value of jth decision unit,

$X_{j\min}$: minimum r value; $X_{j\max}$: maximum r value

6. Findings

The application was addressed under three headings according to the DEA method. In the first one, efficiency results according to the input-oriented variable returns to scale BCC model were obtained. In the second results of the sensitivity analysis then change results were obtained through the Malmquist TFP method. Results of these analyses were evaluated and interpreted.

6.1. Scale Efficiency According to the BCC Input-Oriented DEA Method

Using the input-oriented, variable returns to scale BCC model; scale efficiency data of Islamic banks in Turkey and Malaysia for the period of 2009-2011 were obtained. Table 3 shows these results.

**Table 3: Scale Efficiency Scores of Islamic Banks in Turkey and Malaysia**

		2009	2010	2011
Turkey Islamic Banks	Albaraka Türk	0,983	0,968	0,814
	Bank Asya	0,993	0,870	0,878
	Kuveyt Türk	0,982	0,935	0,809
	Türkiye Finans	0,988	0,895	0,742
	Average Efficiency	0,987	0,971	0,811
	Percentage of Efficiency	98,7%	97,1%	81,1%
	Number of Efficient Bank	0	0	0
Malaysia Domestic Banks	Affin Islamic Bank Berhad	0,968	0,987	1
	CIMB Islamic Bank Berhad	1	1	1
	Hong Leong Islamic Bank Berhad	0,979	0,985	1
	Alliance Islamic Bank Berhad	0,949	0,999	0,998
	Bank Islam Malaysia Berhad	1	0,978	0,962
	Public Islamic Bank Berhad	0,998	1	0,944
	Maybank Islamic Berhad	0,926	0,873	1
	Bank Muamalat Malaysia Berhad	0,992	0,993	0,999
	AmIslamic Bank Berhad	0,993	0,995	0,984
	RHB Islamic Bank Berhad	0,986	0,990	0,999
	Average Efficiency	0,979	0,980	0,989
	Percentage of Efficiency	97,9%	98%	98,9%
	Number of Efficient Bank	2	2	4
Malaysia Locally Incorporated Foreign Banks	Asian Finance Bank Berhad	0,886	0,948	1
	Standard Chartered Saadiq Berhad	0,949	1	0,975
	OCBC Al-Amin Bank Berhad	0,943	1	1
	Al Rajhi Banking & Investment Corpn. Berhad	0,962	0,978	0,995
	Bank of Tokyo-Mitsubishi UFJ (Malaysia) Berhad	0,964	0,930	0,749
	Citibank Berhad	0,904	0,906	0,866
	HSBC Amanah Malaysia Berhad	0,952	0,981	0,985
	Kuwait Finance House (Malaysia) Berhad	0,982	0,976	0,946
	Average Efficiency	0,943	0,965	0,940
	Percentage of Efficiency	94,3%	96,5%	94%
	Number of Efficient Bank	0	2	2
	Total Average Efficiency	0,976	0,963	0,938
	Total Percentage of Efficiency	97,6%	96,3%	93,8%
	Total Number of Efficient Bank	2	4	6

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According to the results obtained, average efficiencies of banks in Turkey decreased from 2009 to 2011 (98.7% in 2009, 91.7% in 2010, 81.1% in 2011). None of the banks in Turkey were efficient in the given period. The most efficient bank in 2009 was Bank Asya (99.3%), in 2010 was Albaraka Türk (96.8%) and in 2011 was Bank Asya (87.8%).

On the other hand, average efficiencies of Malaysia domestic banks increased in 2009-2011 (97.9%, 98%, 98.9%, respectively). Two banks (CIMB Islamic Bank Berhad, Bank Islam Malaysia Berhad) in 2009, two banks (CIMB Islamic Bank Berhad, Public Islamic Bank Berhad) in 2010, and four banks (Affin Islamic Bank Berhad, CIMB Islamic Bank Berhad, Hong Leong Islamic Bank Berhad, Maybank Islamic Berhad) in 2011 were efficient. CIMB Islamic Bank Berhad retained its efficiency in all the three years.

Average efficiency of Malaysia Locally Incorporated Foreign Banks was 94.3% in 2009, 96.5% in 2010, and 94% in 2011. No bank was efficient in 2009, whereas two banks (Standard Chartered Saadiq Berhad, OCBC Al-Amin Bank Berhad) were efficient in 2010, and two banks (Asian Finance Bank Berhad, OCBC Al-Amin Bank Berhad) were efficient in 2011. It is seen that the efficiency of OCBC Al-Amin Bank Berhad was maintained in 2010 and 2011.

Graph 1: Average Scale Efficiencies of Banks
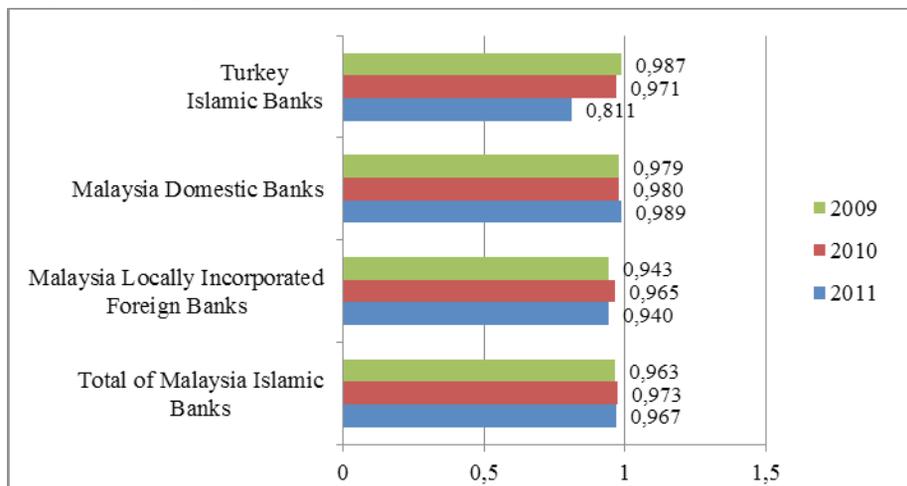
When average scale efficiencies of the included banks are compared by way of the Graph 1; it is seen that Turkey's average is higher in 2009. In 2011, efficiencies of the banks in Turkey are at their lowest.

6.2. Sensitivity Analysis

Sensitivity analysis provides to the managers of decision making units (DMU) the extent their inputs and/or outputs should be changed. When these changes are materialized it will be possible to provide efficiency in inefficient units (Kasap, 2011). Because the Input Driven BCC model taken into account in the analyses conducted through DEAP-XP software is based on the assumption that the outputs remain constant, only the inputs are included in the Table 4 displaying the results of the sensitivity analysis. As it may be reviewed in the Table 4, while no changes have been observed in banks providing pure technical efficiency (vrste=1), it has been detected that the input values of banks with pure technical inefficiency should be decreased.

Table 4: Results of the Sensitivity Analysis

	2009			2010			2011		
	vrste	Total Assets Change %	Total Equity Change %	vrste	Total Assets Change %	Total Equity Change %	vrste	Total Assets Change %	Total Equity Change %
Albaraka Türk	0,972	-2,82	-18,22	0,950	-5,01	-6,84	1	-	-
Bank Asya	1	-	-	0,979	-2,10	-18,11	0,839	-16,18	-40,13
Kuveyt Türk	0,927	-7,26	-7,81	0,918	-8,23	-18,93	0,864	-13,62	-13,62
Türkiye Finans	0,944	-5,55	-19,91	1	-	-	1	-	-
Affin	0,989	-1,08	-1,08	1	-	-	1	-	-
CIMB	1	-	-	1	-	-	1	-	-
Hong Leong	0,946	-5,37	-38,48	0,929	-7,08	-39,33	1	-	-
Alliance	1	-	-	0,944	-5,58	-5.6	1	-	-
Bank Islam	0,978	-2,17	-33,82	0,992	-0,77	-20,93	0,942	-5,76	-26,74
Public	1	-	-	1	-	-	1	-	-
Maybank	0,944	-5,55	-7,17	1	-	-	1	-	-
Bank Muamalat	0,932	-6,80	-50,24	0,962	-3085	-46,55	0,906	-9,43	-12,26
AmIslamic	0,922	-7,82	-21,66	0,868	-13,16	-36,52	0,857	-14,32	-19,66
RHB	0,960	-3,98	-35,11	0,991	-0,94	-38,44	0,940	-6,02	-6,02
Asian Finance	1	-	-	1	-	-	1	-	-
Standard Chartered	0,990	-1,01	-1,01	1	-	-	1	-	-
OCBC Al-Amin	1	-	-	1	-	-	1	-	-
Al Rajhi	0,943	-5,71	-48,71	0,974	-2,57	-24,71	0,950	-4,97	-19,53
Bank of Tokyo M.	0,861	-13,88	-28,29	0,860	-14,01	-27.42	0,887	-11,29	-21,61
Citibank	1	-	-	1	-	-	1	-	-
HSBC Amanah	0,958	-4,20	-42,67	0,971	-2,90	-24,56	0.967	-3,31	-7,53
Kuwait Finance	0,793	-20,69	-78,85	0,808	-19,20	-76,61	0,820	-17,97	-46,77

For example, when the results of Albaraka Türk bank for 2009 are reviewed, it may be observed that the total assets value should be decreased by 2.82% and the total equity value by 18.22%. Comments may be made on other banks as well, according to the percentages of change included in the Table 4.

Having analyzed the Table 4, it can be seen that Islamic banking sector in Turkey should operate with less amount of total equity in order to improve their efficiency. There are several reasons supporting this assumption. During the reconstruction period following the collapse of 1/3 of banks due to the economic crises of 2000 and 2001, banks resumed their operations with high capital adequacy ratios. As stated in Turkish Banking Sector interactive monthly bulletin of Banking Regulation and Supervision Agency, this ratio was generally over 20% before the global crisis. While this ratio is supposed to be kept over 8% according to the Basel II criteria, it was kept extremely high and it didn't fall below 15% even in the aftermath of global crisis in Turkey. While this situation decreases the vulnerability of Turkish banking sector, efficiency of the sector can be limited by this situation. Thus, in the light of the data obtained, it can be concluded that operating with lower capital adequacy ratios values can help to improve the efficiency of Turkish banking sector in parallel with the fading effects of global crisis.

6.3. Results Through Malmquist TFP Method

Malmquist TFP is an index that reveals Technical efficiency change (EFFCH), Technological Efficiency Change (TECHCH), Pure Technical efficiency change (PECH), scale efficiency change (SECH) and Total factor productivity change (TFPCH) (Raphael, 2013).

EFFCH and TECHCH indexes are components of TFPCH. A TFPCH value lower than 1 points to a decline in EFFCH and TECHCH, whereas a value higher than 1 indicates an improvement in EFFCH and TECHCH. PECH and SECH changes are components of EFFCH. Values of PECH and SECH above 1 suggest that decision units have attained administrative efficiency and produce in an appropriate scale. The technological change value represents the change in the technology used. The index is formulated as follows (Bozdağ, 2008; Lorcu, 2010):

$$(EFFCH)=(PECH) \times (SECH) \qquad\qquad (5)$$
$$(TFPCH)=(EFFCH) \times (TECHCH)$$

Through the Malmquist TFP index, banks' technical efficiency, technological efficiency, pure efficiency, scale efficiency and TFP changes were assessed. Table 5 shows Malmquist TFP index results.

Table 5: Change Results According to Malmquist TFP Method

	EFFCH		TECHCH		PECH		SECH		TFPCH	
	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011
Albaraka Türk	0,964	0,881	0,997	1,066	0,965	0,907	0,999	0,971	0,961	0,939
Bank Asya	0,980	0,879	0,997	1,066	0,982	0,902	0,998	0,975	0,977	0,937
Kuveyt Türk	0,980	0,823	0,997	1,066	0,979	0,852	1,001	0,966	0,977	0,877
Türkiye Finans	0,996	0,839	0,997	1,066	0,998	0,861	0,998	0,974	0,993	0,895
Affin	1,016	1,025	0,984	1,025	1,013	1,000	1,003	1,025	0,999	1,050
CIMB	1,000	1,000	0,771	0,893	1,000	1,000	1,000	1,000	0,771	0,893
Hong Leong	0,982	1,099	0,966	1,006	1,007	1,050	0,976	1,046	0,949	1,106
Alliance	0,955	1,026	0,997	1,066	0,945	1,074	1,010	0,955	0,952	1,094
Bank Islam	0,981	0,932	0,906	1,066	0,983	0,940	0,998	0,991	0,889	0,993
Public	0,989	0,946	0,997	1,066	0,992	0,953	0,998	0,993	0,986	1,009
Maybank	1,052	1,087	0,861	1,222	1,000	1,000	1,052	1,087	0,905	1,328
Bank Muamalat	1,031	0,929	0,955	1,066	1,041	0,946	0,991	0,981	0,985	0,990
Amlslamic	0,941	0,963	0,997	1,066	0,944	0,981	0,997	0,982	0,938	1,027
RHB	1,034	0,941	0,979	1,066	1,044	0,947	0,991	0,994	1,012	1,003
Asian Finance	0,986	0,916	0,997	1,066	1,00	1,000	0,986	0,916	0,983	0,978
Standard Chartered	0,952	0,978	0,986	1,066	0,969	1,009	0,982	0,969	0,938	1,042
OCBC Al-Amin	0,978	0,961	0,959	1,066	1,000	1,000	0,978	0,961	0,937	1,024
Al Rajhi	1,019	0,940	0,957	1,066	0,966	0,988	1,055	0,951	0,975	1,002
Bank of Tokyo M.	0,998	0,826	0,997	1,066	0,997	0,912	1,001	0,905	0,995	0,880
Citibank	0,975	0,965	0,997	1,066	0,882	0,971	1,105	0,994	0,972	1,029
HSBC Amanah	1,049	0,976	0,997	1,066	1,036	0,987	1,012	0,989	1,045	1,040
Kuwait Finance	1,000	1,000	1,038	1,194	1,000	1,000	1,000	1,000	1,038	1,194
AVERAGE	0,993	0,949	0,968	1,065	0,988	0,966	1,006	0,982	0,961	1,010

For the periods of 2009-2010 and 2010-2011; rises and declines are observed in banks' change values according to the Malmquist TFP method. For TFP change; the most notable rise in the given periods was in Maybank Islamic Bank, whereas the most notable decline belonged to Kuveyt Türk. Maybank Islamic Bank's productivity declined in 2009-2010 by 9.5%; however, its productivity rose by 32.8% in 2010-2011. On the other hand, Kuveyt Türk experienced a productivity loss by 2.3% in 2009-2010, and by 11.3% in 2010-2011. Table 6 shows banks' average change values according to the Malmquist TFP method.

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Table 6: Banks' Averages According to Malmquist TFP

	EFFCH	TECHCH	PECH	SECH	TFPCH
Albaraka Türk	0,922	1,031	0,936	0,985	0,950
Bank Asya	0,928	1,031	0,941	0,986	0,957
Kuveyt Türk	0,898	1,031	0,913	0,983	0,926
Türkiye Finans	0,914	1,031	0,927	0,986	0,943
Affin	1,020	1,004	1,007	1,014	1,024
CIMB	1,000	0,830	1,000	1,000	0,830
Hong Leong	1,039	0,986	1,028	1,010	1,024
Alliance	0,990	1,031	1,008	0,982	1,021
Bank Islam	0,956	0,983	0,961	0,995	0,940
Public Islamic	0,968	1,031	0,972	0,995	0,998
Maybank	1,069	1,025	1,000	1,069	1,096
Bank Muamalat	0,978	1,009	0,992	0,986	0,987
AmIslamic	0,952	1,031	0,962	0,989	0,981
RHB	0,987	1,021	0,994	0,993	1,008
Asian Finance	0,950	1,031	1,000	0,950	0,979
Standard Chartered	0,965	1,025	0,989	0,975	0,989
OCBC AlAmin	0,969	1,011	1,000	0,969	0,980
Al Rajhi	0,979	1,010	0,977	1,002	0,988
Bank of Tokyo-M.	0,908	1,031	0,954	0,952	0,936
Citibank	0,970	1,031	0,926	1,048	1,000
HSBC Amanah	1,012	1,031	1,011	1,001	1,043
Kuwait Finance	1,000	1,113	1,000	1,000	1,113
AVERAGE	0,971	1,015	0,977	0,994	0,985

Technical efficiencies of CIMB Islamic Bank Berhad and Kuwait Finance House (Malaysia) did not change. On the other hand, Affin Islamic Bank Berhad, Hong Leong Islamic Bank Berhad, Maybank Islamic Berhad and HSBC Amanah Malaysia Berhad attained production frontier. The biggest rise (6.9%) in technical efficiency belonged to Maybank Islamic Berhad, whereas the biggest decline (10.2%) was in Kuveyt Türk. In technological efficiency change; the biggest rise and decline are the following; Kuwait Finance House(Malaysia) Berhad (11.3%) and CIMB Islamic Bank Berhad (17%), respectively. Hong Leong Islamic Bank Berhad (2.8%) attained the highest rise in pure efficiency change, whereas Kuveyt Türk (8.7%) experienced the biggest decline. In scale efficiency change, Maybank Islamic Berhad (6.9%) experienced the highest rise, and Asian Finance Bank Berhad (5%) experienced the highest decline. In TFP change, on the other hand, the biggest rise belonged to HSBC Amanah Malaysia Berhad (4.3%) and the biggest decline was in Hong Long Islamic Berhad (17%).

On average, all banks experienced a productivity decline by 1.5%. This situation stems from the combination of the decline in technical efficiency change by 2.9% and the rise in technological efficiency change by 1.5%. The decline in technical

efficiency, on the other hand, stems from the decline in pure efficiency change by 2.3% and in scale efficiency change by 0,6%.

7. Conclusion

Islamic finance has been growing globally. Efficient operation of Islamic banks, which have a significant share in the financial system, is of utmost importance for the healthy development of many countries' economies.

In the study, efficiencies of Islamic banks in Turkey and Malaysia were compared and their current levels were determined. While commenting on the results of the study, it should be taken into consideration that the results display the efficiency scores in comparison with other banks.The comparison showed that Islamic banks in Turkey were not efficient for the years of 2009, 2010 and 2011. Efficiency average of banks in Turkey in 2009 (98.7%) and 2010 (97.1%) is very close to the efficiency level. In 2011, however, the efficiency of banks in Turkey (81,1%) is lower than that of banks in Malaysia, and this level declined from 2009 to 2011. Having a look at the data, it can be noted that there have been more severe declines in the efficiency level of Islamic banks in Turkey when compared to the Islamic banks in Malaysia between 2009 and 2011. The reason might be the fact that Turkish banking sector is more affected by the developments taking place in EU countries. As the global crisis transformed into public debt issues in EU countries in its second phase, economic bottlenecks in EU countries had a negative impact on the banks operating in Turkey. Especially the challenges faced in the renewal of syndication and securitization loans had caused considerable problems of banking sector between 2009 and 2011.

According to the Malmquist TFP method, productivities of Albaraka Türk, Bank Asya, Kuveyt Türk and Türkiye Finans declined in the period of 2009-2011. This decline was higher in 2009-2010 than in 2011-2012. The productivity decline of Albaraka Türk declined in 2009-2010 by 3.9%, and in 2010-2011 by 6.1%. The values of productivity decline for the other Islamic banks in Turkey are as follows for the periods of 2009-2010 and 2010-2011: Bank Asya (2.3% and 6.3%), Kuveyt Türk (2.3% and 12.3%), and Türkiye Finans (0.7% and 10.5%).

In summation, all Islamic banks in Turkey experienced in the given periods productivity declines. Besides, since their technical efficiency values are not above 1, it could be concluded that they do not produce in appropriate scales. It was also observed that values of the Islamic banks in Turkey came closer to those of the Islamic banks in Malaysia.

Malaysia sets an example for Turkey in terms of the magnitude of Islamic funds, fund management, insurance transactions without interest and sukuk. While a country with a large Islamic population, such as Turkey, is confronted by the rise of developing Islamic financial systems, it is observed that policy-makers take the models adopted by other countries as an example. Apart from this, a second approach is the practice where traditional banks may provide Islamic services with an Islamic perspective. Thus, Islamic banking system may be further developed in a way contributing to Islam achieve its principal socio-economic goals. At the same time, the system should continue to fulfill the traditional functions fulfilled by other banking systems pertaining to its field of activity.

It is important that the most efficient Islamic banks in other countries be analyzed in respect of input and output usage. This is because, by analyzing inter-country Islamic bank performances, identifying the countries having the most efficient Islamic banks may provide an orientation for policy-makers.

We think that our study, which aims to conduct an originial research by comparing the efficiencies of the Islamic banks in Turkey with those in Malaysia, may contribute to the literature. Besides, this paper may be advanced with studies in the future by diversifying the input and output variables used, expanding the period analyzed and including other Islamic countries besides Malaysia.

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