







## A COMPARATIVE STUDY OF OPERATIONAL EFFICIENCY OF PAKISTANI AND MALAYSIAN ISLAMIC BANKS: DATA ENVELOPMENT ANALYSIS APPROACH



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### ABSTRACT

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G24; G21; G30; F65.

This study compares the execution and potency of the Islamic banking operations currently practiced by Pakistan and Malaysia Islamic banks. In the 1980s both countries embarked their work on the Islamic banking system by using different entirely approaches. Malaysia adopted moderate solicitations towards the implementation of the Islamic financial system according to the shariah and law, which allows Islamic and the conventional banking system to operate on a parallel basis. On the other side, Pakistan engaged in converting the financial system in accordance with the Islamic shariah and law all at once. This study assays the approaches pursued by both countries towards the adoption of the Islamic banking system. For this meticulous prospect DEA (Data envelopment analysis), Malmquist total factor productivity index is used. To inspect the competency of the banks and further performance of these banks in comparison, eleven financial ratios are used in this study. We find that the productivity level of the Islamic banking system of Pakistan has increased as compared to the Malaysian Islamic banks by using data envelopment analysis.

**Contribution/ Originality:** This study contributes to the existing literature in a way that it contains execution and potency of Islamic banking operations currently practiced by Pakistan and Malaysia Islamic banks. This study is one of the very few studies which have applied the DEA approach specifically restricted to Pakistan and Malaysian banking structure.

## 1. INTRODUCTION

Islamic banking is one of the real facts, and it took valuable time to compete with the commercial and conventional banking system. The Islamic banking system is stationed on Islamic shariah and beliefs. The Islamic banking industry complies the Islamic shariah policy that is a reason these banks are free from Riba (Interest). Likewise, Islamic banks never devote in any genus of business which reflected to be as haram. Islamic banking uses its own perceptions of financing as profit sharing (Mudarabah), Safekeeping (Wadiah), Joint venture (Musharakah). Islamic banks are defined as "financial and investment services that are granted with the help of the financial institutions that follows the shariah and the Islamic codes along with Islamic values and kept themselves in the emulous environment, in addition to reach at a state where economy multiplies and provides the social and

economic return in order to achieve a superlative living standard for the Muslims among various countries of the world (Siddiqi, 2006).

Heterogeneous modes of financing occur in the context of the Islamic banking system. Multitudinous products and services are comparable in the Islamic banking system as products can be systematized in the sales based, equity-based, rental based, Joint venture or Musharakah. All products are under the strain of the equity-based instruments in which profit shares consonant to the pre-decided agreement while the loss distribution is based on the quota of the contribution. This was the first alacrity of Musharakah. It is primarily rigid a joint venture in which the client and the bank brought together in any business or property. Then the share is further divided into the multiple units, and the client continues to buy the share of those units over time. Surrogate type of Musharakah is Mudarabah in which a partner urges to invest money into the business which planned to be as “Rab-ul-Mal” while the management hugely relies on the agent (partner) who deemed to be Mudarib. Furthermore, happenings are done based on a pre-agreed ratio (Usmani, 2002). The key insight of our paper depends on the Islamic banking system, and the juxtaposition of Islamic system amid the banks of two countries named Pakistan and Malaysia. In this paper, we aim to check the efficiency and compartment of various Islamic banks under the time period of six years by proving data envelopment analysis.

### 1.1. Research Objective

The study observed the following objective:

To make a comparative analysis of Islamic banks between Pakistan and Malaysia with reference to Data envelopment technique to get the results in a substantial way apropos the performance of the banks.

### 1.2. Literature Gap

Historical background of the study symbolizes that much research has been done in this area. However, we pinpoint the qualitative and quantitative aspects. Our first contribution is towards qualitative research, as many researchers only had a hub on quantitative research. This study is designed to scrutinize two countries Islamic banking systems and their performances based on data envelopment analysis and because of financial ratios.

### 1.3. Hypothesis of the Study

#### Hypothesis 1

H<sub>0</sub>: There is no difference between the performance of the Islamic banks in Pakistan and Malaysia.

H<sub>1</sub>: There is a difference between the performance of the Islamic banks in Pakistan and Malaysia.

#### Hypothesis 2

H<sub>0</sub>: Islamic banks of Malaysia are competent as compared to the Islamic banks of Pakistan.

H<sub>1</sub>: Islamic banks of Pakistan are competent as compared to the Islamic banks of Malaysia.

The study is further divided as follows:

Section 2 presents an overview of the former studies in the configuration of a literature review. Section 3 approaches on the data and methodology being used. The rationale for the study, data set, a sample of the study, Hypothesis, analysis used in the study, Methodology, and variables measurement. Section 4, award results, descriptive data analysis based on variables being used, and data envelopment analysis. Section 5 epitomizes the integral study, the cessation, and eventual endorsements.

## 2. LITERATURE REVIEW

Lone and Rehman (2017) anticipated that Islamic banks are arbitrator alliances that take care of financiers' anticipations to keep the importance and yield to their monies unspoiled with the market vacillations. According to

their mediations rendered enhanced intuition about Islamic finance to another mend the diligence and obliged the humanity in a more fruitful way. Lone and Ahmad (2017) perused customer consummation in Islamic banks and Islamic banking windows with an allusion to their amenity eminence by means of the SERVQUAL model. Their outcomes revealed a refined appearance about full-fledged Islamic banks as professed by their clientele. Chowdhury *et al.* (2016) by applying the dynamic generalized method of moments (GMM), quantile regression and wavelet coherence approaches in the Gulf Cooperation Council, in order to regulate a comparative analysis of the internal and external determinants of the Islamic banks' profitability. As per their research, dynamic GMM inclines to designate that such as money supply and inflation are highly related to Islamic banks' performance like equity financing, operating efficiency, and macroeconomic variables. Conversely, bank-specific variables such as credit risk and equity ratio are not momentous at various percentiles.

Iqbal and Molyneux (2016); Bakar (2016) nonetheless, some have opposed this opinion seeing that corporate social responsibility cannot be accounted for expediency – both are dispersed. Correspondingly, researches that intended to know consumers' observation and gages of choosing an Islamic bank have encompassed expediency as one of the important rudiments. Imam and Kpodar (2016) in the fortitude of the expediency of Islamic banking, maximum studies have engrossed on patrons' perception, although limited has accentuated on the advantages of Islamic banking to humanity. Ramlan and Adnan (2016) worked on the effectiveness in Islamic and conventional banks in Malaysia by applying data from 2006 to 2011 comprised of annual figures. According to their findings, with a comparison to conventional banks as per profitability, Islamic banks are more profitable, although regarding conventional bank in comparison to an Islamic bank, total loan to total asset ratio higher (Yusuf and bin Bahari, 2015). According to some of the researcher's consideration regarding benefits with the vantage point of Islamic banks that it is their corporate social responsibility, containing adroit and enhanced amenities, as paralleled to conventional banks. Abedifar *et al.* (2015) scrutinized the current experiential works in Islamic banking and finance. The experimental outcomes designed no first modification concerning Islamic and conventional banks in terms of their adeptness, antagonism and risk topographies. Nevertheless, Islamic finance augments annexation and monetary expansion. Furthermore, in the capacities of risk and return structures of mutual funds, Islamic funds are more ahead to conventional funds

Beck *et al.* (2013) shariah based banking services are the intent of Islamic banking systems – a repetition that distinguishes it with conventional banking. Shah *et al.* (2012) performed a comparison of the interest based and the interest-free banks as in Islamic and the conventional banks. They stated that Islamic banks are better in terms of performance as compared to conventional banks based on abstruse efficiency and scale efficiency. Conventional banks performance is less efficient in terms of the scale and the technical efficiency in comparison with the Islamic banks. Conventional banks are only better in the income-based approach. This research had the spotlight on the efficient estimation of the Islamic as well as the conventional banking system. Same in the case the efficiency of the local and foreign banks also contemplates. Islamic banks performance is ameliorated as compared to the local and domestic banks whereas Islamic banking efficiency is lessened in comparison with the foreign banks.

Jaffar and Manarvi (2011) proposed research on the Islamic and conventional banks and their performances. After the analysis of the study, it indicates that Islamic banks are performing better as compared to conventional banks. He applied the CAMEL model for the analysis of the estimation. The sample period which they have taken is of five years including five Islamic and five conventional banks. After the intimation of the CAMEL, approach author has come to the consequence that Islamic banks are performing better as compared to the conventional banks in terms of the quality of the management and the earning ability. He also upshot that profitability and liquidity measurement is not so different between Islamic and conventional banks.

Hamid and Azmi (2011) performed research on the banking system of the interest-free and interest-based banking system. To check the performance of the banking system of these banks they use the statistical measures of the study and as well as the ratio analysis of the study. In the statistical significance of the study, they performed

the study of the measures as the t-test. After the analysis of the study, authors concluded that Islamic banks which are interest-free banking system are more liquid and their performance is higher as compared to the interest-based banking system. Profitability, liquidity, and solvency measures checked through the different sources by different measures. The sample period which they have chosen is from 2000-2009. After the analysis of the study, they conclude that analysis does not indicate any statistical difference in the performance of both the banks which are interest-free and interest-based banking system.

Usman *et al.* (2010) conducted research on conventional banks from different time periods. They use the methodology of the Data envelopment analysis (DEA) technique to check the efficiency and the performance of the conventional banks. They also asserted that foreign-owned banks are more efficient in terms of the technical efficiency whereas all the private banks which are under consideration in this stated are also said to be at least efficient banks. It is in the DEA technique that the technical and the allocative efficiency is under the study of productive efficiency. This study highlights the critical circumstances of the conventional banks. The sample period which they have chosen is from 2001-2008. After the anatomy of the estimation, it surmises that it should need to do better research on the banks which are less capable as in domestic private banks to make the technical efficiency stronger.

Nazir and Alam (2010) aimed to research the commercial banking system of Pakistan. For the performance regard of the banks, they have taken a sample of 28 commercial banks, to check the impression of the privatization over the matter of the operating income. To check the performance of the privatization, the methodology they have chosen is the DEA approach. The sample period which they have chosen is from 2003-2007. They are trying to find the relationship between the privatization and the operating income. According to their scrutiny, they found that privatization cannot help in bettering the operating income even many of the earlier studies show the positive relationship between these two states, and previous studies also evince that privatization and the profitability of the banks have a positive relationship. But in the context of Pakistan, this situation contradicts the antecedent studies relationship as of many reasons behind. Several justifications given on this research study that Pakistan economic situation is not very much consistent and law and order situation in Pakistan is also volatile as well as the situation of the bad debts and less trend of the commercial banking system tends the efficiency system down. But this exceptional study focuses on the commercial banking system and is favorable for this system.

Osmani and Abdullah (2010) stressed on the Islamic bank and their financing in home countries; they inspect on Malaysia for this scrupulous purpose. They narrate the traits of the Islamic home financing which are undertaking in Islamic banks as of Musharaka and Mutanaqisah (MM), These MM are used in the home financing in the case of Malaysia according to the sharia principles. Secondly, they targeted the BBA home financing and provide a comparison of BBA and MM home financing as they are in a view that MM home financing is more appropriate in terms of sharia compliance. And this MM home financing is also the better substitute for the customers to finance trusty. Third, they illustrate and directly related to the MM home financing that what are the drawbacks and challenges which customers need to face in MM financing.

State Bank of Pakistan (2010) after the dissection of Islamic banks in different aspects it is a noticeable fact that Islamic banking performance in terms of profitability, deposits, and assets is increasing but overall it is subsiding as in terms of country industry analysis in Pakistan. For the performance analysis of the banks, it obliges to test tasks and different parameters. It is highly required to provide a systematic study on the analysis of the Islamic banks.

Khattak (2010) stated after the analysis of the Islamic and the conventional banks that customers are facing many problems regarding the issue of Islamic banking. According to the author point of view that the customers of the Islamic banks are less satisfied as compared to conventional banks. People are less satisfied with the Islamic banks as firstly they are unaware about the products and services about the Islamic banks and secondly, they have the reason behind on the less satisfied that the products which Islamic banks are offering are not up to the mark and efficient, as conventional banks usually offer. Moreover, it is a fact that people do not want to invest in any of the

Islamic banks as they are reluctant to invest in the Islamic banks and they are more satisfied towards the conventional banking system as they have more experienced related to that.

Awan (2009) proposed a study on the performance of the Islamic and the conventional banks and according to his point of view that Islamic banks are performing better as compared to the conventional banks in Pakistan. The sample period which he has taken is of 2006-2008 in which he analyzes the performance and growth of the banks, and then he proposed a result that market share of the year 2006-2008 increased from 2 to 5 which shows a growth of about 100%. He also pointed out that the state bank of Pakistan grant every conventional bank a permission to open an Islamic windows or to offer Islamic products so for this very reason it is hard for the Islamic banks to compete with the conventional banks as conventional banks are going fast in pace and as well as now every conventional bank is now offering Islamic products that put too much pressure on the Islamic banks to compete with the conventional banks as Islamic banks are only offering products according to the Shariah principles.

Mokhtar *et al.* (2008) use the same method as past studies were undertaking; he uses the DEA non-parametric approach to analyze the full-fledged Islamic banks and the Islamic windows operated in Malaysia. For the period of 1997-2003. He uses the DEA nonparametric approach to check the efficiency of the banks; for that particular purpose, he uses the multiple inputs and outputs for the sake of proper estimation. He takes the sample of 2 fully Islamic banks, 20 Islamic windows, and 20 conventional banks. After the analyzation and the estimation of the banks, he concludes that Islamic banks are working efficiently under the sample taken; in fact, their efficiency tends to improve more. Moreover, Islamic windows are not as efficient as pure Islamic banks are because they are working sharia principles accordingly. He examines that conventional banks are working more efficiently as compared to full-fledged Islamic banks.

Aikaeli (2008) provides a case study for the performance and efficiency of the commercial bank in Tanzania, and the methodology he undertakes in his study is DEA (Data envelopment analysis) nonparametric approach for the measurement of the efficiency of the commercial banks. The sample period he has chosen for the study is from 1998-2004. According to the results after the analysis indicates that the commercial banks are performing in a good situation in the financial sector while working with the services of the related banks as its score of the efficiency under the DEA approach is 96% which shows the excellent performance of the commercial banks. CAMEL procedure as a matter of estimation used by the author as no one consider this methodology before, banking sector literature indicates the importance of the CAMEL in the study. Najjar (2008) analyzed the performance of the bank of Palestine and Jordan bank. The primary objective of the study is to explore the efficiency and the performance of the related banks and to highlight the importance of CAMEL in the study to ensure the equity distribution properly.

Rashid (2007) conducted research on the performance and the efficiency of the Islamic banks for the period of 1999-2006. For the evaluation of the Islamic banks, he uses the financial ratios. The ratios which are used to check the performance of the Islamic banks are profitability ratio, liquidity ratio, risk and solvency ratio. For Performance measurement of the banks, he uses the statistical measures to understand better and interpretation of the study. In the statistical measurement t-test, mean, the standard deviation is used. The author uses both the Islamic and conventional banks for the more significant differences exist between the Islamic and the conventional banking system. The sample which he has taken for the study is Meezan bank, Albaraka Islamic bank, and Alfalah bank, in an Islamic context and eight other conventional banks for the analysis. After the inquiry and estimation of the bank's, the author has finalized that Islamic banks are less profitable as compared to conventional banks. He also founds that in Islamic modes of financing, the concept of the Mudaraba and Musharaka are not very popular in Pakistan.

Akhtar (2007) proposed a study on the market share of the conventional and Islamic banks, so he stated that the market share of the Islamic banks in the context of Pakistan is 3.2% in which Islamic banks have are with 170 branches with the thousands of borrowers as 23.000 according to the study, however the conventional banks are

with the 7,700 branches with the borrowers are five million. He suggests that conventional banks are different from the Islamic banks and if Islamic banks offer innovative products and services then they would perform better than the conventional banks. They can compete with conventional banks in the context of the market share.

Hassan (2006) examined the efficiency of the Islamic banks, in which he used to check the principles of the Islamic banking industry and their performance. The sample he has taken of 21 countries in which 43 Islamic banks are highlighted for seven-year from 1995-2001. For the proper estimation of the banks, the author used the two procedures; one is a parametric and non-parametric model by using the technique DEA (Data Envelopment Analysis). In this case, he used different inputs and different outputs for the proper estimation of the years taken. These models are based on the cost and profit frontiers. The cost is usually dependent on the inputs, outputs, and random error. But in the non-parametric technique which is in the situation of DEA are typically based on different inputs and outputs. The inputs which he considered are funded (short term), capital, and the labor expense. Loans and the earning assets are as the main outputs, total inputs and outputs are five which are enough to get the perfect estimation of the Islamic banks. After the detailed study, Hassan concludes that Islamic banks are not so efficient in terms of technical efficiency each year.

Jaffry *et al.* (2005) also use the DEA model to check the efficiency of the banks, He highlighted the banking sector by choosing three south Asian countries: Bangladesh, Pakistan, and India for the period of 1993-2001. He focuses on the same scenario of the DEA as the VRS variable returns to scale by using multiple inputs and outputs for the better and proper efficiency estimation. The inputs are taken the same as Valli and Wadud as interest cost and non-interest cost, and the outputs are taken as interest and non-interest income. He also introduced a Tobit model to check the efficiency scores of the environmental variables in his study. Batchelor and Wadud (2004) used the approach related to the DEA (Data Envelopment Analysis), a period of 1997-2002 for the analysis. 14 banks are taken as a sample, five foreign and nine commercial banks. Two inputs and two outputs are taken for more examined study. Interest and noninterest cost are taken as inputs and interest, and the noninterest cost is taken as outputs. They used the procedure of technical efficiency for better efficiency measurement, scales efficiency to get the scores, and pure technical efficiency. In the case of the Islamic banking efficiency, the level of the scale efficiency and the technical efficiency are examined to decline, and the pure technical efficiency founds no change.

Hassan and Bashir (2003) examine the Islamic banking efficiency and their performance for seven years as from 1994 to 2001, for the sample of 21 countries. They performed their study regarding the ratio analysis to check the profitability of the banks. When they performed their study with the commercial banks, they come to a result that Islamic banks perform relatively better than the commercial banks, in terms of capital asset ratio. Capital asset ratio increase shows that Islamic banks are very well capitalized to perform their essential activities. For the comprehensive study to check the profitability of the banks, they also use the internal and external characteristics of the banks which can show the profitability factor from different aspects. They consider many other factors to check the profitability of the banks as economic measures, country variables, and many other factors. They use many other financial ratios to get to know the profitability in the broad term, as they use ROA (Return on assets), Return on equity (ROE), Net non-interest margin. Hassan and Bashir (2003). They also found that total asset has a negative relationship with the measurement of the profitability which means that the small Islamic banks perform relatively better and more profitable. They also explore that overhead expenses have a positive relationship with the profitability which ultimately means that if expenses increase, profitability also increases.

### 3. METHODOLOGY AND FRAMEWORK

This section employs different study measures, the reason for the study, sample framework, data set, methodology, and the analysis technique used in this study are highlighted.

### 3.1. Reason for the Study

The interpretation of the facts that the Islamic banking system is not much practiced in the Pakistan banking industry. Nevertheless, it urges excellent value to be exercised in the country because Pakistan is an Islamic country and it craves financing according to the sharia doctrines as interest-free. Numerous dissections of the absoluteness and the crescent banking industry, there should be a comparison between the Islamic banking concepts between Malaysia and Pakistan while taking Malaysia as a benchmark. Our study makes a new addition to the literature thereby all the former studies are awfully based on the concept of the interest-based. Islamic banking devotes a surrogate way of financing which is built on the interest-free banking system. The Islamic banking system also cherishes and assists the system of halal financing, investments, along with opportunities to get countries more indulge in it.

### 3.2. Dataset

The collation of the Islamic banking system between two different countries based on variables in addition to reviewing the performances and efficiency of the Pakistan based Islamic banking system and the Malaysian Islamic banks, the data set which used for the analogy is of 6 years, as from 2013-2018. As none of the studies has been done on the 2018 base year. The elementary engagement in research is of qualitative research on these sample years especially in the context of Pakistan. The secondary data collection technique is used. Data has been compiled from the annual reports of the banks and from the bulletins of the Islamic banking which is accessible on the site of the central banks of both countries.

### 3.3. Sample of the Study

Due to the limited span of time, it is decided to take a sample of the five Islamic banks of Pakistan and five Islamic banks of Malaysia for the comparison of the performance and the efficiency between the Islamic banking systems. The type of data which is taken for this purpose is panel data. The banks which are chosen for his study shown in Table 1.

**Table-1.** List of Malaysian and Pakistani Banks used in this study.

Sr. No.	Islamic Banks of Pakistan	Islamic Banks of Malaysia
1	Meezan Bank	Bank Islam
2	Burj Bank	Alliance Islamic Bank
3	Dubai Islamic Bank	Public Islamic Bank
4	Albaraka Bank	Standard Chartered Saddiq
5	Bank Islami	Am Bank Islami

Source: State Bank of Pakistan (SBP), and Bank Negara Malaysia (BNM).

### 3.4. Sample Selection Criteria

The sample which is chosen from Pakistan and Malaysia is highly based on the concept of Islamic banking which is different from the conventional and commercial banking system. The Islamic banking system took in the sample because of the growing trend of the Islamic banks in the scenario of Pakistan. As Pakistan is an Islamic based country, so it obliges all the modes of financing according to the Islamic sharia and principles. In the context of Pakistan, the sample of the Islamic banks is the Meezan bank as this bank got the first license from the state bank of Pakistan being in the state of Islamic commercial bank. As in 2012, it ceases its 10 years being in the state of Islamic banking. It also got the highest rating in terms of short-term financing, that's why Meezan bank is taken into consideration. Other Islamic banks of Pakistan as bank Islamic, Albaraka, Dubai Islamic bank, Burj bank are taken. Other are commercial or conventional banking system which offers Islamic related products and services. In the context of Malaysia, Islamic banks are focused on the comparison of the Islamic banking system between Pakistan and Malaysia.

After selecting the sample, the banks are observed over the period of six years from 2013 to 2018 based on the availability of data. From each country we have taken a sample of five banks, so the total sample is about 10 banks taken from Pakistan and Malaysia. There are many inputs and outputs are chosen for this study, so the inputs of our study are deposits, operating expenses and total assets. And the outputs are Investments, net earnings and loans and advances for the measurement of the efficiency of these Islamic banks by using the DEA (Data envelopment analysis approach), and some financial ratios are also used to measure the performance of these banks.

### *3.5. Analysis Used in the Study*

The analysis which we used in this research is quantitative analysis, qualitative analysis, and the descriptive analysis for the better results.

#### *3.5.1. Descriptive Analysis*

Descriptive analysis is used to evaluate the performance and efficiency of the Islamic banks of Pakistan and Malaysia. In descriptive analysis tables, figures and graphs are used to explain the data and the context in a more concise and a clear way. We used tables and graphs to explain the performance, efficiency, and some key variables relationship about the selected Islamic banks of Pakistan and Malaysia.

#### *3.5.2. Quantitative Analysis*

We used quantitative analysis too as in many financial ratios, the DEA approach help to assess the efficiency and the performance of the Islamic banks of Pakistan and Malaysia.

#### *3.5.3. Qualitative Analysis*

In this research, there is a detailed study and description of the Islamic banking history, their performances, and measures whether these banks are from Pakistan or Malaysia.

### *3.6. Methodology*

As many theorists provide different approaches to measure bank performance, and one of them is the accounting ratios, in which financial ratios are used to know the performance of the banks. Bank regulators Booker (1983); Korobow and Stuhr (1983); Putnam (1983); Sabi (1996); Samad (1999) and Akkas (1996) used financial ratios to evaluate the performance of the bank as ROA and ROE are the significant indicators of the firm performance.

In numerous studies, the DEA approach is used to recognize the efficiency of the selected sample. DEA, this is the non-parametric mathematical programming approach to frontier estimation, which estimate the technical and scale efficiencies. And DEA is also applied for the objective of cost and allocative efficiencies as well. DEA deals with the linear programming which creates the assumption of the non-parametric approach to providing efficient data and results. Farrell (1957) proposed Linear convex hull whereas Boles (1966) and Afriat (1972) proposed all the mathematical approaches used in this model to accomplish the task of efficiency. Actually, the term data envelopment analysis was invented by Rhodes *et al.* (1978). The Rhodes, Charles, and Cooper suggested a model which is the constant returns to scale, and it focuses on the input orientation of the data. Whereas Färe *et al.* (1983); Banker *et al.* (1984) proposed a model of VRS which is variable returns to scale and is based on the output orientation of the data.

#### *3.6.1. Constant Returns to Scale (CRS)*

Constant returns to scale are for the input-oriented data, and seemly when all firms are working on a most favorable scale. In this, there is the model which represents many different characteristics as X denotes as input and Y denotes as output, and firms are represented by N and the DMU are denoted to be as vectors as p and q



respectively. For the matrix estimation, there is  $X^*N$  input matrix  $P$   $Y^*N$  output matrix  $Q$ . There is the mathematical model for the implementation of the CRS (Constant returns to scale) as;

$$\begin{aligned} & \max_{u,v} (u^i y_i / v^j x_j) \\ \text{St} \quad & u^j y_j / v^j x_j \leq 1, j = 1, 2, \dots, N, \\ & u, v \geq 0. \end{aligned}$$

And the multiplier form of the linear programming problem is;

$$\begin{aligned} & \max_{\mu,v} (\mu^i y_i) \\ \text{St} \quad & v^j x_j = 1 \\ & \mu^j y_j - v^j x_j \leq 0 \quad j = 1..N \\ & u, v \geq 0. \end{aligned}$$

### 3.6.2. Variable Returns to Scale (VRS)

CRS assumption is based on the technique when all the firms are operating on an optimal scale, whereas there are many imperfections, constraints, and government regulations which presumes not to apply CRS model but we have an alternative model present named VRS (Variable returns to scale) by Färe *et al.* (1983); Banker *et al.* (1984). These authors provide an extension in the CRS model named VRS. When DMU's are not working correctly, then the assumption of the CRS is not up to the mark so the extensive approach VRS can be used alternatively. There is a mathematical model of VRS as;

$$\begin{aligned} & \min_{\theta,\lambda} \theta \\ \text{st} \quad & -y_i + Y\lambda \geq 0, \\ & \theta x_i - X\lambda \geq 0 \\ & N1^i/\lambda = 1 \\ & \lambda \geq 0 \end{aligned}$$

Where  $N1$  is  $N \times 1$  vector of ones, and VRS assumption envelope the data points more tightly than the CRS and Provides technical efficiency scores which are greater than or equal to those obtained using the CRS model.

### 3.6.3. Malmquist Total Factor Productivity Index

Data envelopment analysis (DEA) deals with the efficiency but with not the total factor productivity (TFP) changes over time. So, for this purpose, the Malmquist approach is used, and to find the changes in the total factor productivity over time further decomposition needs to be focused as changes in technology, changes in efficiency, scale, and the pure efficiency. This study introduced by the Caves *et al.* (1982a;1982b). These authors CCD defined

the total factor productivity index (TFP) in which Malmquist distance functions are applied input and output. These indexes are basically the ratio of output indexes to input indexes. Economic variables and the change in them are measured by the index. The index number is the originated real and the actual number which measures the changes in different variables, and these are used to compare the change of different variables in times, place or both (Büyükkılıç and Yavuz, 2005).

The index is established after the calculation of the distance radials of the related inputs and outputs vectors for different time periods as in  $t_1$  and  $t_2$  in relation to that technology. This technology can be input based and output based. Fare *et al.* (1994) define the decomposition of the technical change (TE) into the scale efficiency and pure technical efficiency type components. So, we applied an output-oriented Malmquist TFP index.

Suppose that the production technology of different times as  $st_1$  to  $t_1$  can be written as

$$st_1 = \{(x_{t_1}, y_{t_1}): \text{inputs } x_{t_1} \text{ can be used to produce } y_{t_1}\}.$$

Where  $x_{t_1} \in R_+^N$  denotes input bundles and  $y_{t_1} \in R^+$  refers to output bundles for time  $t_1$  ( $t_1=1\dots T$ )

whereas Fare *et al.* (1994) defines output distance function at the time  $t_1$  as  $D_c^{t_1}(X_{t_1}, Y_{t_1}) \leq 1$  in the situation if and only if  $(x_{t_1}, y_{t_1}) \in S_{t_1}$  under the theory of the constant returns to scale. Same as this output distance functions can also be described by the equation or by the time  $t_2$ . For the measurement of the Malmquist index function, two more functions related to the distance needs to be defined for two different time periods. One function is related to the estimation that is the distance of production  $(x_{t_2}, y_{t_2})$  related to the technology at the time  $t_1$ , and the other is related to the production  $(x_{t_1}, y_{t_1})$  related to the technology at the time  $t_2$ . So, the Malmquist distance function can be described as:

$$M(x_{t_2}, y_{t_2}, x_{t_1}, y_{t_1}) = \sqrt{\frac{D_c^{t_1}(x_{t_2}, y_{t_2})}{D_c^{t_1}(x_{t_1}, y_{t_1})} * \frac{D_c^{t_2}(x_{t_2}, y_{t_2})}{D_c^{t_2}(x_{t_1}, y_{t_1})}}$$

These observations indicate the distance of the time. If the Function  $m$  is greater than one than it means that the TFP (total factor productivity) increases from the time  $s$  to time  $t$ , but if the function  $m$  is less than one than it means that the TFP (total factor productivity) decreases over time as from time  $s$  to time  $t$ .

### 3.7. Variables Measurement

#### 3.7.1. Inputs

##### a. Deposits

Deposits denoted as money which is used for safekeeping in the banking institutions; it is basically the liability owned by the bank. Farhat Ullah Khan, Bakhtiar Khan, Zahid Awan uses deposits in their research work as an input in the article growth of "Islamic banking in Pakistan." Deposits are taken as output in many of the studies, but I am taking it as inputs because bank accepts deposits and make loans and derive a profit from the difference of the interest rate paid.

*b. Operating Expenses*

Operating expenses are basically all the expenditures which are related to the banking activities, at which any business incurs after performing its normal business operations. Abdul Ghafoor took operating expenses as an input in the article “Comparison of Islamic and conventional banking in Pakistan,” and operating expenses are taken as input in this research because the efficiency of any bank is highly based on the excellent bank performance to minimize expenses. To check the efficiency, it is the critical input to consider.

*c. Total Assets*

Total assets are basically all the gross investments, receivables, and cash equivalents, etc. which are on the balance sheet. In many of the studies, total assets are taken to be as the inputs as Yudistira (2004) and Burki and Niazi (2006). So, we take total assets as inputs for this study because ten Islamic banks are taken to check their performance and efficiency and total assets are the fundamental elements and the variable for the evaluation of the performance. Assets are basically there to increase the value of the firm after generating profit.

*3.7.2. Outputs*

*a. Investments*

Investment is basically the asset which is purchased in a sense that it will generate income and provides opportunities in the future. In many of the studies investments are taken as outputs for many of the reasons behind as Burki and Niazi (2010); Sufian and Abdul Majid (2007); Shahid *et al.* (2010) so I am also using this as output to measure the efficiency of the Islamic banking system of Pakistan and Malaysia. Mokhtar *et al.* (2006) also taken as output in the study “Efficiency of Islamic banking in Malaysia. A stochastic frontier approach” and I took this as an output because Deposits are taken as inputs, same is the case investments are taken as outputs, to generate profit.

*b. Net Earnings*

Net earnings are the total company earnings or the total profit which generates from the business activities and operations. Mokhtar *et al.* (2006) uses net earnings as an output in his study “Efficiency of Islamic banking in Malaysia. A stochastic Frontier approach”. As net earnings are the vital element and variable to consider so taken as output because Net earnings measure the performance of the bank, that how much profit a bank can generate.

*c. Loans And Advances*

Operations and all the activities related to the business highly depends on the availability of loans and advances for the expansion of the business and for more returns. Many previous studies took loans and advances as output; Burki and Niazi (2010); Ncube (2009) and as well as Subhaya Majumdar also used loans and advances as output in the article “A comparison of Cost efficiency levels of private and public sector banks –Application of Data Envelopment Analysis” and I used this as output in my research because Primary objectives of banks is to borrow funds from depositors and mobilize them through advancing loans.

## **4. RESULTS, ANALYSIS, AND DISCUSSION**

*4.1. Descriptive Analysis*

Islamic banking is an important concept which needs to be adequately evaluated so for this particular purpose we compare different Islamic banks from Pakistan and Malaysia, and the measures which choose for this very comparison are total deposits, Deposits, and operating expenses which is taken as input and the Investments, Net earnings, and loans and advances are from outputs shown in Figure 1, 2, 3, 4, 5, & 6.

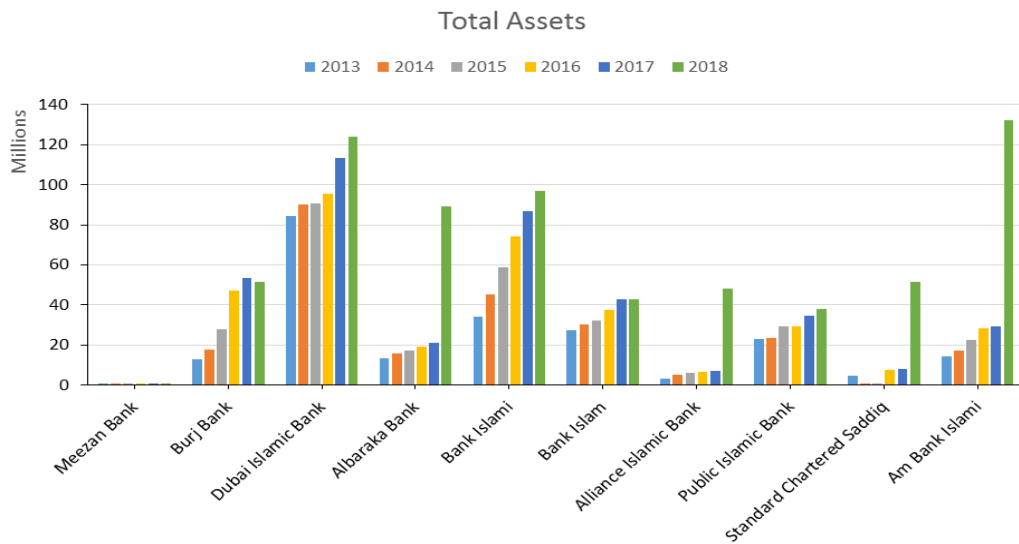


Figure-1. Total assets comparison of Malaysian and Pakistani Islamic banks.

Source: Developed by authors based on data sources from respective audited financial statements of the banks.

The total assets of the Meezan Bank (124169) are less than from the other four banks in the year 2013 to 2018. Total assets show the amount of the assets which a bank or the entity have. The total assets of the Meezan Bank are less from all the Islamic banks from the sample of Pakistan which shows the low performance of the Meezan bank respectively. Whereas in the case of Malaysian Islamic banks Alliance Islamic bank and the Standard Chartered Saddiq performance was quite similar in the context of the total assets, and the Ambank Islami total assets were highest in 2018 from all the other Malaysian banks. According to Figure 1, it is clearly shown that the Meezan bank performance in terms of total assets is low in all sample years as compared to all the other Islamic banks of Pakistan and Malaysia. Total Assets of Burj bank has been continuously increasing from 2013 to 2018. Dubai Islamic Bank shows fluctuations in the total assets from time to time but in 2018 and 2015 total assets are the same. Albaraka bank also shows an increase in the total assets, but the year 2018 shows a drastic increase in total assets, as well as Bank Islamic also shows a higher trend of the total assets from the sample period. In comparison with the Malaysian Islamic banks, the total assets of all the sample Malaysian Islamic banks have been continuously increasing in the year 2018 specifically. Whereas Ambank Islami performance in terms of total assets is the highest.

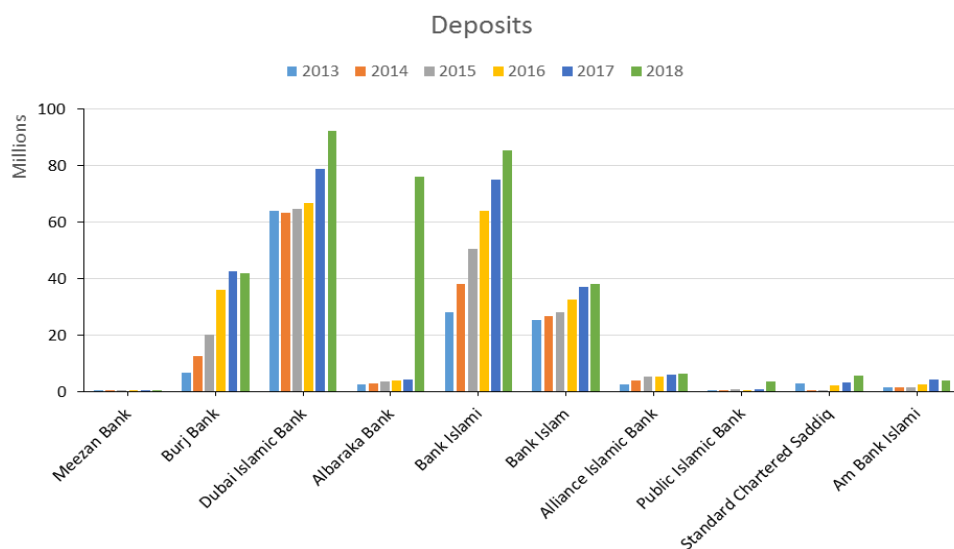


Figure-2. Deposits comparison of Malaysian and Pakistani Islamic banks.

Source: Developed by authors based on data sources from respective audited financial statements of the banks.

Banking deposits are basically the deposits made into the banking institutions as money market accounts, checking accounts, and the saving accounts. These accounts have account holders who can withdraw their money any time, and this is the money which is used for safekeeping. The deposit itself is a liability owned by the bank. Figure 2 shows the position of the deposits with Islamic banks of Pakistan and Malaysia during the period of 2013-2018 six years period. It can see clearly in the table that the Islamic banks of Pakistan especially the Dubai Islamic bank, Burj Bank, Bank Islami, and Albaraka in the year 2018 have more deposits carry than the Islamic banks of Malaysia. It can see from the figure that the trend of the Meezan bank deposits is almost the same in all the sample years, whereas Burj bank shows a tremendous increase in the deposits in the observed sample years till 2013 and in 2018 it becomes low in deposits again. Dubai Islamic bank, Albaraka bank and the Bank Islami shows the increasing trend throughout the sample years. Whereas with the comparison of the Malaysian Islamic banks the Bank Islam shows a massive trend in deposits from 2013 to 2018 but in 2016 and 2017 shows a constant trend, and then afterward it went on increasing. Whereas Islamic public bank, Standard Chartered Saddiq, and alliance Islamic bank shows an increasing trend but am Bank Islami increase in 2018 the most.

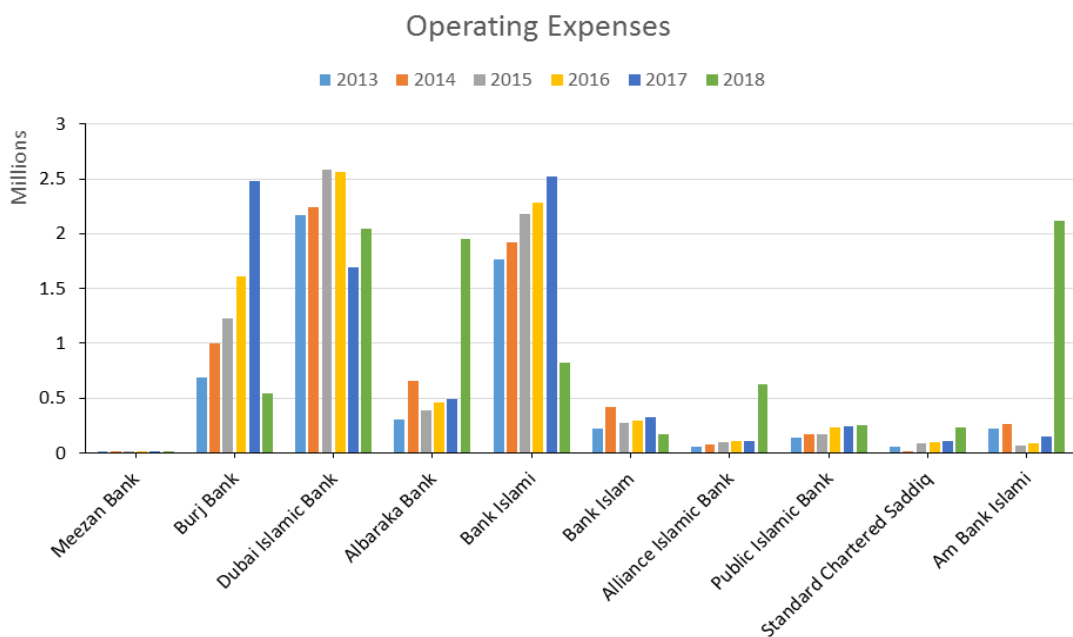


Figure-3. Comparison of operating expenses of Malaysian and Pakistani Islamic banks.

Source: Developed by authors based on data sources from respective audited financial statements of the banks.

Operating expense is basically the cost associated with running a business, so as with banks. Figure 3 describes the trend analysis of the Islamic banks of Pakistan and Malaysia. It can be clearly seen in the figure that the Pakistan Islamic banks are with the more operating expenses as compared to the Malaysian Islamic banks Specially Burj bank, Dubai Islamic Bank, and Bank Islami are with the more operating expenses. Meezan Bank is showing constant change towards the operating expenses. Burj bank sees reduction in the operating expenses in the sample year 2018. Dubai Islamic bank is showing continues increase in the operating expenses. Albaraka bank shows a drastic increase in the year 2018, and bank Islami shows a reduction in the operating expenses in the year 2018. Whereas with the comparison of the Islamic banks of Malaysia Bank Islam shows fluctuations in the operating expenses whereas Alliance Islamic bank, Islamic public bank, and the Standard Chartered Saddiq shows the consistent change of operating expenses, as am Bank Islami increase its operating expenses in the year 2018.

### Investments

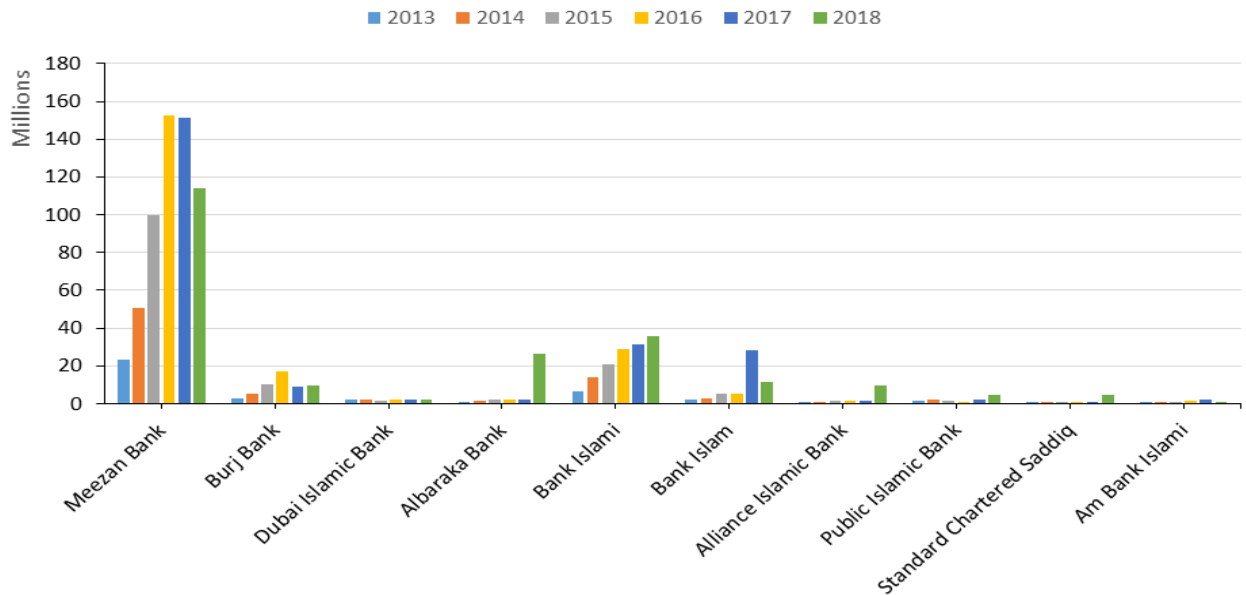


Figure-4. Investments comparison between Malaysian and Pakistani Islamic banks.

Source: Developed by authors based on data sources from respective audited financial statements of the banks.

Investment is something in which anything an asset or a thing which buys on an intention that it will generate profit, an income which can use in the future to generate profit. As Figure 4 indicates that the investment of the Pakistan Islamic banks is more as compared to the Islamic banks of Malaysia. Investment of the Meezan bank of Pakistan is in the position to invest more so from the year 2013-2016 it keeps on increasing, but in the year 2017, it remains constant as it was in the year 2016 then again in 2018 it becomes low again. Burj bank also shows the increasing trend analysis. Albaraka bank shows a more significant trend in the year 2018 in the investments. Whereas in the Islamic banks of Malaysia the Bank Islamic in the year 2013 shows excellent investments. From all the banks of Malaysia, Bank Islam performs relatively better.

### Net Earnings

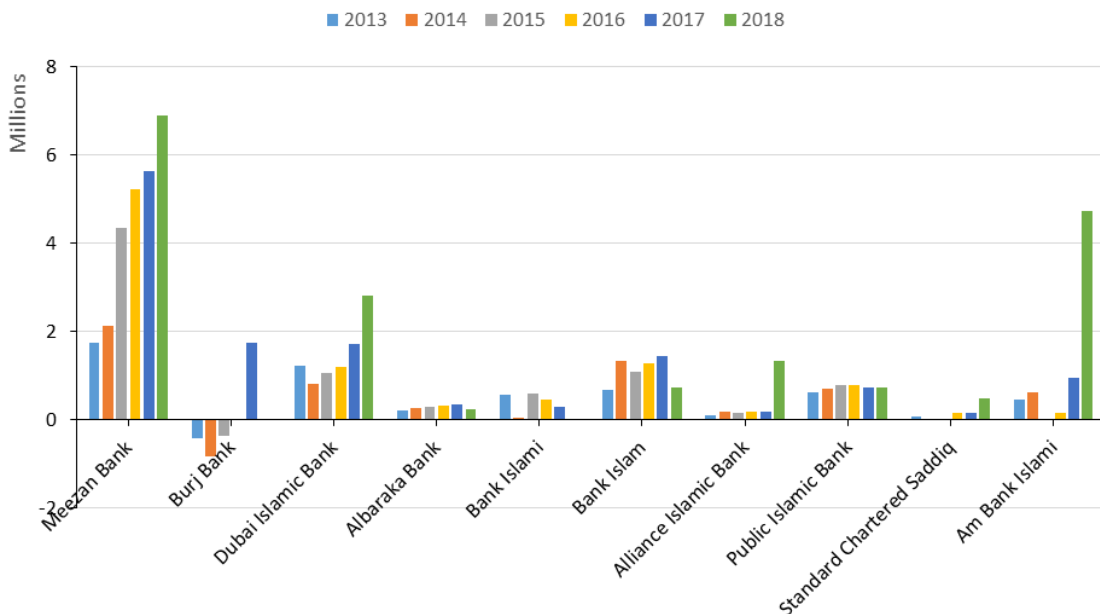


Figure-5. Malaysian and Pakistani Islamic bank's net earnings comparison.

Source: Developed by authors based on data sources from respective audited financial statements of the banks.

Net earnings basically represent the revenue which generates from the activities of sales, and these revenues are generated by deducting of all the operating expenses, interest taxes and all the relevant stock dividends from the total revenue of the company or the bank. Figure 5 shows that the net earnings from the year 2013 to 2018 is increased, but in the case of Burj bank it is in the loss situation in the first three years, but then in 2013 it generates some net earnings. Dubai Islamic bank and Albaraka bank keeps on increasing their net earnings which means they are working efficiently, whereas the Bank Islami generate decidedly fewer net earnings which show their less efficiency. In the context of the Malaysian Islamic bank, Bank Islam shows fluctuations throughout the sample years chosen, whereas the Islamic alliance bank increased in their net earnings in the year 2018. public Islamic bank keeps on increasing their net earnings every year from 2013 to 2018. Standard chartered bank shows a drastic change in the year 2018, but in the year 2014, it generates very less revenue as compared to the other sample years. Am bank Islami net earnings were highest in the year 2018 from all the other banks of Malaysia in comparison.

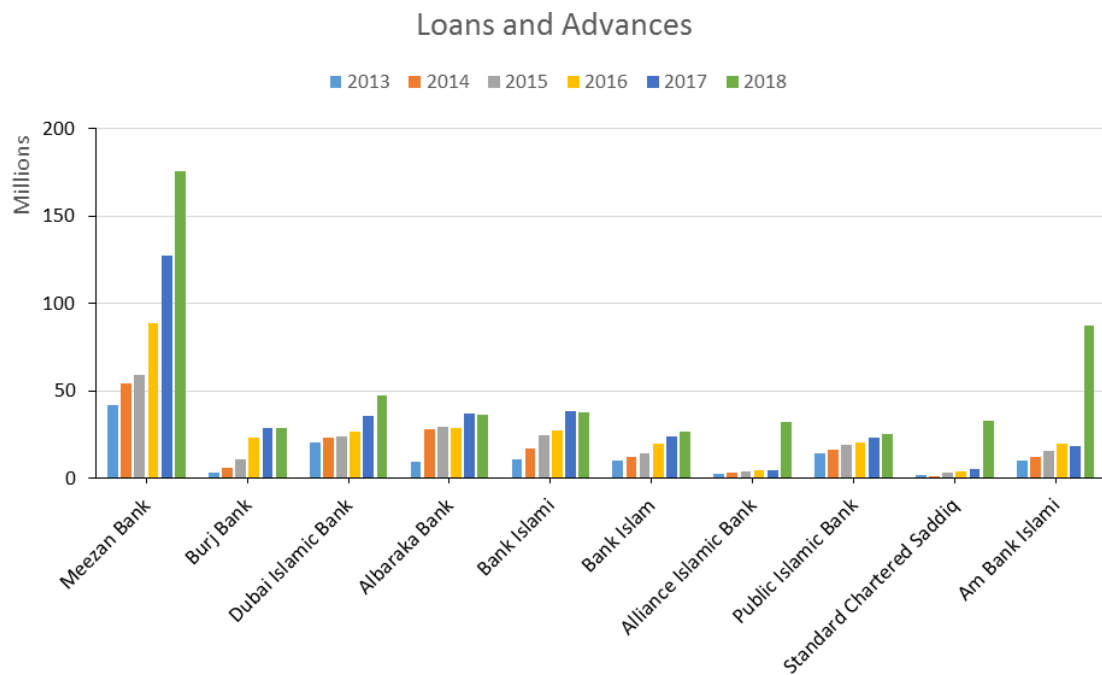


Figure-6. Loan and advances comparison of Malaysian and Pakistani Islamic banks. Source: Developed by authors based on data sources from respective audited financial statements of the banks.

Loans are basically the money that is owned by the government and is as the promissory note. In the context of a banking environment, these loans and advances are as the account receivables. Loans are a part of any bank to make some investments. As Figure 6 indicates that the Pakistani Islamic banks in which a Meezan Bank keeps on increasing their loans and advances from the year 2013-2018 no downturn faces in Meezan Bank. Whereas Burj bank was quite low in their loans and advances, but then from the year 2016 it keeps on increasing till 2018. Dubai Islamic bank and Albaraka Bank keeps on increasing their loans and advances from the sample period. Whereas, Bank Islam shows consistency in the year 2013 and 2018. In the scenario of the Malaysian Islamic banking system Bank Islam and public Islamic banks keep on increasing their loans and advances, but Alliance Islamic bank, Standard Chartered Saddiq and the Am Bank Islamic shows a drastic change in the year 2018.

4.2. Descriptive Statistics

Detail of mean, standard deviation, and standard error mean shown in Table 2.

Table-2. Descriptive statistics.

Variables	G	N	Mean	Std. Deviation	Std. Error Mean
	1.00	5	.9500	.11180	.05000
	2.00	5	.9124	.12194	.05453

The 2-tailed t-test in Table 3 shows the significance of the study.

Table-3. Independent sample test.

Levene's Test		Equality of Variances		Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
V	Equal variances assumed	.568	.473	.508	8	.625	.03760	.07398	-.13301	.20821
	Equal variances not assumed			.508	7.941	.625	.03760	.07398	-.13323	.20843

According to the results of this analysis, the first section of the output box gives the Levene's test results for the equality of variance. This examines and tests that the variance or the variation of scores for the two groups namely the Islamic banks of Pakistan and the Islamic banks of Malaysia is the same. The outcome of Levene's determines which of the t-values needs to use. So, we can see that the significance value is more extensive than 0.05 which is 0.47 which means that the variances of the two groups are the same or equal variances assumed. So, in the box significance, two-tailed the value is above 0.05 which shows that there is no significant difference in the mean self-esteem scores between two groups.

#### 4.3. Results and Discussion

Data envelopment analysis (DEA) is the model of the study which measures the efficiencies of various organizations with not one input and output but with multiple inputs and outputs. This chapter explains the results which wrangled after the implementation of the DEA (data envelopment analysis technique) to the data of the ten Islamic banks taken from Pakistan and Malaysia for the study period 2013-2018. This model refers to the Islamic banks to inspect the performance of the Islamic banking system in Pakistan as well as in Malaysia for a comparison. In the study of the DEA technique our focus is on CRS (Constant returns to scale) output based, VRS (Variable returns to scale) output based and Malmquist DEA which are employed to measure the efficiency of Meezan Bank, Burj Bank, Dubai Islamic Bank, Albaraka Bank, and bank Islamic from Pakistan, and Bank Islam, Alliance Islamic bank, Public Islamic bank, standard Chartered Saddiq, and am bank Islamic are from Malaysia. Malmquist total factor productivity index is used to compute the distance and the change concomitant with productivity. For this reason, there is the decomposition in the total factor productivity, change as there is the change of technology, efficiency change, pure efficiency change, and the scale efficiency change. In this study Malmquist, CRS and VRS approaches are concentrated on the evaluation of the performance and the efficiency.

Table 4 represents all the sample Islamic banks of Pakistan and Malaysia and their efficiency/inefficiency scores indicated as CRS, VRS, scale, and their cumulative average, as well as their efficiencies, are considered as CRS efficiency VRS efficiency and scale efficiency.



Table-4. CRS and VRS of Malaysian and Pakistani Islamic Banks.

BANKS	CRS	VRS	SCALE	Approach
<b>Pakistan Islamic Banks</b>				
Meezan Bank	1.000	1.000	1.000	-
Burj Bank	1.000	1.000	1.000	-
Dubai Islamic Bank	1.000	1.000	1.000	-
Albaraka Islamic Bank	0.734	0.978	0.750	DRS
Bank Islamic	1.000	1.000	1.000	-
<b>AVERAGE</b>	<b>0.947</b>	<b>0.996</b>	<b>0.950</b>	
<b>Malaysia Islamic Banks</b>				
Bank Islam	1.000	1.000	1.000	-
Alliance Islamic Bank	1.000	1.000	1.000	-
Public Islamic Bank	0.804	0.990	0.812	DRS
Standard Chartered Saddiq	0.734	0.978	0.750	DRS
Am Bank Islamic	1.000	1.000	1.000	-
<b>AVERAGE</b>	<b>0.908</b>	<b>0.994</b>	<b>0.912</b>	

Scale efficiency is efficient when it is equal to one, but if the ratio of the CRS to VRS is less than one, then it is as less efficient or inefficient. We can see under the Islamic banks of Pakistan that according to the DEA technique Meezan Bank, Burj bank and Dubai Islamic bank are considered to be efficient because their efficiency score of the CRS and VRS are 1.000 which represents efficiency and as well DMU (bank) only and only efficient if their CRS is one, and all the slacks are equal to zero but if any input or output slacks are non-zero then that firm or bank is considered to be as CRS inefficient, and they would need to improve their efficiency after reducing its level of input or after increasing its output level. Albaraka Islamic bank of Pakistan shows CRS/VRS scale as inefficient because the scale of this bank is 0.750 which is less than the point 1.000 and shows the inefficiency and their slacks are also non-zero Whereas Bank Islamic CRS to VRS ratio is as efficient because it denotes 1.000 in the results. All the sample Islamic banks which require more inputs to produce more outputs on the efficiency frontier are technically inefficient. In the case of Islamic banks of Malaysia and their performance Bank Islam and Alliance Islamic bank is considered to be efficient because they showed the CRS/VRS ratio scale of 1.000 which represents their efficiency, but Public Islamic bank and Standard Bank Saddiq both are in the category of inefficiency because their CRS/VRS ratio scale is less than one public Islamic bank is with the scale of 0.812 and Standard Bank Saddiq is with the scale of 0.750 which shows inefficiency of these Islamic banks whereas Am Bank Islamic is with the ratio scale of the 1.000 which indicates the efficiency of this bank. On average if we compare these two countries sample Islamic banks then we comes to a conclusion that Pakistan Islamic banks average ratio is 0.950, and the Malaysian Islamic banks average ratio is 0.912 which shows a little change between these two countries bank averages as Pakistan Islamic banks according to these results are performing better than the Malaysian Islamic banks on average, it defines the second hypothesis of our study that Islamic banks of Pakistan are efficient as compared to the Islamic banks of Malaysia.

Table 5 represents the data of the Malmquist approach used, as all the sample Islamic banks of Pakistan and Malaysia, and their measures from the year 2013 to 2018. Six years of data are taken into consideration to analyze the efficiency changes of the Islamic banks. Malmquist TFP index is used to calculate the effect of the total factor productivity and their changes from time to time. This also measures distance functions. Malmquist functions actually show and represent the change in the total factor productivity which represents as  $t+1$  which shows positive change or increase in the level as productivity increases from the time  $s$  to time  $t$ . change represents by the number one(1) as all of the banks having technical efficiency greater than one then it represents a positive change towards their development but if they are showing a value less than one then that represents regress of that particular bank or decreasing any bank productivity, less than one in the value also shows that it moved away from the frontier, and a value of one shows the stagnation in the total factor productivity. We can see from the Table 5 that the total factor productivity change of the Islamic banks of Pakistan are above the level 1 which means that the

Islamic banks represent a positive change towards the factor productivity and these banks are moving towards the development. Bank Islamic is with a ratio of 7.396 which is the highest in all the banks taken from.

**Table-5.** Malmquist total factor productivity index of Islamic Banks of Pakistan and Malaysia.

BANKS	EFFCH	TECHCH	PECH	SECH	TFPCH
<b>Pakistan Islamic Banks</b>					
Meezan Bank	1.000	3.462	1.000	1.000	3.462
Burj Bank	0.977	2.654	1.000	0.977	2.594
Dubai Islamic Bank	1.000	4.352	1.000	1.000	4.352
Albaraka Islamic Bank	0.975	6.601	1.000	0.975	6.435
Bank Islami	1.018	7.264	1.000	1.018	7.396
<b>AVERAGE</b>	<b>0.994</b>	<b>4.534</b>	<b>1.000</b>	<b>0.994</b>	<b>4.504</b>
<b>Malaysia Islamic Banks</b>					
Bank Islam	0.872	0.815	0.954	0.914	0.711
Alliance Islamic Bank	1.000	1.824	1.000	1.000	1.824
Public Islamic Bank	0.849	0.788	1.002	0.848	0.669
Standard Chartered Saddiq	0.863	0.983	1.004	0.860	0.849
Am Bank Islami	1.000	1.013	1.000	1.000	1.013
<b>AVERAGE</b>	<b>0.915</b>	<b>1.031</b>	<b>0.992</b>	<b>0.922</b>	<b>0.943</b>
	<b>Effch&lt;1=5</b>	<b>Techch&lt;1=3</b>	<b>Pech&lt;1=1</b>	<b>Sech&lt;1=5</b>	<b>Tfpch&lt;1=3</b>
	<b>Effch&gt;1=0</b>	<b>Techch&gt;1=7</b>	<b>Pech&gt;1=0</b>	<b>Sech&gt;1=0</b>	<b>Tfpch&gt;1=5</b>
	<b>Effch=1=5</b>	<b>Techch=1=0</b>	<b>Pech=1=9</b>	<b>Sech=1=5</b>	<b>Tfpch=1=2</b>

Pakistan and means that Bank Islamic is moving towards a significant change to make themselves more developed. The overall average ratio of the Islamic banks of Pakistan is 4.504 which is right in the case of Islamic banks performance because the ratio is above 1 which indicates better performance and efficiency. Whereas in Malaysian Islamic banks, Alliance Islamic bank and Am Bank Islamic are with the ratio of above 1 percent which indicates a better and a positive change. As Alliance Islamic bank has 1.824 total factor productivity change and the Am bank Islami have 1.013 total factor productivity change which is above than the one and indicates positive performance, whereas, Bank Islam, Public Islamic bank and Standard Chartered Saddiq are with the ratios less than one which indicates that these banks are returning towards the less developed state. The average ratio of Malaysian Islamic banks 0.943 which is less as compared to the Islamic banks of Pakistan which highlights Pakistan Islamic banks and their better performance. Total factor productivity highly depends on the efficiency change and the technological change if these two changes are positive then banks performance can reach to the higher level and compete for all the related banks.

As we can see in Table 5 that the positive change of the efficiency banks or the banks which are showing improvement in the efficiency are none in both of the groups as not in Islamic banks of Pakistan and not in Islamic banks of Malaysia, but we can see that there are 5 banks which are constant in their performance in which three banks are of Pakistan and 2 banks are of Malaysia. The banks which are deteriorating the efficiency change are also 5 banks in which three banks are of Malaysia, and 2 banks are of Pakistan. In technical efficiency change, we can see in Table 5 that the banks which are less than one are three, the banks which are higher than one are seven and the banks which are equal to one are none which shows that no bank is showing constancy whereas banks are showing deterioration and betterment in different cases. As three banks which are showing deterioration are of Malaysia and the banks which are performing better, and their technical efficiency increase from time to time are five from Pakistan and two from Malaysia which reflects the better performance of the Islamic banks of Pakistan.

Now in the third case the pure technical efficiency change we can see that the banks which are less than one in pure technical efficiency are one bank from Malaysia and the banks which are more significant than one are zero and the banks which are equals to one are (nine) five from Pakistan Islamic banks and four are from Malaysian Islamic banks which shows that Pakistan Islamic banks are constant in their pure technical efficiency but no deterioration.

Now is the case of scale efficiency, change in this situation there are five banks which are less than one and five banks which are equals to one and no bank which shows the ratio higher than one. This means that the two banks are of Pakistan and three banks are of Malaysia which shows the scale efficiency less than one which indicates no better performance or showing no improvement in the efficiency but is only deteriorating. But there are five banks which are equals to one which shows constancy in their performance in which three banks are of Pakistan, and two banks are of Malaysia.

In the fifth situation it can be seen from Table 5 that the total factor productivity change of three banks are less than one, five banks are more significant than one and two banks are equals to one which indicates that three banks which are less than one are of Malaysia which shows deterioration of the Malaysian banks, and the five banks which are higher than one are five banks which are from Pakistan which shows the betterment and improvement in the technical efficiency and the two banks which are equals to one are from Malaysia.

## 5. CONCLUSION AND RECOMMENDATIONS

### 5.1. Conclusion

Using DEA, this research paper canvasses the distinction of the Islamic banks in all over the world and imparts a comparison of the Islamic banking system in Pakistan and Malaysia. The Islamic finance industry has augmented expeditiously worldwide in general coupled with Islamic countries like Malaysia, and Pakistan in particular. Malaysia and Pakistan are non-secular states in which the basics of Islamic financing are the same, but there is a difference in the strategy and applications. Data envelopment technique has been applied in which CRS and VRS are used to check the efficiency scores of different banks as DEA approach is used to know the efficiency of the selected sample. DEA (Data envelopment analysis), is the non-parametric mathematical programming approach to frontier estimation, which calculate the technical and scale efficiencies. And DEA is for the purpose of cost and allocative efficiencies as well. Malmquist productivity index also used to measure the distance and the change in productivity. We used the Malmquist productivity index to measure the efficiency change, technical change, pure efficiency change, scale efficiency change, and the total factor productivity change to compare the different Islamic banks of Pakistan and Malaysia.

According to the results of the CRS and VRS efficiency scores, Pakistan Islamic banks are considered as efficient on average as compared to the Malaysian Islamic banks. The average score of the Pakistan Islamic banks is 0.950, and the average score of the Malaysian Islamic banks is 0.912 which shows the efficiency of the Islamic banks of Pakistan. Moreover, for the period of 2013-2018, the study also considers the patterns of the Malmquist total factor productivity index which highlights the efficiency, technical and the total factor productivity change. If the ratio of the productivity index equals to the 1, then it means banks are performing consistently, likewise, if the ratio is above 1 percent, then it indicates the improved performance of the banking sector, and if the ratio is less than one than it indicates deterioration in the banking sector. But overall the analysis is in favor of the Islamic banks of Pakistan. Islamic banks of Pakistan are performing better as compared to the Islamic banks of Malaysia. Eleven financial ratios are used in this study for the comparison of the productivity of the Islamic banking system in Pakistan and Malaysia. Profitability ratios, Liquidity ratios, Risk and solvency ratios, are applied on the Islamic banks of Pakistan and Malaysia. The overall result of the performance critique demonstrates that Islamic banking is a vital doctrine which requires to grow and defend internationally.

### 5.2. Recommendations

Based on the analysis and the results, following recommendations needs to be highly considered as; Islamic banking methods are essential to highlight properly as Islamic banks require to train their personnel for Islamic banking methods which can provide alternative modes of financing. Training of the Islamic banking is essential in the Muslim country in all the conventional and commercial banks as well to make the Islamic banking system

stronger not only in the Islamic banks but in different banks as well. As Islamic banking is important in Pakistan for the development and economic stability, so the rest of the Islamic world should consider Islamic banking system a reliable way of financing to make their economy strong and developed. The Islamic banking system needs to be implemented in the rural areas as well to keep them aware of all the Islamic modes of financing and their importance.

### 5.3. Limitations, and Future Directions

Focus of the current study is only on the Islamic banking of Pakistan and Malaysia and a comparison of different approaches followed by these two countries for the progress in the Islamic banking industry, but this study ignored the conventional and commercial banks in comparison with the study of the Islamic banks because of the time constraint, as to get the data of all the commercial conventional and Islamic banks would not be comprehensive due to limited span of time.

The current study has focused only on the Islamic banking industry, but Islamic, commercial, and conventional banking industry can also be considered for research purpose as no such study is found in the context of Pakistan. There is also the scope of carrying out research using event study methodology in order to analyze the Islamic banking performance and efficiency before and after the financial crisis of 2008.

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