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A LITERATURE REVIEW ON THE TECHNICAL EFFICIENCY OF ISLAMIC BANKS: CLASSIFICATION AND KEY FINDINGS

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Abstract

This paper presents a comprehensive literature review and classification scheme to examine the technical efficiency of Islamic banks. It primarily focuses on two methodological approaches: parametric and nonparametric. Drawing on more than 100 articles on the technical efficiency of both conventional and Islamic banks, this study identifies key factors influencing efficiency levels. Articles are classified based on various criteria, including journal source, publication date, paper type, study context, bank nature, efficiency measurement approach, selected inputs and outputs, determinants of efficiency, and empirical findings. The review highlights that research on the technical efficiency of Islamic banks remains less developed compared to conventional banking. Several key findings are discussed, shedding light on the current state of knowledge in this field.

Keywords

Technical Efficiency, Islamic Bank, Literature Review, Classification Scheme, Parametric and Nonparametric Approaches

Introduction

In recent years, Islamic banking has become an important feature of the financial sectors; indeed, the term Islamic banking became common in the 1960's, but the mechanisms and concepts of the system have been implied and used since the birth of Islam. Many studies have shown that Islamic finance mechanisms were used in the Muslim world throughout the middle Ages. For this reason, some Muslim countries have considered converting their entire banking system according to Islamic principles. Since the growth, efficiency and competitive environment of the financial sector are vital for economic development and stability (Al-Jarrah and Molyneux 2006; Brissimis et al. 2009), it is important to assess the efficiency of Islamic banking and compare it with conventional banking.

This aspect has been addressed by several studies, reports and conferences about Islamic banks and its efficiency, and they are widely available. This means that Conventional Banking System has always been the root of many evils and it has never given a total satisfaction neither to bankers nor to clients. Many problems have always been weaknesses in that conventional system and this is due to its structure, services and techniques.

The aim of this paper is to provide a comprehensive literature review, which evaluates the technical efficiency of Islamic banks and describes the different approaches and methods adopted by them. However, due to the short time over which Islamic banking has been operating, there is only a small literature is available for evaluating its efficiency. That is why we resorted to some conventional research. To fulfill this primary purpose, we use criteria to select, classify and analyse the studies in this research. In this paper, we use the classification scheme technique to study the papers selected.

The rest of the paper unfolds as follows: the next section aims at defining the central concepts and details of the methodologies of classification. Then in Section 3, we discuss the results,as well as, introducing the classification scheme. Finally, we finish with a conclusion and mention the avenues for future research.

1. Classification scheme technique

This classification is the research process of referring to journals, doctoral theses and conferences in the field of the technical efficiency of banks.

The research criteria are composed of seven categories :(i) the nature of the paper, (ii) Period and countries of study (iii) Nature of the Bank (iv) Adopted approach to measure technical efficiency (v) Outputs and inputs (vi) Determinants of banks efficiency and finally (vii) empirical finding. Each category is further divided into subcategories. We will discuss all of them in what follows.

1.1 Nature of papers

It constitutes a characteristic in terms of which we can have two categories of papers, either theoretical or empirical. In fact, the theoretical papers have a common definition in which the majority of the researchers base themselves on a question that they would answer in the development of the ideas or theories; it is what we call a theoretical framework. So, it consists of an identification process of the papers that examine the issue of the technical efficiency of banks whether they are conventional or Islamic without the empirical analysis, which can be defined by an experimental study.

1.2 Period and countries of study

Adapting this criterion, the paper will be classified according to countries of study. This classification is necessary because every country has its own characteristic.

In fact, it is important to understand the structure of the markets and environments in which the banks operate because we know that these two last elements impact the results. So, it is useful to take these criteria into consideration.

As for the study period, we can adopt this criterion based on the transitory period of the world economy, which has influenced the banking sector. Here we talk about the world crisis because the banking efficiency has been considerably impacted by that phenomenon.

1.3 Nature of the Bank

Under this criterion, papers will be classified into three categories:

At first, conventional bank is a loan establishment that represents the heart of the money commerce (trade) and which has a direct responsibility towards the financial risks management that could threaten the clients account in different ways.

Second, the Islamic banks, which are just like their classic competitors, place themselves in an intermediate position between the capital holders and the people seeking to borrow money but with principles different from the spirit of the traditional finance, which are inspired from Shariah and its five sources: Coran, Sunna, Qiyas, Ijtihad and Ijmaa.

Finally, the Islamic windows are a window within conventional banks via which customers can conduct business utilizing only Shariah compatible instruments.

So, in front of the wide gap between the Islamic banking and the conventional one and the hybrid model, we can deduce that the nature of the bank affects its technical efficiency. That is why, it is obligatory to use these criteria as a method of classification.

1.4 Approach adopted for measuring technical efficiency

Literature in this classification is mainly divided into two broad categories: a parametric and non-parametric approach.

On the one hand, by parametric approach, we mean here, is many papers of bank efficiency with Stochastic Frontier Approach (SFA) which is well acknowledged in the literature in a considerable number of studies in measuring banking efficiency.

Indeed, the SFA method is an econometric, deterministic method for estimating the efficiency frontier. Unlike the non-parametric methods based on the technique of linear programming, the SFA method entails a certain functional form for the relation between inputs and outputs.

The SFA method was first proposed by Aigner et al. (1977), Meeusen, and Van den Broeck (1977). Several authors used this approach in their research for example ; Al-Jarrah and Molyneux (2007), El-Gamal and Inanoglu (2004), Mohamad et al (2008), Mokhtar et al. (2006), Kwan (2006), Rossi et al (2009), Srairi (2013), Baten and Kamil (2010), Tahir and Haron (2010), Hamilton et al (2010), Burki and Ahmad (2010), Chelo (2011), Zhang et al (2012) and Bannour and Labidi (2013).

In all instances, the parametric approach is regrettable, as it requires the prior writing of a cost function or profit of the firm concerned. However, this is not always possible or practical whatever the type of business is. The fact is the same as regards the non-parametric approach.

On the other hand, talking about non-parametric approach leads us to Data Envelopment Analysis (DEA), which is Farrel approach in which he simply constructs input and output ratios by linear programming techniques. This method is used by many scholars, and like many techniques, it has some strength and limits. A more detailed description of the DEA will make us understand this aspect

The term "data envelopment" was introduced in a model developed by Charnes, Cooper and Rhodes (1978) (hereinafter referred to as the CCR model) analysis to measure the efficiency of each Decision Making Unit (DMU) which is obtained as a maximum of one report of weighted outputs to weighted inputs.

This method involves placing all DMUs in a sample, and each of their performances represents a point on a graph. The efficient frontier is then established. In the case of the DEA, this frontier connects all points that surround the point cloud through the top: the border points are effective units by cons the other points, located below this frontier, represent units which are "Less than efficiency" or "inefficient units". Also, the distance between each point of the boundary is a measure of the level of technical efficiency.

DEA is an uplifting example of the non-parametric approach. Furthermore, the non-parametric approach has other methods such as the method FDH (Free Disposal Hull, or set free disposal).

Non-parametric approaches have the characteristic that does not require a model specification in order to compute the best-practice frontier. It also enables to integrate several variables in the result, thereby providing a means of comparing performance when several criteria are involved. The brokerage process includes multiple inputs and outputs, and hence analysis of the performance of the bank is suitable for the one of the effectiveness. This is why many works have been done through this method mentioning by way of example; Cook et al. (2000), Darrat et al (2002), Sathye (2003), Brown (2003), Yudistira (2004), Isik et al. (2005), Hassan (2006), Karray and Chichti (2006), Weill (2006), Park And Weber (2006), Alpay and Hassan (2007), Chortareas et al. (2007), Fadzlan (2007), Fadzlan and Zulkhibri (2008), Pasiouras (2008), Bader et al. (2008), Akhtar (2010), Kamaruddin et al. (2008), Fadzlan et al. (2008), Fadzlan (2009), Hsiao et al. (2010), Mensi and Zouari (2011), Said (2013), Romzie et al. (2013).

Briefly, DEA method is commonly used in statistics to model and analyze ordinal or nominal data with small sample sizes. Unlike parametric models, non-parametric models do not require the modeler to make any assumptions about the distribution of the population. So they are sometimes referred to as a distribution-free method.

Then each of the two approaches has its specific characteristics.

Therefore each Influence the following result, and that is why we opt for the approach as a criterion of classification.

1.5 Outputs and Inputs

It is commonly acknowledged that the choice of variables in efficiency studies significantly affects the results. Thus, the variables input and output should reflect the objectives and the actual bank efficiency as accurately as possible. Under this criterion, articles will be classified according to the inputs and outputs used.

Some studies use many indicators such as “labor” as input such as Ferrier and Lovell (1990), Mokhtar et al (2006, 2007, 2008), Mohamad et al (2008), Farhana et al. (2013), Bannour et Labidi.(2013).

However, more recent studies have used many other indicators in their application, such as “Fixed Assets” as an appropriate measure of input (Yudistira 2004, Mohamad et al 2008, Johnes et al 2009, Romzie et al. 2013, …)

Similarly, deposits are used as measures of input in several studies like Mokhtar et al (2006, 2007), Fadzlan (2007, 2009), Nor Aiza (2007), Gardener et al. (2011), Nor Hayati et al. (2010), Almumani (2013), Said (2013).

In studies of the technical efficiency of Islamic banks, there is a wide choice of output, although “total loans” and “liquid assets” and also “income” are used frequently.

Some studies have used different natures of output such as investment which was indicated by Leong et al. (2003), Mohamad et al (2008), Fadzlan (2007, 2009),…

1.6 Determinants of banks’ efficiency

It is also of considerable interest to explain the determinants of the technical efficiency which are called also sources of technical efficiency of banks.

Until now, the bank research has focused on the operational and technical efficiency of various world regions. We will focus mainly on the technical efficiency, which varies from one research to another.

Thus, under this criterion, we can find many sources of efficiency such as size, ownership, labor, capital, equity, Profitability, loan ratio, technology, market power, bank capitalization… that are the most used and appropriate for the measurement of bank technical efficiency.

In the literature in the field, the studies regarding the factors influencing the efficiency of banks used the following factors:

1.6.1 Internal factors

Determinants of technical efficiency are considered internal, related to the characteristics of the banking firm. It was, for example, figures from accounting, or other non-accounting items, linked through strategic choices of the bank. Accounting factors already identified include the default risk (measured by the rate of bad debts, cash surpluses, the proportion of equity in total loans and total assets, and even the return on assets). In contrast, non-accounting factors identified are for example the duration of deposits, the volume of deposits collected, geographic coverage, size, origin or ownership, managerial and commercial policy…introduce some studies that lead to these results

Concerning size, Karray and Chichti (2006) focused on banks' technical efficiency by using DEA method. They found that large banks are more efficient than small banks. Indeed, for the former, the sources of inefficiencies are allocative rather than technical; however, the inefficiencies of small banks rather explain inefficiencies of scale.

Mostafa (2007) attempts a survey of determinants of efficiency of Arabian banks around ownership using an estimate by the DEA method; he showed that the most efficient banks were large international banks, not small domestic ones.

And also one of the most important sources of efficiency is the type of bank, which can be Islamic or conventional. In fact, Kamaruddin et al. (2008) demonstrate that Islamic banks achieved technical efficiency through use of technology such as ATMs, Internet banking, smart cards, and wireless banking. Also, they were twice as inefficient as conventional banks in Malaysia. However, Islamic windows and foreign Islamic banks operated more efficiently on the cost side than the profit side. In the same year, Mokhtar et al (2008) found that Islamic banks were more efficient than banks with Islamic windows, but the efficiency level of Islamic banking proved less than Western banks.

Technical efficiency of Islamic Bank is also influenced by factors of a different nature, such as external factors that control the bank.

1.6.2 External factors

External factors, that affect the level of efficiency of a bank, are those, which are not under the control of the bank itself.

We can distinguish them between two categories: factors resulting from state action and factors dependent on the structure of the banking market.

Research analyzing the determinants of technical efficiency of banks is fairly numerous. Similarly, several factors have been identified as causes of the efficiency or inefficiency of banks.

1.7 Empirical findings

By adopting this criterion, the papers will be classified according to the efficiency scores of each study. We will rely on the minimum, maximum and average efficiency scores in each study to classify the papers.

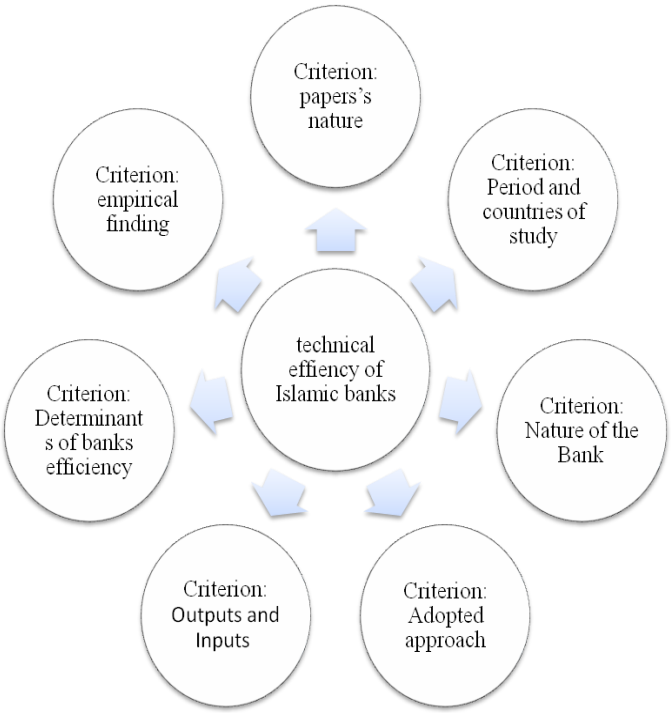

Figure 1: The proposed classification scheme

The empirical results of the studies regarding the efficiency of banks show that the level of efficiency differs in time and from one bank to another, indicating that the level of efficiency of a bank is influenced by many factors. The performances of a bank are determined by a series of internal factors that are specific to the bank and external factors that are specific to the environment in which the bank performs its activity, these factors influence the degree of efficiency of the respective bank.

2. Results

2.1 The distribution of papers by journals

The technical efficiency of banks has garnered much attention in recent surveys. The technical efficiency of a company refers to its ability to transform an input in the maximum level of production or minimizing input for a given output quantity given quantity

In our sample of papers examined, we focus on studies that are interested in determining the banks' technical efficiency. Table 1 shows the distribution of articles in different journals.

Journals	2000-2005	2005-2024	Total
• Islamic Economic Studies	2	5	7
• Science Direct (Elsevier)	_	7	7
• Munich Personal RePEc Archive (MPRA)	_	5	5
• International Research Journal of Finance and Economics	_	4	4
• JSTOR	3	1	4
• Journal of Banking & Financial	2	1	3
• The World Bank	_	2	2
• International Management Review (Springer)	_	2	2
• Journal of Islamic Economics, Banking, and Finance	_	2	2
• International Journal of Economics & Finance	_	2	2
• International Journal of Islamic and Middle Eastern Finance and Management	_	2	2
• Economic Research Forum	_	2	2
• International Management Review	_	2	2
• Journal of Banking & Finance	2	_	2
• Industrial Management + Data Systems (Emerald)	_	2	2
• Economic Research Forum (ERF)	2	_	2
Total	11	39	50

Table 1: The distribution of papers by journals between 2000 and 2014

This summary table focuses on recent articles in the field of banking technical efficiency, whether for Conventional or Islamic banks, knowing that most of them focus primarily on the conventional ones.

On this basis, we see that many research studies focusing are on this issue and therefore many of the papers have been published in this context. Firstly we see that both Islamic Economic Studies and Science Direct published about 14 percent of the total of articles that we used in our survey.

Both are refereed journals of high academic standards, and are the foremost publishers of all the scientific and technical content in the world.

Another remarkable thing is that the majority of papers were published between 2005 and 2014.
Then comes Munich Personal RePEc Archive (MPRA) in the second position with 10 percent which could be considered as a high percentage, with 5 articles in the period of 2005-2014 because it has been started few years ago.

In the third position are the International Research Journal of Finance and Economics and JSTOR with 8%. The first one focuses on the comparative study of banking technical efficiency of the islamic and the conventional banks such as the case of Hamilton et al (2010) who study the case of The Jordanian Western and Islamic Banks using the SFA method. Also, the case of Shahid et al. (2010) compares the efficiencies of Islamic and Conventional Banks of Pakistan. By contrast, the second journal focuses mostly on the studies dealing with conventional banking system such as that of Abd Karim (2003) where it studies the case of Malaysian banks by the bases of the SFA method.

Finally, thanks to the importance of this topic, many studies were carried out in many other journals which are themselves very famous. Among them, we can list International Management Review (Springer), Journal of Islamic Economics, Banking and Finance, Middle Eastern Finance and Management, and International Journal of Economics and Finance.

2.2 Nature of papers

It involves books, articles, memoirs. These publications have deepened our knowledge by providing us with the information we need for our study of technical efficiency for Islamic banks. The information is collected through documentation centers, public research institutions, including University Libraries. Information is also collected from the Internet through academic journals which are working in competitive and dynamic fields across theoretical and empirical research in all areas of international economics and finance. These include technical efficiency.

From a technical point of view, the resort to papers of empirical type enabled us to have objective results that are more professional without any influence of other authors and systems of thinking. That is why; we used only this type of papers in our research.

2.3 The classification of papers by authors, context of studies and date of publications

This section gives a general idea about all the articles that are collected and related to our research topic.

We collected and classified the publications by authors, nature of papers, context of the study, and the date of publications.

The data collected is presented in the table 2, which provides this study with valuable information on the research of its staff and uses the publication data as a key performance indicator in the analysis of technical efficiency of Islamic banks and in benchmarking with other research of conventional banks.

AUTHORS	DATE OF PUBLICATION	NATURE OF PAPERS	CONTEXT
Shahid et al.	2010	Empirical	Pakistan
Akhtar	2010	Empirical	Pakistan
Saeed et al.	2013	Empirical	Pakistan
Mokhtar et al.	2006	Empirical	Malaysia
Mokhtar et al.	2008	Empirical	Malaysia
Fadzlan	2007	Empirical	Malaysia
Fadzlan	2009	Empirical	Malaysia
Fadzlan and Zulkhibri	2008	Empirical	Malaysia
Fadzlan et al.	2008	Empirical	MENA countries
Nor Aiza	2007	Empirical	Malaysia
Kamaruddin et al.	2008	Empirical	Malaysia
F. Sufian and M. Akbar	2009	Empirical	Malaysia
Farhana et al.	2013	Empirical	Malaysia
El-Gamal and Inanoglu	2004	Empirical	Islamic turkey
Mohamad et al	2008	Empirical	Islamic turkey
Johnes et al	2009	Empirical	GCC
Alkhathlan and Abdul Malik	2010	Empirical	GCC
Kashani and Obay	2010	Empirical	GCC
Said	2013	Empirical	GCC
Almumani	2013	Empirical	GCC
Saeed and Izzeldin	2014	Empirical	GCC
Brown	2003	Empirical	Asia, the Middle East, and North Africa
Tahir and Haron	2010	Empirical	Africa, the Far East and Central Asia, Europe, and the Middle East
Gardener et al	2011	Empirical	Asian countries
Chelo	2011	Empirical	ASIA (Philippine)
Bader et al	2008	Empirical	21 Country Asia Islamic
Romzie et al. (2013)	2013	Empirical	Middle Eastern and Asian countries Islamic
Nor Hayati and Mohamad Akbar	2010	Empirical	78 Islamic banks in 25 countries
Viverita and Skully	2007	Empirical	Islamic bank in Asia, Africa and the Middle East
Nor Hayati et al.	2010	Empirical	77 Islamic banking sectors in the world covering 25 countries

Table 2: Distribution of papers between 2000 and 2011

During the last quarter of the last century, a particular interest was given to Islamic Banking System. This reflects the desire to understand their contracts, their various services and hence their technical efficiency.

According to the table above, we notice that the majority of the studies are done starting from 2000. On this basis, we can observe the existence of the Islamic Banks all over the world such as Malaysia, Pakistan, The Golf Countries, Africa and even Europe. The graphics below will explain better.

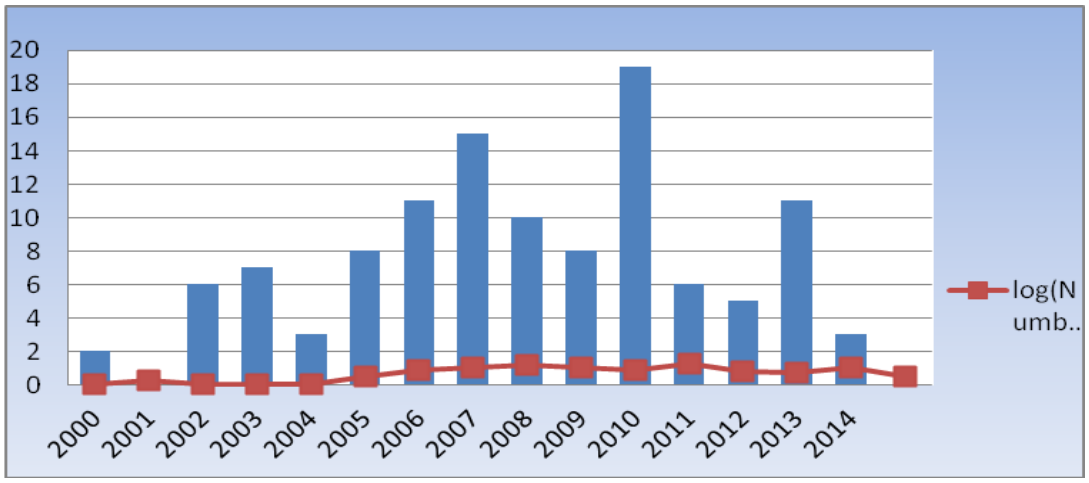

Figure 2: Distribution of papers on Islamic bank technical efficiency by date of publication.

This bar graph shows the number of papers used in our work per year, which is related to the technical efficiency of Islamic banks. The main results suggest that more than 18 articles are published in 2010 just after the world crisis because due to this crisis it has become useless to check if the Islamic banks are more efficient than the conventional ones or not. This was deduced because the last ones have been adversely impacted by the crisis. However, the Islamic ones have done well during it. In other words, many comparisons suggest that Islamic banks are less involved than the traditional one.

We also find that there are many publications in 2013 and also in 2014.

Saeed and Izzeldin (2014) provided a comparative analysis of the efficiency of Islamic banking sectors in Gulf Cooperation Countries and non-GCC banks during the period between 2002 and 2010 by utilizing SFA and VAR. The findings suggested that the relationship between profit efficiency and default risk banks across the sample, for CBs and for the GCC, is such that a decrease in default risk is associated with lower efficiency levels. With the single exception of IBs, the causality from profit efficiency to default risk is inversely related for all categories for conventional banks; the trade-off between efficiency and risk is evident.

They find evidence suggesting that the absence of a trade-off for IBs suggests that efficiency and default risk are plausible early warning indicators of IB instability.

The research also established that conventional banks are the most cost efficient with a mean cost efficiency score of 91% compared to 86% for Islamic banks.

Sardar et al (2011) examined the efficiency of 15 Islamic banks in Pakistan by utilizing DEA to estimate the technical, pure technical, and scale efficiency for each bank during the period between 2008 and 2010. The findings showed that Scale efficiency of Islamic banks was higher as compared to the technical and income efficient.

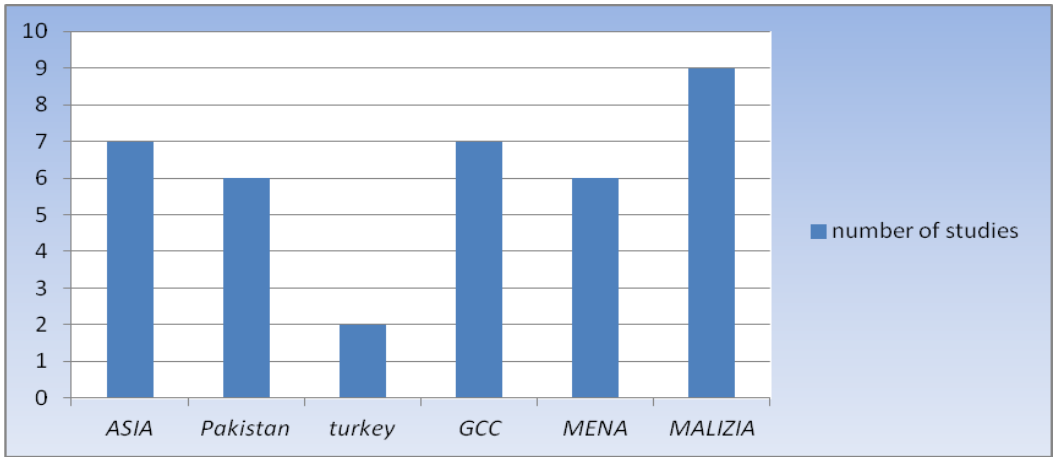

Figure 3: Distribution of papers on technical efficiency of Islamic bank by countries of studies

The findings also indicated that Pure Islamic banks were more efficient as compared Islamic banks branches operated by the conventional bank. However, National Bank and Standard Chartered were the most efficient banks.

The study found that the average efficiencies of pure Islamic banks were higher than the Islamic banks branches operated by conventional banks. This is due to the fact that pure Islamic banks have more branches than the Islamic banks branches of conventional banks.

The analysis of the technical efficiency of an Islamic bank is an interesting case in all different economies. According to the papers examined in this study and if we look at a graph that shows the distribution of papers on technical efficiency of Islamic bank by countries of studies, we find that Malaysian contexts are the most studied. Then there are some studies that examined the efficiency of Islamic banks relative to Islamic banks operating in Asian and GCC countries; for example Johnes et al. (2009) and also Said (2013) who provided a comparative analysis of the efficiency of Islamic banking sectors in 32 banks from the Mena Region, which consists of 18 banks operating in GCC Countries; 8 banks operating in North Africa, and 6 banks operating in other MENA Countries by utilizing DEA to estimate the technical, pure technical, and scale efficiency for each bank during the period 2007 to 2009. However, other countries have recently become interested in this field of research. For example, Isik and Hassan (2002) and Alpay and Hassan (2007) propose an application in the Turkish context. Shahid et al. (2010), Akhtar (2010) and also Saeed et al. (2013) used Pakistan data and there are some studies for Islamic banking sectors in the world covering many countries at the same time such us the case of Nor Hayati et al. (2010) who adopted an international comparative perspective for 77 Islamic banking sectors in the world covering 25 countries, by using DEA method.

2.4 Nature of the Bank

For the classification of banks as Islamic, conventional or windows, we refer to our sources which are BankScope, DataStream; journals 'web sites and the International Finance Information Service.

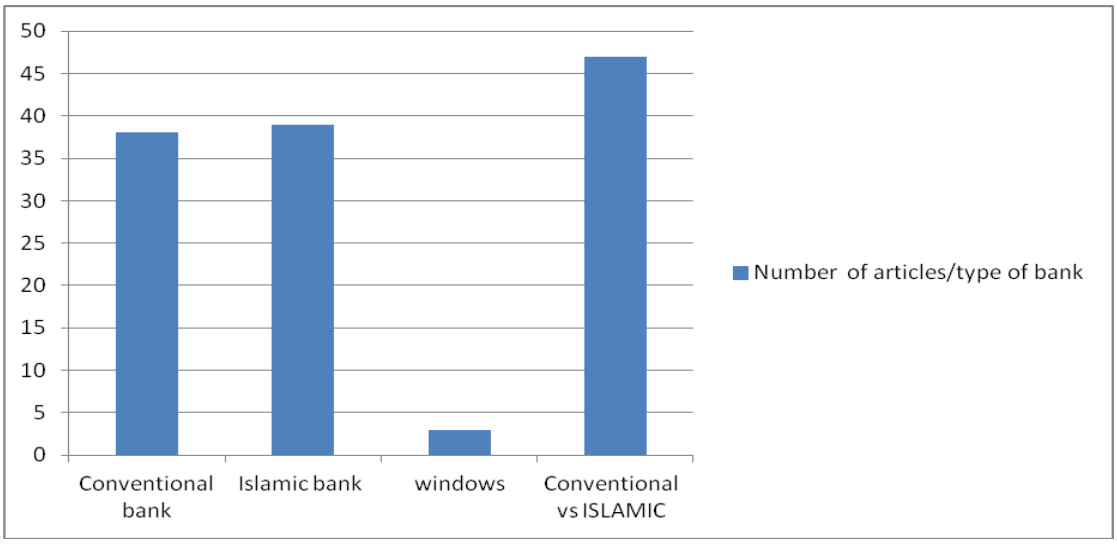

Figure 4: Distribution of papers by type of bank.

This section discussed the literature on bank efficiency by investigating the nature of bank referent to recent studies because the phenomenon of Islamic banking and finance has developed significantly in recent years. However, only a few studies have tackled technical efficiency like a central question.

Past studies on bank efficiency and other financial institutions have focused mainly on western banks, but nowadays few studies have been devoted to examining the efficiency of Islamic banks. This is relevant to our work since we mainly consider studies about Islamic banks, which is almost 39 cases. Also, we considered the papers that compare the conventional banks to the Islamic ones. They are almost 46 articles such as the case of Omar et al; (2007) who made a comparative study based on DEA method and concluded that the two Islamic banks were operating above the average cost and profit efficiency of the western banks. Bader et al. (2008) who deduced that Islamic and Western banks were equally efficient in using their resources in proportion to their capability for creating profit. Also, they showed that the cost and profit efficiency of older Western banks was better than that of older Islamic banks because Western banks had learned more from their business experience over a longer period of time.

Also, recent studies based on comparison show that the performance of conventional banks is better than Islamic banks in terms of efficiency and liquidity ratio.

Saeed et al. (2013) by using DEA method conclude that Islamic banks are better than public sector and foreign banks but the performance of private sector is much better than Islamic banks. Therefore, conventional banks are more efficient than Islamic banks. According to this article, we notice that the researchers always resort

to comparative studies thanks to the advantages brought by this method. It enables detection of the strengths and the weaknesses of each bank type.

We also notice that there are some studies about the Windows which is a solution suggested by the commercial banks that are specialized in the sales of the Islamic products and services. This aims at facing the tough competition of the Islamic banks. However, this type of banks is still used on a smaller scale due to the ambiguity that surrounds it. In this study, we considered the article of Mokhtar et al. (2006). It was noted that the efficiency level of Islamic banking is still lower than that of conventional banks. In addition, Full-fledged Islamic banks are more efficient than Islamic windows while Islamic windows of foreign banks tend to be more efficient than those of domestic banks. However, the efficiency of the overall Islamic banking industry has increased during the period of study while that of conventional banks remained stable over time. Finally, we pooled the data to carry out factors that influence banks' efficiency.

2.5 Approach adopted for measuring technical efficiency

Technical efficiency indicates how an optimal use of physical resources is available for a given production level institution.

Different techniques have been applied in bank efficiency studies to estimate the technical efficiency score of a bank. Indeed, the most used approaches are parametric approaches, which comprise the SFA, Distribution-Free Approach (DFA), and the Thick Frontier Approach (TFA). Whereas, the non-parametric approach most commonly used are the DEA and Free Disposable Hull (FDH) (Berger and Humphrey, 1997).

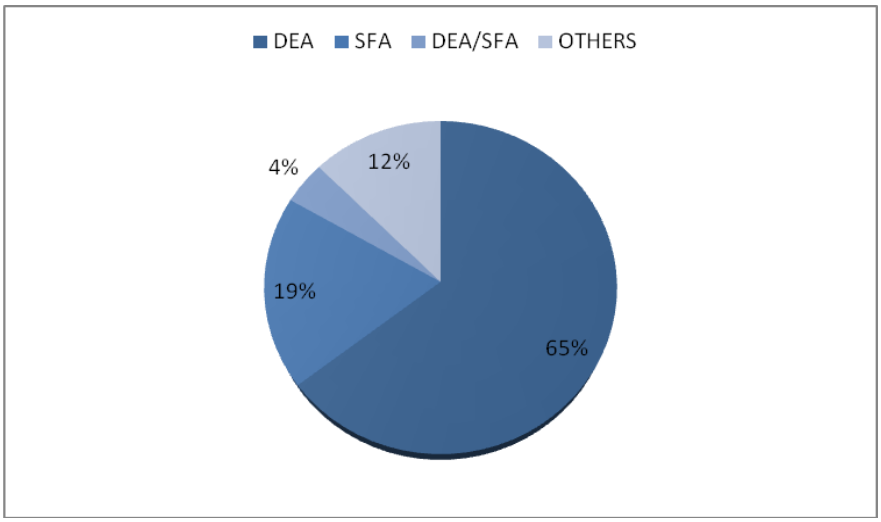

Figure 5: Distribution of papers by adopted method.

Measuring the efficiency of the bank is mainly focused on two different methods namely parametric and nonparametric approaches. It is clear from the information given in this pie chart that in our sample there is around 65 percent of studies, which have analysed efficiency in banking, particularly using non-parametric methods.

The DEA methodology is a mathematical programming approach used to develop efficient frontiers, which are then used to generate relative efficiency measurements. In other words, Non-parametric approaches have the characteristic that they do not require a model specification in order to compute the best-practice frontier.

The excessive resort to this method makes it clear why DEA is among the most useful and most widely used statistical methods. It is a reliable and easy to use tool to determine banks efficacies, as it is shown by Cook et al. (2000), Abdul Majid (2007), Chortareas et al. (2009, 2011), and Almumani (2013).

One of the strengths of the DEA method is that it is less demanding of data and works with a small sample size (Canhoto and Dermine, 2003). In other words, DEA method is suitable for small samples (Ludwin and Guthrie, 1989). The small sample size was among the reasons that made researchers to choose DEA as the efficiency assessment tool of Islamic banks across the world. This is because of the small number of Islamic banks. Secondly, DEA opens the door to measure the technical efficiency of firms combining several inputs to produce several different outputs. Finally, DEA assumes that the linear replacement is possible between the inputs on an isoquant combinations observed.

However, the DEA also has some limitations such as extreme sensitivity of the data for any errors, given the deterministic nature of the method. On the other hand, it spreads the extent of allocative efficiency and, therefore, does not take into account the cost of different factors.

Otherwise, the Stochastic Frontier approach, which is, also known as the econometric frontier approach indicates a functional form for the relationship cost, profit or production between inputs, outputs and environmental factors, while allowing error random.

The SFA method is used to analyze the efficiency of banks in the sample. This method is well documented in the literature: Bonin et al. (2005), Kwan (2006), Rossi et al. (2009), Chelo (2011), Zhang et al. (2012) and Yin et al. (2013).

Briefly explained, SFA method has been widely used by a considerable number of studies to evaluate the bank efficiency (around 19 percent). The SFA method specifies a functional form for costs, profits or production relationship between inputs, outputs, and environmental factors. It is usually a translog function. Unlike the two non-parametric approaches, the presence of SFA allows random errors.

Moreover, SFA uses the method of maximum likelihood to estimate the stochastic frontier. Similarly, this method can specify noise (separates noise from efficiency scores).

However, a major disadvantage of the parametric approach is that the pre-specified functional form for the frontier efficiency can result in inaccurate measurement of efficiency (Berger and Humphrey, 1997). Although the non-parametric approach can avoid this problem misspecification, its assumption of no random errors and their influence on the performance of banks may lead to errors in the estimates omitted efficiency. It is for this reason that studies appear with a mixed method; in other words, the addition of flexible parametric approaches or introduction of random errors in the non-parametric methods.

Among the studies that use mixed approach (SFA/DEA) for measuring banks efficiency, we can mention Hassan (2005, 2006) and Hassan and Bashir (2005).

There are around 12 percent of articles used in our research which use other measurements methods. There are many examples, such as ROE, ROA, GWE, VAR…Bashir (2003), Hassan (2003), Tabak et al. (2013) and recently Saeed et Izzeldin (2014) use SFA/VAR method.

2.6 Outputs and Inputs

The purpose of this classification is to determine whether efficiency in Islamic banks is improving, worsening or is static during the reform period.

In general, the literature on bank efficiency begins with taking into account inputs and outputs.

In our samples, the most notable inputs are those showing the high variability in the use of inputs and outputs in banks technical efficiency.

Most studies use labor, fixed assets, and total deposits as inputs (Mokhtar et al. (2007), Mohamad Akbar and Nor Hayati (2012) and Said (2013) have an application using labor as the most important input). But not all of them include those inputs although there are also other inputs. For example, Ayadi (2013), Saeed et Izzeldin (2014) and Chan et al. (2014) include physical and financial capital. Leong et al. (2003) use the total number of employees in their studies about Singapore banks. And concerning Islamic banks, Akhtar (2010) uses this input for Pakistani banks.

A similar variety of numbers of indicators is observed with output; Investments, total loans (used by Fadzlan and Habibullah (2010) and Said 2012), liquid assets, and other income are among the most useful and most widely used output.

In fact, choosing the appropriate output is an important issue for research on banks efficiency. Although the multiproduct nature of Islamic finance is widely recognized, there is still no agreement on the explicit definition and measurement of inputs and outputs, which justifies the variety of variables.

2.7 Determinants of Banks efficiency:

Our analysis of the estimated efficiency score shows the variation trend of banking efficiency with some fluctuations and variations in efficiency between different banks whether Islamic or Conventional.

Under this criterion, we examine the determinants of bank efficiency by regressing the technical efficiency scores on various bank characteristics that are believed to affect bank efficiency.

To understand the reasons for efficiency scores in a subsample of banks, these are studied more closely in which researchers suggest specific determinants for example size, ownership, type, Age, Profit, Costs Structure, competition, market power, Political Economy regulatory and environments.

First, we examine the effect of bank ownership. It has been widely documented in the literature that ownership is an important determinant of firm performance. Some studies have compared the efficiency of the public and private sector and the results show a positive and statistically significant ownership impact on bank efficiency. In other words, private banks are more efficient than public banks (Cook et al. 2010). In the banking literature, Weill (2006) found that Banks on foreign ownership have better technical efficiency than credit institutions to the domestic property. Similarly, Micco et al. (2007) confirm that state-owned banks are less cost-efficient than private banks in developing countries.

Therefore, in bank efficiency studies, it is observed that private banks have a higher mean efficiency score than public banks, which supports the arguments for rapid privatization (Taci and Zampieri 1998; Yao et al. 2007). Secondly, with a more updated and comprehensive data set for banks, we re-examine the relationship between bank size and technical efficiency.

Banks' size might explain the discrepancies in efficiency. Kwan (2006) confirmed that large banks were found to be less efficient than small banks. In this context, the size effect seems to be related to differences in the characteristics of the portfolio of banks of different sizes. The empirical work done so far yielded has conclusive results; famous examples of this are Pasiouras et al. (2007) who stated that there is a positive relationship between bank efficiency and size. In the same context, Al Shamsi et al. (2009) affirmed that the sample banks became more efficient by increasing their size. And recently, Almumani (2013) stated that the relative efficiency of Saudi smaller banks significantly outperforms medium and larger size banks.

Also, Said (2012) found that Islamic banks experience difference in efficiency due the size and region of that bank during a financial crisis, then, the size of a bank would affect the efficiency during financial troubles. Thus, there is a positive relationship between bank efficiency, loans intensity, size, capitalization, and profitability.

Moreover, Fadzlan (2009) examined the efficiency of Islamic banks, and Western banks using DEA method. His study found that the variables of ownership structure, size, and profitability have a positive and significant effect on the efficiency of the Malaysian banking sector.

Thirdly, we test the effect of bank Age. In this context, there are two ways.

On the one hand, Bader et al. (2008) affirmed that both smaller and larger Islamic banks needed to pay more attention to cost and profit efficiency if they wished to stay competitive. Also, they found that the cost and profit efficiency of older Western banks was better than that of older Islamic banks because Western banks had learned more from their business experience over a longer period of time. Similarly, Newer Islamic banks were less efficient than older ones, and the older Western banks were better in cost and revenue efficiency than the newer ones.

On the other hand, Viverita and Skully (2007) observe that Technical efficiency results were not correlated with the bank's age. This may result that the age of each bank was correlated against the various efficiency results. It could be expected that newer banks may have had a chance to implement newer technologies.

Fourth, we test the effect of the types of banks in their efficiency. With the development of the financial sector, different types of banks emerged such as commercial bank, Islamic bank, and Islamic window.

There has been a widespread discussion on the lack of an adequate technical efficiency of banks.

Hassan (2005) found that the Islamic banks are more profit efficient, with an average profit efficiency score of 84% under the profit efficiency frontier compared to 74% under the stochastic cost frontier. The main source of inefficiency is allocative rather than technical.

So, on average, the Islamic banking industry is relatively less efficient compared to their conventional counterparts in other parts of the world.

Mokhtar et al. (2006) presented a rigorous econometric study on the 20 Islamic windows, 2 full-fledged Islamic banks and 20 conventional banks in Malaysia. They claim that full-fledged Islamic banks are more efficient than Islamic windows, while Islamic windows of foreign banks tend to be more efficient than those of domestic banks. They also conclude that the efficiency level of Islamic banking is still lower than that of conventional banks. Then, in 2007, Al-Jarrah and Molyneux used a sample of 82 banks operating in Jordan, Egypt, Saudi Arabia and Bahrain. They suggested that Islamic banks were found to be the most cost and profit efficient while investment banks are the least (cost and profit efficient).

In the same year, Fadzlan (2007) has focused on Malaysian banks and he found that the window based Islamic banking operations performed better than the full-fledged Islamic banks. This superior performance of the window-based Islamic banks is mainly due to the sub-optimal scale of operations. Thus, technical efficiency scores are improving more for the conventional banks offering Islamic banking products and services than for the full-fledged Islamic bank. That is why he suggests that for the full-fledged Islamic bank to be efficient, they need to minimize their size.

Additionally, Safiullah (2010) states that Islamic banks performed better in business development, profitability, liquidity, and solvency than the Western banks. Recently, Saeed et al. (2013) showed that Islamic banks are better than the public sector and foreign banks but the performance of the private sector is much better than Islamic banks**.**

In addition, efficiency levels could mostly be improved by cost and Profits: At an Islamic bank, the level of nontraditional activities chosen by management can be analyzed in light of profits earned from traditional activities. As regards this type of profit, two possible scenarios would exist. First, it may be that the profits are low compared to its competitors, inside and/or outside of the banking industry. Volumes of profits or net income margins or both are declining. In this case, a measure of nontraditional activities would be inversely related to a measure of profits from traditional activities across a sample of banks. Secondly, the profits from traditional activities may be high relative to competing banks. Either volume or the margins have not declined, or a decline in one is offset by a rise in the other. Here, the income from nontraditional activities is augmenting the profit from traditional activities.

Profits from traditional activities in Islamic banks are measured by Net Income Margin (NIM). It is calculated as the ratio of the difference between income from the investment of depositors' fund and income attributable to depositors, to total assets.

In general, the higher the NIM is, the higher is the banks' profitability, and the most stable is the banking sector. If banks with large amounts of nontraditional activities have fewer profits from traditional activities, then a negative relationship will exist between fee income and NIM, and vice versa.

For Islamic banks, the income consists of the profit generated from various banking activities including; financing such as equity financings (*mudarabah* & *musharakah*), debt-financings (*bay' bi thaman ajil*, *murabahah* and *ijarah*); participation in direct investment (investment securities and dealing securities); and non-financing income, such as fee and other operating income.

A significant difference existed in cost and profit efficiency between Islamic and Western banks. This is proved by many studies such us Isik and Hassan (2002) who concluded that there is a very low correlation between profit and cost efficiency in the Turkish banking system.

Omar et al. (2007) found that the two Islamic banks were operating above the average cost and profit efficiency of the Western banks.

Abdul Majid et al. (2005), Kamaruddin et al. (2008) concluded that Islamic banks were more efficient than conventional banks relatively at controlling costs than at generating profits.

Bader et al. (2008) in their research found that Islamic and Western banks were equally efficient in using their resources in proportion to their capability of creating profit. Then the cost and profit efficiency of older Western banks were better than that of older Islamic banks because Western banks had learned more from their business experience over a longer period of time. In addition, newer Islamic banks were less efficient than older ones, and the older Western banks were better in cost and revenue efficiency than the newer ones. Finally, both smaller and larger Islamic banks needed to pay more attention to cost and profit efficiency if they wished to stay competitive.

Moreover, concerning the windows**,** Kamaruddin et al. (2008) found that Islamic windows and foreign Islamic banks operated more efficiently on the cost side than the profit side.

There are also serious research works by Nor Hayati et al. (2010) for 78 Islamic banks in 25 countries. They noted that Profit efficiency and pure technical efficiency, outweigh scale efficiency in World Islamic banking countries. They also added that banks from the high-income countries were the leaders by dominating the most efficiency frontier. And high-income country Islamic banks seem to have dominated the highest three efficiency frontier, led by Bahrain, followed by UAE and number three is Qatar.

Lastly, past studies on bank efficiency focused mainly on Political Economy and regulatory environments. In this context, González (2005), in his study over the period 1996-2002 in banks from 69 countries, claimed that the ability of the efficiency structure hypothesis to explain bank-market structure varies across countries depending on national political economy variables. He added that increased market monitoring and better-quality contracting environment amplify the positive influence of bank efficiency on market share and market concentration. In addition, banks that are more efficient have, on average, larger national market share and higher market concentration. Thus, for reducing efficiency in a country where there is greater private supervision and a stronger contracting environment while it could improve efficiency in countries with less efficient regulatory environments and more generous deposit insurance.

Hassan (2006) showed that Islamic banks operate in overall regulatory environments that are not very supportive of their operations.

Chortareas et al. (2011) noted that the variables capturing regulatory restrictions on bank activities and private monitoring appear to be affecting adversely the efficient operation of banks. Considering the economic and institutional environment within which bank supervisory and regulatory policies affect bank performance, they find that larger banks operating in countries with less concentrated and more developed systems tend to have relatively higher levels of efficiency. Moreover, their results are consistent with the view that the functioning of national political systems may affect the efficient operation of banks. Controlling for these broader, national characteristics, can explain cross-bank differences in terms of efficiency. Furthermore, their evidence shows the potential perils in terms of loss of bank efficiency from excessive requirements for market monitoring in the attempt to strengthen market discipline. The emerging challenge is to consider which specific aspects of regulatory and supervisory policies affect bank performance and how their implementation and effectiveness is related to the broader institutional framework.

In addition, Zhang et al. (2012) concluded that a better legal environment, increased efficiency in the legal system and strengthening the protection of intellectual property rights are associated with a higher level of efficiency between banks.

2.8 Empirical findings

In the papers reviewed in Table 1, the authors discuss the technical efficiency of Islamic and conventional banks. For this reason, we pooled the data to carry out many results based on papers' nature, period, and countries of study, the nature of the Bank, adopted approach and determinants of banks efficiency.

To Some extent, we find evidence suggesting that empirical findings depend on the adopted Approaches. Indeed, differences in the underlying instrument assumptions imply that the nonparametric and parametric stochastic approaches may influence bank efficiency scores.

Thus, according to this criterion, there are many results and suggestions that are based on the employed method where each researcher defends his/her results that are obtained through either the method of DEA or SFA or both at the same time as we have seen or using another method, which has its characteristics.

Then, we can say in addition that the results highlight the importance of taking into account the period and the countries of study, as we know that the results vary depending on the period. For example, the efficiency of banks is fragile during any crisis. It also depends on the country of study, that is to say their effectiveness in developed countries is not that even in the developing countries, which can be observed in several examples.

At the same time, we find a relationship between the nature of the bank and efficiency. In that context, we talk about the efficiency of Islamic banks against the efficiency of their conventional concurrent.

In addition to the empirical findings of efficiency measures, determinants of banks efficiency usually are also interesting. In other word, they are the measurement variables that have been widely used such as size, ownership, type, age, profit, costs structure, competition, market power, political economy regulatory and environments… Those variables influence the results.

Recommendations

In general, the literature on bank efficiency begins with taking into account inputs and outputs.

In our samples, the most notable inputs are those showing the high variability in the use of inputs and outputs in banks technical efficiency.

We observed that most studies use labor, fixed assets, and total deposits as inputs and total loans, liquid assets, and other income are among the most useful and most widely used output,(Mokhtar et al. 2007, Mohamad Akbar and Nor Hayati 2012 and Said 2013). But not all of them include those inputs although there are also other variables.

The findings of their studies have important implications for efficiency managing the financial institutions, especially the Islamic banks. For this reason it is important to know that future studies will have an application using labor, fixed assets and total deposits as the most important input and total loans, liquid assets, and other income as an output.

In addition, to understand the reasons for efficiency scores of banks, these are studied more closely in which researchers suggest specific determinants for example size, ownership, Age, regulatory and non-traditional activities … So we have taken all the factors into consideration.

Concerning the adopted approaches., The findings of the study show that implications for the efficiency of the financial institutions depend on the choose of the technique, especially stochastic frontier approaches.

Consequently, drawing efficiency results of banks we must applied SFA method.

Studies show that Islamic banks cannot operate within their full efficiency, so it is a matter of significant importance to know, some recommendation to succeed banks technical efficiency of' topics.

Conclusion

The Islamic banking sector provides an interesting context for studying bank efficiency, as it underwent significant changes during the last two decades.

This has created a new more competitive economic environment, within which the banking sector nowadays operates.

To our knowledge, there are few survey papers focusing on the technical efficiency of Islamic banks. To perform this task, the present study proceeded in two stages.

First, We classified articles of technical efficiency of the Islamic and classic banking system until 2014 by reference to journals, date of publication, the nature of the papers, the context of the study, nature of the bank, the adopted approach by which efficiency is measured, the adopted outputs and inputs, determinants of banks efficiency and empirical findings.

Second, we made a classification of papers by authors, a context of studies and date of publications. Here we have given a general idea about all the articles that are collected and relative to our items. On this basis, the main results suggest that more than 18 articles were published in 2010 but we also find that there were many publications in 2013 and also in 2014.

If we look at the distribution of papers by countries of studies, we find that Malaysia contexts are the most studied. Then, there are some studies that examined the efficiency of Islamic banks relative to Islamic banks operating in Asian and GCC countries.

The nature of the bank means the classification of banks as Islamic, conventional or windows. We refer to recent studies with almost 39 cases about Islamic banks and almost 46 articles that compare the conventional banks

to the Islamic ones. The results differ from one Article to another; there are those who affirm that Islamic banks are more efficient than western ones (Omar et al. 2007), and those who showed that the cost and profit efficiency of older Western banks was better than that of older Islamic banks (Bader et al. 2008).

Also, recent studies that are based on comparison show that the performance of conventional banks is better than Islamic banks and also conventional banks are better in terms of efficiency and liquidity ratio. In the same context, Saeed et al. (2013) concluded that Conventional banks are more efficient than Islamic banks.

In addition, Full-fledged Islamic banks are more efficient than Islamic windows while Islamic windows of foreign banks tend to be more efficient than those of domestic banks. However, the efficiency of the overall Islamic banking industry has increased during the period of study while that of conventional banks remained stable over time.

To our knowledge, different techniques have been applied in bank efficiency studies to estimate the technical efficiency score of a bank. In a nutshell, the results obtained from the various methods are substantially different. This may be attributed to the inner advantages and disadvantages of each approach, and leads to the conclusion that it is important to use more than one methodology to evaluate bank efficiency.

In our sample, there is around 65 percent of studies that use non-parametric methods and around 19 percent of studies that are based on Approach (SFA). There are some studies that use mixed approach (SFA/DEA) for measuring banks efficiency 4% and there are around 12 percent of articles used on our research which use other measurement methods. There are many examples, such as ROE, ROA, GWE, VAR…

The literature on bank efficiency begins with taking into account inputs and outputs; most studies use labor, fixed assets, and total deposits as inputs. A similar variety of numbers of indicators is observed with output such us investments, total loans (used by Fadzlan and Zulkhibri 2008, Fadzlan 2009, Akhtar 2010 and Said 2012), liquid assets, and other incomes are among the most useful and most widely used outputs.

Then, we examine the determinants of bank efficiency by regressing the technical efficiency scores on various bank characteristics that are believed to affect bank efficiency and the measurement variables that have been widely used are size, ownership, type, age, profit, costs structure, competition, market power, political economy regulatory and environments…

First, we examine the effect of bank ownership, which has been widely documented in the literature. That ownership is an important determinant of firm performance; the results show a positive and statistically significant ownership structure on bank efficiency. So, in bank efficiency studies, it is observed that private banks have a higher mean efficiency score than public banks.

Second, we re-examine the relationship between bank size and technical efficiency because banks' size might explain the discrepancies in efficiency. Here, there are two contradictory ideas. The first is that of Kwan (2006) who confirmed that large banks were found to be less efficient than small banks. The second is that of Pasiouras et al. (2007) who stated that there is a positive relationship between bank efficiency and the size. In the same context, Al Shamsi et al. (2009) affirmed that the sample banks became more efficient by increasing their size. This last idea was justified in new researches such as Almumani (2013) who stated that the relative efficiency of Saudi smaller banks significantly outperforms much better than medium and larger size banks.

Then, we test the effect of bank Age. In this context, there are two ways. The first one in which they found that the cost and profit efficiency of older Western banks was better than that of older Islamic banks because Western banks had learned more from their business experience over a longer period of time. In other word, Newer Islamic banks were less efficient than older ones, and the older Western banks were better in cost and revenue efficiency than the newer ones, but in the second way, Viverita and Skully (2007) observed that Technical efficiency results were not correlated with the bank's age. In addition, we examine the effect of the types of banks in their efficiency. Indeed, different types of banks emerged such as commercial banks, Islamic banks, and Islamic windows. In this context, Hassan (2005) found that the Islamic banks are more profit efficient.

Also, Efficiency levels could most be improved by cost and Profits at an Islamic bank. Here Abdul Majid et al. (2005) ; Kamaruddin et al. (2008) concluded that Islamic banks were more efficient than conventional banks relatively at controlling costs than at generating profits. But Bader et al. (2008) in their research found that Islamic and Western banks were equally efficient in using their resources in proportion to their capability of creating profit. In addition those determinants of technical efficiency, past studies focused mainly on Political Economy and regulatory environments.

Concerning Empirical findings, we pooled the data to carry out many results based on papers' nature, period, and countries of study, a nature of the Bank, adopted approach and determinants of banks efficiency. Many results and suggestions are based on this classification and the employed method. Therefore, we can say, in addition, that the results highlight the importance of taking into account the period and the countries of study, as we know that the results vary depending on the period.

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