

Master Thesis Financial Management

Is Islamic banking more efficient than conventional banking?: A Meta-analysis

Name: M.M.C.W. Dumont
ANR: S768719
Date: August 15, 2012
Faculty: Tilburg School of Economics and Management
Department: Department of Finance
Supervisor: Prof. dr. S.R.G. Ongena
Second Supervisor: Prof. dr. J.J.A.G. Driessen





Master Thesis Financial Management

Is Islamic banking more efficient than conventional banking?: A Meta-analysis

Abstract:
The purpose of this thesis is to examine efficiency differences between Islamic banking and conventional banking. A meta-analysis of 42 studies, using non-parametric Data Envelopment Analyses, covering the period 1990-2010, shows that the average technical efficiency does not differ between the two banking types. However, the average pure technical efficiency of Islamic does significantly differ from pure technical efficiency of conventional banks. The results of this research also show that quality of the researches used as an input does influence the efficiency estimates.

Keywords: Islamic banking, Meta-analysis, Data Envelopment Analysis, Stochastic Frontier Analysis, Technical Efficiency, Pure technical efficiency and Scale efficiency

Name: M.M.C.W. Dumont[1]
ANR: S768719
Date: August 15, 2012
Faculty: Tilburg School of Economics and Management
Department: Department of Finance
Supervisor: Prof. dr. S.R.G. Ongena
Second Supervisor: Prof. dr. J.J.A.G. Driessen

[1] Acknowledgement: I would like to thank my supervisor Prof. dr. Steven Ongena for his patience, helpful suggestions, and good spirit throughout the process of this Master thesis. I would also want to thank my family and friends for their patience, support, and their spirit in times needed. A special thank is needed for my parents, and my partner Pauline Verhoef. Thank you all.

TILBURG UNIVERSITY

Index

Index 3
1. Introduction 4
1.1 Research method 5
1.2 Data resources 6
2. Current state of literature 6
2.1 Reviewing Islamic banking 6
2.2 Results of earlier efficiency studies 9
3. Data and Environment 14
3.1 Efficient frontier 15
3.2 Data (re)-sources 18
3.2.1 Data Included 19
3.2.2 Information requirement 21
4. Introduction to statistical analysis 22
4.1 Meta-analyses 22
4.2 Introduction to Data Enveloped Analysis 23
4.2.1 DEA: the intermediation approach 24
4.2.2 DEA: the production approach 24
4.3 Introduction to Stochastic Frontier Analysis 24
4.4 Combining the above research methods step wise 25
5. Meta-analysis 27
5.1 Build up 27
5.1.1 Strong shoulders 28
5.1.2 Panel A featuring Islamic Banking 28
5.1.3 Panel B featuring conventional banking 30
5.1.4 Statistical effects and considerations 32
5.2 Overview 33
6. Comparison between other efficiency estimates 35
6.1 Differences and compliance 35
6.2 Constistency 37
7. Conclusion and recommendations 37
7.1 Conclusion 38
7.2 Recommendations 38
References 40
Input meta-analysis 49
Overview of statistical tests 54

1. Introduction

Islamic finance, a non-interest based way of finance compels a wide range of financial products and is growing fast. Islamic finance is currently practiced in more than 50 countries worldwide, and manages assets worth a staggering US $ 250 billion (2004) which is expected to grow 15 % per annum (Chong and Liu, 2009). A more recent estimate ranges from US $ 800 billion and upwards with growth rates of 10-15% per annum[2]. This clearly shows that Islamic finance is at an extreme pace of expansion. This Master Thesis will address this topic and several implications of it.

The topic of this Master Thesis is even more relevant because banks in the Islamic world did not have to cope with the negative effects of the bank and liquidity crises in the way conventional banks did. Less bankruptcies and less financial distress meant lower volatility figures during the financial crisis. This would suggest that Islamic banking is much more efficient than conventional banking in these volatile market circumstances. Therefore, the aim of this thesis is to investigate the efficiency of Islamic banking compared to conventional banking. Such a comparison would provide more insight into the optimal capital allocation and the ongoing globalization as Islamic banking may provide new finance products and will increase competition in established finance markets. The role of a financial system is the same all over the world: provide finance where needed. This task can be divided into four parts: provide financial intermediation, provide financial services not directly related to financial intermediation, create a wide range of assets and liabilities each of different characteristics (maturity, liquidity, return and risk sharing) and last but not least the creation of incentive for efficient allocation of resources within an economy (Iqbal and Llewellyn, 2002). These key roles are not specific to any form of banking but the way in which they are performed diversifies the conventional way of banking and the Islamic way of banking.

Cross-country studies provide valuable information and meta-analyses will be the tool to do so. Meta-analyses allow us to organize and analyze the results of different studies to obtain unbiased generalizations (Glass, McGaw, and Smith, 1981). Therefore it gives us the possibility for a more comprehensive view on the problem statement. Lining up and considering all available information and considering the quality and the value to the goal of this paper while doing justice to value of the considered paper(s) in the same time is the ultimate goal. Islamic banking is not the same in every country as supervision and regulatory restrictions are not the same in every (Islamic) country or region. Therefore

[2] Oakley, D., Bond, S., O'Murchu, C., Jones, C., "Islamic Finance Explained", Financial Times, May 30, 2008

a more comprehensive view is needed. Earlier research described the similarities and the differences between the two different forms of banking. Most literature is headed on what Islamic banking and financing can learn from the conventional way of banking and financing. Conventional banking and financing has suffered great losses during the credit crunch and the liquidity crisis following. Islamic financing is growing at a fast rate and globalization is an ongoing process. The question to be answered is therefore the following:

Is Islamic banking more efficient than conventional banking?

The research question could be extended with the following question: what are the differences between Islamic banking and conventional banking, and how does this relate to differences in efficiency. How this research question is answered and in which part of the thesis is found below in the research method.

1.1 Research method

The meta-analysis considers 42 efficiency studies, and uses three research methods, namely Data Envelopment Analysis (DEA), Stochastic Frontier Analysis (SFA) and Meta-analysis. Combining the three research techniques will be dealt with in latter of this thesis as they all have their own extinct features

As stated by Bader, Mohamad and Hassan (2008), the Islamic banking literature contains meanly studies examining emerging markets, and less developed countries, whereas the conventional banking literature includes studies from both developed and less developed countries. Only few studies cover the whole banking industry, due to the limitations that are associated with comprehensive efficiency studies. Indeed there are a lot of limitations associated with doing a comprehensive research on a fairly new industry but meta-analysis could help doing so. Data availability and comparability of efficiency figures are possibly the two major limitations.

This thesis starts with a fundamental literature review, concerning both Islamic and conventional banking in the last two decades. Next, the basic features of Islamic banking and finance will shortly be described. Subsequently, the pros and cons of the research methods used in previous efficiency studies will be discussed. The next section consists of the results of the comparison between the several non-parametric studies and methodologies, as well as non-parametric and parametric analyses based on technical efficiency and other efficiency estimates. Finally, conclusions and policy recommendations are given.

1.2 Data resources

This research will consider an evaluation of empirical findings over the last two decades on similarities and differences of the Islamic and conventional banking forms. The empirical assessment will be done on the basis of comparing average efficiency ratios of Islamic banks to conventional banks. This empirical assessment will be constituted through a meta-analysis comprising data of 42 multiple year DEA Studies. Furthermore, the Stochastic Frontier Approach is used to further explain the nature of the results to ultimately establish an overall view which banking method is more efficient. Together they will give an overview of efficiency statistics which can be evaluated, ultimately this will lead to a better understanding of the business opportunities for Western Banks to possibly adapt some operational activities or financial products for the global market or the challenges that Islamic banking will face in the near future. The exact use and method to combine these two research methods is explained in section 3.

2. Current state of literature

In this section, the current state of the literature will be described. A wide range of studies of information are used as Islamic banking is attracting a lot of attention from various economists, researchers or policymakers. The use of DEA and SFA efficiency studies is already described but the flow of economic and financial reform and restructuring studies is a major sources of this literature review.

2.1 Reviewing Islamic banking

Islamic banking is often described as a way of banking that does not permit any form of interest. This is not completely true. A return is prohibited only if it is earned with a certain risk that was compensated. The Islamic community has rationalized the elimination of riba (interest) based upon values of justice, efficiency, stability and growth. In terms of justice, the removal of riba results in the sharing of the risk of a project between the borrower and the lender. In addition, tying the reward to the performance of the business venture, both the efficiency, the stability and growth part are based on a better allocation of capital to more productive assets which will produce higher value for society (Zaher and Hassan, 2001).
Hassan (2005) describes Islamic banking as follows: “One must see Islamic banking as an on-going process in a social milieu characterized with mass poverty and gross inequalities in the distribution of wealth, income and opportunities”. The increased importance of Islamic banking in modern society is fueled by ongoing globalization and the increasing market share of Islamic finance in non-Sharia law restricted countries. Market openness in the banking sector and the thereby increased influence of Islamic banking worldwide has also been fueled by technological change, market integration and liberalization.

The main goals of an Islamic banking and financial system are to: (1) Implement the value system of the Quran and the Sunnah, (2) Foster growth of the economy of Muslim nations by developing financial markets, instruments and institutions, (3) Dampen the shocks of extreme economic output by promoting risk sharing instruments.[3] Islamic law does not object to payment for the use if an asset, and earning of profits or returns from assets is indeed encouraged as long as both lender and borrower share the investment risk together (Jobst, 2007).

The three most common investments forms of Islamic banking are murabaha, mudarabah and musharakah. Murabaha is similar to a term loan; the bank purchases a real asset from a third party or supplier, and sells it to its customer with a mark up. This mark up is not considered as interest as the bank is exposed to risk in the period the bank purchases the product and resells it to its customer. The possibility of paying in parts and the obligation of taking care of its customer in possible default distinguishes Murabaha from the conventional term loan. Mudarabah and musharakah are partnership investments comparable with each other but in mudarabah one party invest its knowledge and the other party the actual investment. In musharakah both parties invest knowledge and money in the business or activity. Diminishing ownership or rights on property are part of the deal as profits rise. Cost and profits are shared and thereby the risk entitled to the economic activity. An investment under Sharia restriction must hold itself from gharar and maysir where the prior means obviate preventable uncertainties and the latter a prohibition of investment in businesses associated with gambling and speculation.

Profit and loss sharing (PLS) is characterized as one of the main elements of Islamic banking. However, PLS is not used as often as one might expect.. For example, Baele, Farooq, and Ongena (2011) found that in their sample of the Pakistan market less than 3 percent of the loans outstanding was based on PLS-sharing. Furthermore Chong and Liu, (2009) found that only 0.5 percent of the Islamic loans outstanding in Malaysia adopts PLS-sharing. Thus, this paradigm is not fully utilized or carried out.

The last important feature[4] of Islamic banking is zakat, which refers to the redistribution of wealth. It is judged to be a distinct feature of Islamic banking as it directly supports the thoughts of increasing common wealth, and allows everyone to have a fair share of economic opportunities through a redistribution of ribh (profit). Hence, the Islamic banking and finance sectors are equity based, rather than

[3] Shadid Ebrahim and Tan Kai Joo, 2001

[4] More and an extensive view at Islamic banking and its features can be found in Iqbal, M. and Molyneux, P. (2005) and Beck, T., Demirgüc-Kunt, A., Merrouche O. (2010), as it is too much to address all features in full.

interest based industries. Still, Chong and Liu (2009) state that from a theoretical perspective, Islamic banking is different from conventional banking because interest (riba) is prohibited in the Islam. The conclusions of their research show that Islamic deposits are not completely interest-free at all because of competition and agency problems. Thus, although Islamic banking aims at being completely interest free, Chong and Liu deem this impossible. Some Islamic scholars state that the aim is a balance sheets free from interest baring products but other scholars state that some interest baring products could be contained if the balance is positive for non-interest baring products and other principles of Islamic banking are not harmed.

The Islamic banking sector is becoming more than just a niche market in many countries. However, competition between Islamic banks is still low, with the increasing market size for Islamic banking competition growing fast and competition is expected to increase as well. What implication will this increased competition have, and what are the possible risks? This is an important question, as increased competition will ultimately cause more efficiency or failure/bankruptcy. Kayshap and Stein (2000) found that small banks with liquid balance sheets cut their lending less than other small banks, and large banks maintain their lending irrespective of their liquidity positions. Zaheer, Ongena, and Wijnbergen (2011) found that Islamic banks although similar in size to small banks, respond similarly to monetary events as large banks. The growth of the Islamic banking sector can therefore be a threat to potency monetary policy instruments. Another remarkable fact is mentioned by Hussein (2003) as he finds that smaller Islamic banks operate more efficiently than their larger counterparts in Sudan, and that banks with a larger proportion of musharakah and mudarabah finance relative to total assets have efficiency advantages during the research period of 1990-2000. There are very few countries where well-developed conventional and Islamic banking co-exist for a considerable time. Pakistan may be one of the few countries in the world where both well-developed conventional and Islamic banking sectors have co-existed for a considerable period, formally since 2002 when Islamic banking was reintroduced in Pakistan (Zaheer, Ongena, and Wijnbergen, 2011). It is therefore worthwhile to investigate where differences can be found in efficiency as this will be the ultimate economic weapon that this battle between Islamic and conventional banking will decide.

Islamic financing is becoming more diverse and venturesome. Islamic finance has pervaded many non-Muslim countries, operating alongside and in competition with conventional financial institutions (Hasan, 2004). Not only pure economics or finance is needed to be successful but the integration of culture variables is needed to support social integration goals and successfully adopt Islamic banking products.

Simply replicating the Islamic finance products and services is not enough to achieve success, but adding a "human touch" to the banking sector is needed by making in social as well as religious elements fundamental to business goals (Ferro, 2005). Islam convictions on the responsibility of business go well beyond mere profitability goals and coincide with the renewed perception on business recently at stake within the most advanced sectors of western business and civil societies (Ferro, 2005).

Evaluating Islamic banking performance is important for several reasons. First of all, in a competitive environment you need to be efficient to be economically viable. The ongoing globalization has removed several obstacles for foreign entries and or competition. Secondly, Ahmad and Luo (2010) argue that the existence of Islamic products will increase European banking efficiency and competitiveness, because of the integration of horizontal and vertical differentiation of European banking industry products. Thirdly, comparing conventional and Islamic banks is important as they operate under similar market risks and failure of either one may cause systematic risk to the entire financial system.

2.2 Results of earlier efficiency studies

Efficiency can be measured in different ways. X-efficiency also called economic efficiency stems from technical efficiency and allocative efficiency (Yudistira, 2004). X-efficiency is also called cost efficiency. In this meta-analysis, technical and pure technical efficiency will be considered. Financial system efficiency is measured in term of efficiency achieved in mobilizing savings from the savings-surplus units in the economy and in allocating these funds among saving-deficits units in the economy. Efficiency is one aspect of investigating a firm's performance, and can be measured in three ways: maximization of output, minimization of cost, and maximization of profits. In general, economic efficiency is divided into two components, namely: technical and allocative components (Farrell, 1957) and (Kumbhakar and Lovell, 2003). A firm is regarded as technically efficient if it is able to obtain maximum outputs from given inputs or minimize inputs used in producing given outputs. A firm is considered to be allocative efficient when the right mix of input or output is found. For a financial system in a country or region as a whole these standards can be used in a same manner. According to Koopmans (1951) a system or producer is technical efficient if, and only if, it is impossible to produce more of any output without producing less of some other output or using more of some input.

Because of severe competition between banks and between banking methods it is extremely important for both Islamic and conventional banks to operate efficiently. Therefore, studies on bank efficiency gained attention not only from policy makers, but also from researchers and managers. Policy makers can use a

better understanding of bank efficiency to schedule the impact of policies implemented in the financial system. Managers can base their business strategy on efficiency studies to improve profitability or to create a benchmark to their main competitors.

Yaumidin (2007) compares different literature findings on efficiency including Iqbal (2001) and Yudistira (2004) and Samad and Hassan, (1999) and continues his paper by doing a DEA on the productive efficiency of Islamic banks in the Middle East and South East Asia in the years 2000 to 2004.
Beck, Demirgüc-Kunt and Merrouche (2010) described and did academic research on the relative performance of Islamic banking compared to the conventional way of banking and especially to what extent the information asymmetries between lender and borrower or investor affect the financial products as agency problems arise. More importantly, they compared the two business models on efficiency, asset quality and stability using a dataset constructed from data of Bankscope. Their conclusion is that there is little difference between the two bank types when it comes to risk taking, business models, and stability. It remains unsure, however, whether the data does not allow for this distinction or whether the difference is indeed less significant.

Iqbal and Molyneux (2005) examined twelve top Islamic banks and compared them with a peer group of twelve conventional banks comparable in size and from the same countries as the Islamic banks. The results of this relatively small but renewing research are sometimes remarkable. A short summary of Iqbal and Molyneux statements that address issues between Islamic banking and conventional banking is to be found below. Key words in their statements are liquidity, variation and of course cost of input. Islamic banks have to keep more liquidity on their balance sheets because of legal reserve requirements and because the possibility to loan from a central bank is more difficult due to the involvement of interest. Furthermore, it is stated that on the bases of a return on assets and return on equity ratios that the profitability in general is at least or even surpasses the profitability of the ‘international standards’ for banks. But if one could include the higher risk factor for the deposit holders of Islamic banks as their principal amount are not guaranteed the compensation should be higher. The rates of returns are however lower and therefore less attractive. Rates paid to deposit holders must be made more attractive as to make Islamic banking not only an attractive business because of the loyalty of customers. On the long run deposit holders must be facing an amount equivalent to a return is positioned closed to the market rate of interest plus a compensation for the risk that is shared with the bank.

Variation in the dataset is according to Iqbal and Molyneux (2005) more than often a statistical problem. They conclude that compared to conventional banks, Islamic banks as a group outperformed the former in almost all areas and in almost all years in their research. However there were considerable variations among Islamic banks in terms of growth as well as performance. Therefore results based on averages figure must be taken with caution.

Iqbal and Molyneux (2005) conclude that it seems that Islamic banks have higher cost efficiency because of their generally lower cost of funds compared to commercial and investment banks. However, they state that just looking at cost efficiency could cause a biased view at economic reality. Just looking at this parameter may be misleading as it can state that a highly cost-efficient bank could earn very low revenue and vice versa. The overall conclusion of Iqbal and Molyneux is that Islamic banking can act as effective competitors to conventional banks and operate with at least the same technology.

Mohamad, Hassan, and Bader (2008) conclude in a SFA based paper that there is a significant difference between Cost and Profit efficiency for banks. They however find no significant differences between Cost and Profit efficiency between Islamic and Conventional banks. They concluded that this implies that both banking streams have similar levels of cost and profit efficiency. Profit efficiency is a lot harder to estimate with DEA. The difficulty to measure output prices is the most obvious reason.

Shah, Shah, and Ahmad (2012) constructed a paper based on two different input output models: the loan and income based models, when estimating the efficiency of Pakistan banking efficiency of Islamic and conventional banking. Out of their Tobit-regression follows that Total markup expenses, Total Liability and Ownership has a significant effect on technical efficiency based on the loan model. Total Profit, Ownership and Total Liability have a significant effect in the Income based model measuring technical efficiency. Islamic banking is stated to be more efficient based upon the loan based approach than conventional banking; 0.808 to 0.759, but less efficient based upon the income approach; 0.691 to 0.868. The difference is mostly caused by pure technical inefficiency through Islamic banks as conventional banks operate quite constant considering the spread between pure technical and scale efficiency. A limitation of this study is that the years used range from 2001-2008, but the study only estimated averages over the complete period. On the positive side, a substantial amount of banks were considered: 25 Islamic and 249 conventional banks .

Abu-Alkheil, Burghof, and Khan (2012) investigated the first stand-alone full-fledged Islamic commercial bank in the western world. They stated that the Islamic bank of Britain is technically inefficient, as compared to small conventional banks from the UK and small Islamic banks from Muslim-majority countries. Compared to large conventional and Islamic banks the relative inefficiency is caused by operating in a sub-optimal size. There is, however, upwards positive trend in efficiency seeable, and IBB is considered to have superior lending intensity and capital adequacy.

Johnes, Izzeldin and Pappas (2012), recently constructed a Meta-frontier of mean efficiency between 210 conventional and 45 Islamic banks across nineteen countries over the years 2004-2009. In a more profound component of their analysis they look for determinants affecting the different components of efficiency. They elaborate on gross and net efficiency and their determinants. One important aspect in their research is that they only consider banks from countries with a 60% or more Muslim population.

Most of the managerial inefficiency is described in the literature as being due to scale inefficiency rather than pure technical inefficiency. However, a closer look is necessary as the findings of efficiency studies between conventional and Islamic banking are not conclusive. Most studies find scale inefficiency for Islamic banks compared to conventional banks. For example, Johnes, Izzeldin and Pappas (2012) found that Islamic banks and conventional banks appear to be similar, however when looking at pure technical efficiency, Islamic banking performs better. Therefore it can be concluded that conventional banks must perform better on scale efficiency to overcome the difference in pure technical efficiency. Johnes et al. (2012) also found a notable difference in performance on the technical frontier between the two banking methods. Conventional banks have some outperformers and Islamic banks have some underperformers but if measured both against their own frontier it is found that the majority of the banks score similarly on efficiency measures.[5] On the contrary, in an IMF working paper Grigorian and Monale (2005) found that technical efficiency for Bahrain Islamic banks is higher than for their conventional counterparts. They indicated that technical inefficiency differences in Bahrain (0.54 to 0.57) is caused by a much better scale efficiency as pure technical efficiency for conventional banks is eight percent higher. Hassan (2003) also found that the mean source of technical inefficiency is not scale but pure technical efficiency while studying Islamic banks in Pakistan, Iran and Sudan[6]. In addition Grigorian and Manole (2005) examined

[5] Johnes, Izzeldin and Pappas (2012) found, in a second stage analysis over a sample period from 2004-2009 that taken into account environmental and bank-specific characteristics do not affect the conclusion or significance of the results. The significant higher (0.07) pure technical and significant lower (0.06) scale efficiency remains.

[6] The difference could be found in regulatory principles or the higher Muslim population in these countries.

the technical efficiency of Bahrain, Kuwait, Qatar, and United Arab Emirates relative to their Singapore counterparts including a robustness test. The results of this study show that banks in Bahrain, on average, are more technically efficient compared to other GCC countries, but lag behind their Singaporean counterparts. Although only stating a comparison of internal efficiency figures for conventional and Islamic banking in Bahrain, Bahrain Islamic banks are outperforming conventional banks on scale efficiency. Still, overall, Bahrain banks are more technical efficient than their GCC counterparts. It has to be stated that Kuwaiti banks are underperformers for scale efficiency and Bahrain banking performance is not always constant. The difference however with their Singaporean counterparts is quite robust.

Omar, Majid, and Rulindo (2007) found Islamic banks to be more efficient than conventional banks in Indonesia in the sample years 2002-2004. However. the sample used for this research is very small and a lot of banks appear to be highly efficient in the sample. Errors are maybe present or the sample does not justify for comparison/dispersion between banks. This could be caused by the construction of the sample as only two Islamic banks are taken into account against 19 conventional banks. A reason for this data sample is stated by Pramuka (2011) as during the sample period of 2002-2004 only two and in 2004 three full-fledged Islamic banks were constituted in Indonesia, and the presences of Islamic windows was sufficient to improve the sample size. Pramuka (2011) also states a big growth of Islamic banking institutions from 2000 till now.

Some researchers find Islamic banks to be less efficient than conventional banks, For instance, Mokhtar, Abdullah, Alhabshi (2007) conducted a DEA study considering the Malaysian banking sector and found that in the period of 1997 to 2003 Islamic banks were less technical and cost efficient than conventional banks. Furthermore, full-fledged Islamic banks were more technical and even more cost efficient than Islamic windows but cannot tip the efficiency scores of conventional banks.

Other researches find after testing with t-tests no significant differences between Islamic and conventional banks (Shadid, Rehman, Niazi, and Raoof (2010), Rettab, Kashani, Obay, and Rao, (2010)). Johnes, Izzeldin, and Pappas (2012) included an overview of some bank efficiency studies which compare conventional and Islamic banking, and some studies that consider Islamic banking only. As this table does not provide all available studies an extension of this table can be found in table 2 of the appendix.

Looking further into technical efficiency through dividing overall technical efficiency in pure technical and scale efficiency is important as it can lead to more insights for policymakers and managers. The

difference of these figures will be further addressed in the latter of this thesis. To conclude this chapter, the literature review can best be summarized by a citation: "The literature on efficiency does not provide any conclusive evidence of the absolute superiority of Islamic or conventional banks in terms of efficiency. The results are overall mixed, with Islamic banks more efficient in some forms or countries and less in others. This suggests that, banks both Islamic and conventional have potential to gain efficiency in different regions or employing certain structure" (Farooq, 2011).

3. Data and Environment

In this section, the data building the meta-analysis will be described, and a comparison between efficiency studies is made. An discussion of the data requirements and the data included in the meta-analysis will conclude this section.[7]

The current state of literature described in the former part of this thesis, has shown that Islamic banking and conventional banking can be compared using a variety of methods, but will always have their own principles and have their own insights. Caution is needed as comparing different financial products influenced through culture, politics and different believes, make efficiency studies less valuable if these principles and differences are neglected. It is therefore important to realize that the Islamic bank as an enterprise plays an important role in society as a welfare-soldier rather than a profit-machine.

When comparing different studies, complexities are encountered which are impossible to circumvent. For example, some countries only use one of the above stated banking methods, as for instance Sudan[8], or are in completely different development stages. Economics must make decisions on consistent and comparable information. Therefore, only comparable and economically viable information, such as frontier estimates from comparable economies are included. Islamic banking is practiced in more than 50 countries and some studies use information from different countries which makes a country specific comparison rather difficult. An overall comparison between banking methods is therefore the best way to overcome this problem. Therefore, country specific frontier data, and aggregated regional efficiency data is used to examine the effectiveness of the two banking methods. The efficient frontier will be discussed in part 3.1, section 3.1 elaborates on the most important statistical measurement of this thesis and its build

[7] Please note that efficiency definitions are always subject to ambiguity. Efficiency measures are not sufficient to assess the overall performance of a bank, as other risk factors might be of influence as well.

[8] Data after the political breakup and religious civil war is not yet known or useful for an analytical thesis. Furthermore, the economy is in a miserable state which makes banking at a reasonable efficient level impossible.

up. In 3.2 the data resources and the selection criteria of the data are described. The quality of the underlining data will also be discussed in this section.

3.1 Efficient frontier

Why is the concept of efficiency important in understanding Islamic banking? This question could be answered in several ways. First of all, understanding efficiency is needed to base policies upon. Policymakers must understand the behavior of banks to formulate their policies, as even the tiniest changes in policy will affect the banking industry. Second, a change in cost efficiency means an instant change in profits and thereby competitiveness. Third, in an open market clientele and customers of banks are interested in the operation of banks. If these operations function efficiently, the customers can expect new services and products as well as a safe and sound bank partner. To evaluate the performance of an economy, firm, machine or human being we need to construct a benchmark to compare its performance with. A suitable technique to measure this is the construction of a frontier on which the distance to the individual will measure its inefficiency. Frontier approaches are considered to be more reliable than ratio analyses, as the statistical information is less affected through differences in input prices and other exogenous factors.

CCR-model an abbreviation of the developers Charnes, Cooper, and Rhodes (1978) and the BCC-model an abbreviation of Banker, Charnes and Cooper, (1984) are the two most used application in DEA to estimated an efficiency frontier. CCR is named after its developers Charnes et al. (1978), and is a multi input multi output expanding variation on Farrell's efficient frontier framework. Combining multi input and output it utilizes the combined information to formulate one single efficient frontier using it to calculate relative efficiency of each Decision Making Unit (DMU) in a constant return to scale principle. BCC uses the same input and output used in the CCR model but is not considering constant return to scale as an assumption. BCC uses the assumption of variable return to scale (VRS). BCC ensures that a firm is compared only to firms of a similar size (Fiorentino, Karmann, and Koetter, 2006). It allows for a separation between scale and pure technical efficiency which allows for judging what optimal scale will suit the particular DMU. VRS ensures DEA to be more precise and gives a possibility to implement what should happen to the scale of a firm to be scale efficient.[9] A further elaboration of characterizations and the possible use of DEA are discussed in section 4.2.

[9] Increasing the size will let to a more efficient process when operating at increasing return to scale. Decreasing returns to scale means a lower scale will be more efficient to reach the optimal production function. Constant returns to scale which considers the DMU to be in it its exact efficient state.

Cost efficiency is denoted as CE = technical efficiency * allocative efficiency. Technical efficiency can be divided into pure-technical efficiency and scale efficiency[10]. Pure technical inefficiency results from using more inputs than necessary, while scale-inefficiency occurs if the bank does not operate at a constant return of scale (Darrat, Topuz, and Yousef, 2002). Reducing excess inputs would increase technical efficiency and selecting the optimal cost minimizing mix of inputs, would lead to allocative efficiency. By achieving both types of efficiencies a bank would gain a competitive advantage by competing more effectively.

Technical efficiency and the frontier methods used to estimate them are described including some clear pictures imported from Johnes, Izzeldin and Pappas (2012). Figure 1, 2 and 3 provide an exact overview of the basis of technical efficiency within DEA and SFA. A notable difference between the two, is that the DEA frontier boundaries are estimated with best practices decision making units, in our case banks, and that the SFA paper additionally accounts for an error term which makes it possible for the DMU to appear outside the initial frontier. The SFA frontier is estimated with a production function and therefore affected by the distribution of errors and assumptions made to compose such a function. The DEA frontier is not affected by misspecification but is also not accounting for an error term which could affect outcomes. Figure 3 represents the concept of efficiency. 0P/0P' would determine the technical efficiency of the Bank P in a given time period and given input and output values. Line ZZ' is the optimal production possibility of all banks.

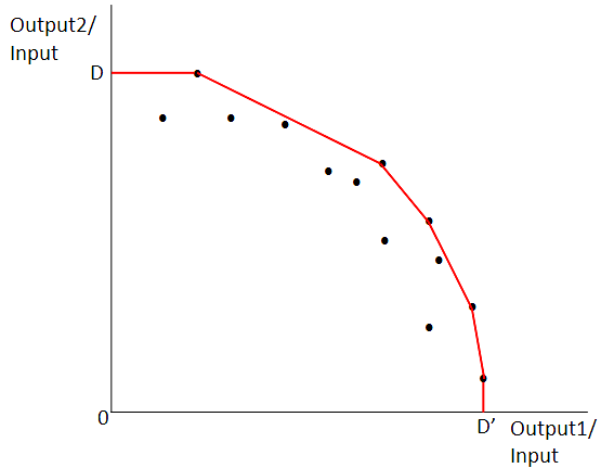


Figure 1: DEA Efficiency frontier

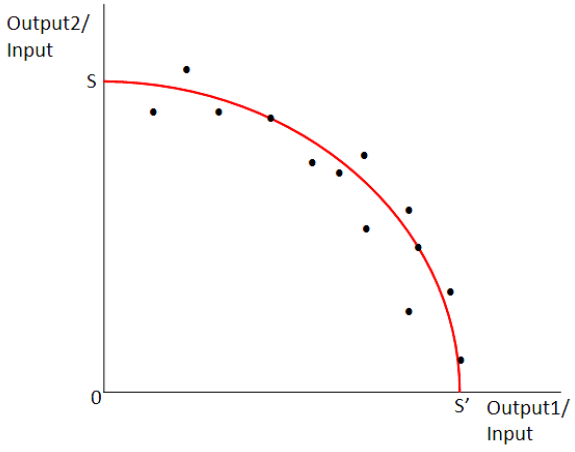


Figure 2: SFA Efficiency frontier

[10] Technical efficiency is denoted as TE= pure technical efficiency * scale efficiency.
Technical inefficiency is denoted as TIE= (1-TE)/ TE.

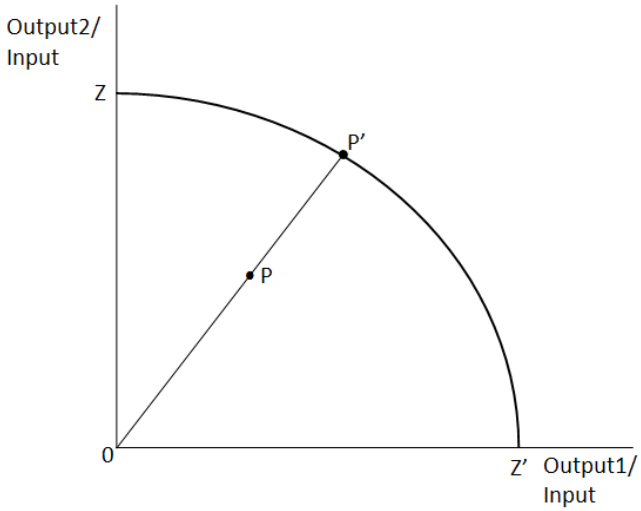


Figure 3: Theoretical measurement of efficiency

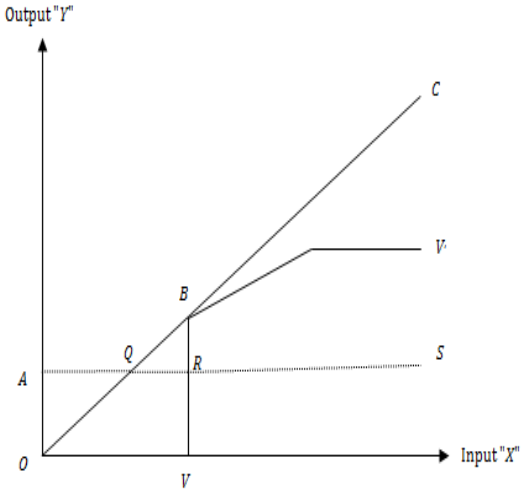


Figure 4: CRS and VRS efficiency measurement[11]

Figure 4 illustrates the CRS and VRS frontier under DEA linear programming. If a bank is theoretically efficient it will appear on the line OC if CRS is assumed. If the VRS restrictions are added to the DEA linear programming equations, technical efficiency can be divided into pure technical and scale efficiency. In figure 4 this is illustrated for bank S in point S with the following equations: technical efficiency is calculated by AQ/AS, pure technical efficiency is calculated by AR/AS and scale efficiency is therefore calculated by AQ/AS/(AR/AS).[12]

As stated earlier, according to Koopmans (1951) a system or producer is technically efficient if, and only if, it is impossible to produce more of any output without producing less of some other output or using more of some input. Studies in the field use two different approaches to measure productive efficiency: parametric methods and non-parametric methods. The non-parametric method uses linear programming, specifically the Data Envelopment Analysis, to construct the productivity frontier. It imposes the hypothesis of the convexity of the entire production. It is, therefore, not necessary to impose a priori particular specification of the production function, the cost function or the profit function which is a clear advantage of this non-parametric method (Moussawi and Obeid, 2011).

Iqbal and Molyneux, (2005), investigated cost efficiency using a standard cost to income ratio of twelve Islamic banks and compared these criteria to the averages of the top 1000 banks of the world. For the 1000 top banks, the overall average of 62 percent is used as a benchmark. For the Islamic banks, using the

[11] Source: Yudistira (2004), "Efficiency in Islamic Banking", Islamic Economic Studies, Vol. 12, No. 1

[12] More and extensive explanation is to be found in Yudistira (2004) or Farrell (1957).

weighted averages of the ratio for the period 1990-2002, this is 56.22 percent. Thus, Islamic banks perform considerably better, however, it must be noted that the ratio in the first part of the period was lower at 53.51 percent, and that two outliers influenced the outcome quite a lot. Although cost to income ratio is a different efficiency measure than the frontier efficiency approach, this exact example states the problem that must be addressed when looking at efficiency ratios. Detecting outliers, consistency, and relative values are of importance when trying to explain efficiency. Only addressing the differences is not enough. Explaining and checking them with other academically and empirical material is even more important.

Other important factors that may influence performance of a bank are risk and variable market circumstances are most often described or denoted with standard deviations. Not all of the papers included in this thesis have published these estimates. What is important to recognize is that the exact value of the efficiency determinant is not the most important value, however, the difference to its counterparts or competitors does. Moreover, the deterministic or stochastic efficiency model is an important determinant in how to evaluate the efficiency measure. The way in how these differences are recognized and will be accounted for is described in subpart 4.2 to 4.4.

3.2 Data (re)-sources

The literature used in this meta-analysis are displayed in the appendix. Table 1 and table 2 sum up different characteristics of the data included in the meta-analysis. The development stage of the economy of the observed region or country is an important selection criterion, as it determines the technical efficiency of a bank. If this selection criteria is neglected, the overall quality of the comparison between the two banking methods will be low. A correction factor /grade (which is tested in a regression analysis in chapter 5) is added to test for quality in geographical or economic development stage. Shortcomings in papers are therefore tested for overall influence on the results. By adding this variable it is possible to test for this influence without altering or the initial data. For instance, Arslan and Ergec (2010) are included as they included both conventional and participation banks in their DEA research for Turkey. They, however, did not include continuing years in their research, but only the years 2006 and 2009. In addition, they used 26 conventional banks and only four participation banks. The initial data of Arslan and Ergec (2010) is included in the data but is given a low grade. Testing if grading makes a differences will further explain the nature of the data included. The overall grading can be found in the appendix.

3.2.1 Data Included

Two datasets were created which include technical efficiency data of the same economic development level and years. The first selection was generated by using papers that mentioned data per year, banks under consideration, and explicitly mention the region and method used. Most papers use a mix of input consisting of information from banks using Islamic windows, full-fledged Islamic banks and conventional banks. The efficiency measures are selected by a comparison between conventional and Islamic banks active in each country, region, and same economic development stage.

Eleven papers address a country wide or region wide comparison and a counterpart of conventional banking is automatically imbedded [Ahmad and Luo, (2005), Arslan and Ergec, (2010), Ellahi, Khattak, Rehman, and Jamil (2011), Isik, Gunduz, and Omran (2004), Johnes, Izzeldin, and Pappas, (2009), Johnes, Izzeldin, and Pappas (2012), Mokhtar, Abdullah, and Al-Habshi (2007), Omar, Mijad, and Rulindo (2007), Rettab, Kashani, Obay, and Roa (2010), Said (2012), Shadid, Rehman, Naizi, and Raoof (2012)]. For all other papers, which do not contain such a comparison, a more general counterpart was found. In some countries conventional banking is not permitted, does not exist, is not included in the existing Islamic literature, or is practiced on a very low scale. Other selection criteria such as the development stage of Islamic countries and banking conditions are addressed in the next paragraphs.

Comparing Islamic banking against only top end conventional banks or countries with a fully established banking industry will give an oblique effect on the meta-analysis. It is however necessary to find a benchmark to explore the nature of efficiency estimates. Djankov and Murrell (2002) stated that "the prevailing sentiment in the literature is that the quantitative variables are to be trusted more (even with the misreporting and accounting difficulties that are rife in transition countries)." It is important to note that DEA studies construct an efficiency frontier by benchmarking banks to the most efficient bank in the sample. Therefore, comparability of the data used for such a research is very important to overcome selection biases.

The BRIC countries and "the Next Eleven"[13] are used as comparison material. Economic development of a country is to be considered as a major component of efficiency. As this thesis compels a large sample

[13] BRIC countries (Brazil, Russia, India and China) and their economic importance are well known. The Next Eleven countries are less known. A further elaboration of these countries is included in the panel B discussion in chapter 5.

period, all of the bank information included from certain economies is subject to change and could be outdated. Region, economic development, regulatory and competition-based information of these countries is therefore critical. Choices of including countries or regions are made upon availability of such efficiency data. The total discussion of countries and economies included can be found in the panel discussion in section 5.

The meta-analysis includes 42 technical efficiency studies, describing two approaches to the definition of the input-output of banks and the quantitative measurement of these figures. The constant and variable returns to scale figures are taken into account and possible differences between these estimates are addressed. International integration is sought considering the data requirements as well as data restrictions. Data requirements are addressed further in section 3.2.2.. The selection criteria that are taken into account are:

- Good and evenly distributed period/year selection (multiple years);
- Diversification around the world is sought (see table 1 and 3 in the appendix);
- Economic development stage;
- Indication of competition and regulatory variables;
- Input/output variables used in a similar way;
- Share of Muslim population (see figure 5 in the appendix);
- The use of the intermediation approach used to select in-and output;
- Variable return to scale in the DEA model;
- Must state clearly which banking types are considered and included in the efficiency figures.

Period data and papers stating only efficiency scores of one year are excluded of this research as collecting biases are more likely to appear. Therefore researches as Isik and Hassan, (2002) and Onour Abdalla, (2008) are excluded from the meta-analysis. Onour and Abdalla (2008) investigated Sudan and state only efficiency estimates of the year 2008 which does not comply with the selection criteria. Isik and Hassan (2002) only state period data of Turkey. Both researches are therefore unqualified for this thesis.

Another goal of this meta-analysis is to diversify initial research by combining countries and regions, using either Islamic banking or conventional banking. As of limited data and concentration of Muslim

For more information of the Next eleven take a look at *http://blog.euromonitor.com/2008/02/the-next-11-emerging-economies.html.*

population in some regions or countries a possible concentration of data is detected but the Meta-analysis deployed is aware of double counting and a lingering the data set. If correction and when corrections are made they are fully addressed in sections that comprise the panel discussion in chapter 5.

This study is not taking into account foreign entry risk management on an individual basis. Industry specific control variables are important on a country or regional basis. But the differences of these factors are described and are mostly dealt with in the current state of literature above. Another factor to consider is the fact that some researchers do not included in detail all the countries under investigation which makes importing country specific variables less determinant. By taking into account a larger timeframe, short-term effects are smoothened as outperformers or selection biases in one year will not affect other years. Furthermore, increased years under supervision in a single study can also overcome selections made in favor of a certain effect in a single year. Therefore, larger timeframe is preferred and taken into account while grading the different researches. Furthermore, differences in input and output variables and their interpretation can affect the outcome of such a efficiency study quit a lot. In addition, as the quality of the papers differs, a rating construction is added to correct for selection biases, short time spans, and crisis years. Papers are rated on a scale from 1 (low quality) to 5 (high quality). The appendix contains an overview of the quality rating per paper.

Comparing banks that have a relatively similar size will enhance the predictability of the figures in the near future and will narrow down large differences in efficiency caused by scale efficiencies or inefficiencies by counterparts in the frontier analysis. Papers accounting for individual banking efficiency are configured by using a weighted average to a country or banking method. Banks and banking environment changes continuously, and thus it cannot be guaranteed that banks included in the sample are still working within the same environment or principles.

3.2.2 Information requirement

The studies in the meta-analysis differ on years studied, controlling for input or output biases, countries, and economies. The longer the time span of a study, the lower the chance of studies containing biases through crises years or extreme outliers that will affect the quality of the outcomes. Information shortcomings or controlling for extreme outliers will always affect efficiency studies, however, not all research papers are controlling for these shortcomings. A summary of the divers characteristics of the papers are outlined in table1-5 (see appendix).

Another difficulty that has to be dealt with is that efficiency studies differ in economic development per year. For example, an efficient bank in the US in 1999 cannot be compared to a bank in Europe in 1999 without the certainty that there are no biases as there may be external factors that affect these estimate. An average efficiency estimate over certain years or over a certain period is likely to be less affected by biases if it is stating each year separately. A natural mitigation of outliers is thereby imposed for the complete period and yearly data and changes can be observed. A comparison over more years and controlling for economic differences and the tendency of the market is important, let alone the economic development stage overall as this is an important factor in DEA efficiency estimates. Besides outlining the differences between studies, there are also some important similarities to be discussed. as the studies in the meta-analysis are similar in their methodology and research method used.

In the above paragraphs similarities and differences of the studies used in the meta-analysis were outlined and how these similarities and differences are addressed in the data. In chapter 4 the research methods are explained, which are used to come to a conclusion about the efficiency of both Islamic banking and conventional banking (and possible differences between them).

4. Introduction to statistical analysis

In this chapter, the usage and the importance of statistical analyses are explained.

4.1 Meta-analyses

This study will use the studies of Djankov and Murrell, (2002) "enterprise restructuring in transition: a quantitative survey" and "Relationship Lending: A Meta-Analysis" of Kysucky and Norden, (2012) as a guideline to perform the Meta-analysis. Most features of the study of Djankov and Murrell can be used to schedule an economic paper on. Some features of Kysucky and Norden, (2012) are necessary to implement to increase the explanatory value of this thesis. Combining the strong points of these papers will ultimately complete this thesis. Some quotes confirm the explanatory use and the employability of Meta-analysis. Meta-analysis is now a widely used technique for summarizing evidence from multiple studies (Sutton, Song, Gilbody, and Abrams, 2000); Meta-analysis serves as a quantitative literature review (Stanley, 2001) and; If a number of independent studies have been conducted on a particular subject, using different data sets and methods, then combining their results can furnish more insight and greater explanatory power than the mere listing of the individual results (Stanley, 2001).

Comparing different studies and regions will ultimately give a more comprehensive view on Islamic banking versus conventional banking. Below the concepts of Data Envelopment Analysis and the latter on used Stochastic Frontier Analysis are described and their usefulness explained.

4.2 Introduction to Data Enveloped Analysis

Data Envelopment Analysis (DEA) is a non-parametric analysis to investigate efficiency. The DEA plots all banks in one single framework and shows how the banks related themselves to the most efficient one in the group. When matching firms in more than one dimension it is possible to add constraints, however caution is needed. Adding more constraints can result in a situation that a bank is called highly efficient only because there is no other bank in the same marketplace to compare it to because of a lack of observations.

Mokhtar Abdullah, and Alhabshi (2007) point out that DEA is most often chosen to measure technical efficiency as it can be applied to multi-input and multi-output variables which make the outcomes more reliable. The main advantage of the DEA is that it requires less data. Without knowing the specific form of the function, we can assess the efficiency without disaggregating the separate activities and resources. Because less data is required, it is possible to introduce cross sectional varieties such as countries with varied cost structures. As such, the DEA allows a comparable relative efficiency. Another advantage of DEA is its ability to account for environmental variables (Coelli, Prasada, and Battese, 1998). For example, Yudistira (2004) investigated eighteen Islamic banks from different regions using DEA to investigate the stability and efficiency of these banks, with a specific focus on Technical and Scale efficiency.

As compared to previous studies, this meta-analysis (using the DEA) adds the following: First, combining DEA research for a more robust view across countries and several time spans than one single DEA paper can. This approach will mitigate one of the most important flaws of DEA: noisy, and biased statistical estimates. Second, combining DEA studies allows for a more elaborate view of data from different regions and timelines, improving the statistical power. Third, DEA has the advantage of not having to apply a particular functional form as with the parametric models. Still, it has the disadvantage of not measuring any error term (Farrell, 1957).

4.2.1 DEA: the intermediation approach

Deposits and other purchased funds combined with labour and capital complete the input of the intermediation approach. The outputs of this approach are loans and other assets. Berger and Humphrey, (1992), suggest that this intermediation approach can be divided into three sub settings: (1) the asset approach, which states that the bank is a financial intermediary between liability holders and the those who receive funds. Outputs are defined as various assets and inputs are defined through deposits and other liabilities. This method excludes thereby off-balance sheet services; (2) the value-added approach, which states that intermediate products are considered to be the input of the bank, and input and output are characterized through the value-added that could be generated with them; (3) the user-cost approach, which states that opportunity cost of funds is very important, and cost output is measured by comparing this through the opportunity cost. The comparison will ultimately lead to the definition of what are the input and the output of the bank. Obtaining reliable data is the main drawback of this method. The intermediation approach is the most often used approach for defining input and output for the DEA analysis.

4.2.2 DEA: the production approach

Loan and deposits are the output of the production process of the bank and the bank uses labour and capital as inputs. Number of accounts is sighted as the proper definition of its output. This approach is mostly used to explain and investigate financial systems as a whole. as the intermediation approach is most often used in DEA, and as the production approach is employed primarily to explain bank branches efficiency the production approach is not further discussed or used in the meta-analysis.

4.3 Introduction to Stochastic Frontier Analysis

The parametric model to plot and analyze the efficiency frontier is the parametric counterpart of the above described non-parametric DEA. The Stochastic Frontier Analysis is additionally used to test and compare the results of the papers in the meta-analysis to gain more insight into efficiency outcomes and their economic relevance. The principle of SFA is to construct an efficient frontier, and label banks as inefficient if they use more input than estimated by the constructed frontier and this difference cannot be addressed to statistical noise in the process.

Combining both frontier methods will allow for mitigation of weaknesses of both methods. In short, there are several limitations of both methods: For the use of SFA models, it is necessary to construct a function form and make assumptions on the data prior to the estimation. DEA is less open for misspecification

because it does not require any assumptions about its function form. However, SFA efficiency outcomes are less likely to be biased because of an error term in its function, DEA does not use any form of error term in its underlying distribution, which makes its result open for noise and makes this method less accurate. Using the Data of twenty DEA structured efficiency studies and checking the outcomes to with the SFA outcomes must mitigate the statistical noise in the data, and puts a stochastic element in this research. The different efficiency scores can help us identifying the nature , and permits for investigating the influence of economic surroundings of Islamic banking and conventional banking on efficiency scores.

The SFA papers on which the conclusions and observations will be checked on consistency or differences with the outcome of the meta-analysis are: Kablan and Yousfi (2011), Mokhtar, Abdullah, and Al-Habshi (2006). The strength of these SFA Papers is that they in themselves give an comparison for both banking types as Kablan and Yousfi (2011) compare efficiency measures of both banking types in the same research. Mokhtar, Abdullah, and Al-Habshi (2006) investigated Malaysia in a thorough manner. Section 6.1 will further elaborated on the comparisons made with SFA and other efficiency estimates and their consistency to the outcome of the meta-analysis.

4.4 Combining the above research methods step wise

The meta-analysis contains data that covers a period ranging from 1990 to 2010. As mentioned before, the research methods used in the surveyed papers are using different principles and even if a paper uses the same research method the use and outcomes can differ tremendously. To overcome these differences in the comparison of the DEA studies on technical efficiency every paper is rated on quality and soundness. To overcome the differences and to be able to compare the frontier estimates coming from SFA and DEA, the results will be carefully described, differences mentioned and consistency sought.

While it is not necessary to achieve consensus on the best frontier approach for efficiency analysis, it is of crucial importance to be aware of potentially conflicting information the two methods may provide. By using multiple techniques, especially parametric versus non-parametric techniques, the robustness of results can be put into perspective[14]. Charnes et al. (1978) described this approach as methodological cross-checking. Reporting methodological cross-checks is important to ensure that policy makers are aware of the different information contained in efficiency measures derived with alternative methods

[14] Discussionpaper No. 10/2006, Deutsche Bundesbank Eurosystem

(Bauer et al., 1998) and if efficiency estimates are consistent across different methodologies then these measures will be convincing and therefore valid (or believable) estimates (Bauer et al., 1998)

As stated above, using and comparing different efficiency frontier estimations in one single study will not in itself improve the quality of such a study or the results that come out of it. It is necessary to look at more than one efficiency measure for the following reasons:

- Comparing more than one efficiency measure is necessary, as consensus on the best possible way to measure relative efficiency does not exist.
- Efficiency estimates derived from different approaches should be consistent by generating analogous efficiency levels. Efficiency estimates should be consistent over time and in line with the competitive conditions of the market, and also with the standard non-frontier measures of performance.[15]
- The research methods will combine strengths and benchmarks of efficiency estimates between Islamic banking and the conventional way of banking.
- Ranking efficiency estimates over time and in markets or economies with different standards and competition will improve the overall explanatory value of this thesis.

Support for using both the DEA and SFA methods can be found in Hassan's (2005) paper. Hassan evaluates the use of DEA and SFA to compare performance of Islamic and conventional banking. Hassan is one of the first to recognize that Islamic banking is an ongoing process which is not founded for profit alone, and that comparing efficiency measures only is insufficient. Furthermore, he argues that research fall short, that complete datasets are not always provided, and only conclusions on ratios or efficiency measures are described. Hassan also emphasizes the fact that some papers claim to make a comparison between conventional and Islamic banking but they in fact give minimal attention to certain differences. For example, Majid, Nor, and Said (2003) compare 34 conventional banks to two Islamic banks and do not discriminate for Islamic banks acting in the Mainstream.

What can be learned of Hassan is that a researcher has to base his findings beyond the cost and profit criteria in evaluating efficiency of a producing entity. In some samples, Islamic banks suffered from the global crisis in 1998-1999, whereas conventional banks suffered from the financial crisis from 2007 till

[15] Iqbal, M. and Molyneux, P. (2005) in "Thirty years of Islamic banking: History, Performance and prospects"

now. These crises stem from different causes, but influence technical efficiency scores in a negative manner overall, as volatile market circumstances almost never increase efficiency in the short run.

To conclude, combined use of parametric and non-parametric efficiency estimates can strengthen the output of efficiency research. Both approaches have their advantages and disadvantages to estimate bank efficiency. The parametric approach requires assumptions to be made on the form of the distribution and the cost and profit function, while it allows for noise in the inefficiency estimates. The non-parametric approach does not require any assumptions on the function form but does not allow noisy data as this will be measured as inefficiency. In the next chapter, the execution of the meta-analysis is described.

5. Meta-analysis

This part of the paper aims to report new empirical evidence on Islamic banking. Extensive empirical research has been done on Islamic banking but still it is in it childhood and most often the quality leaves to be desired. Kablan and Yousfi (2010) emphasizes the need for meta-analysis as they write that "data on Islamic banks are scarce limiting such studies as well as comparative studies across countries", explaining the basis of these studies is limited by the number of Islamic banks or the countries included. As the quality of some papers is low, for whatever reason, combining these papers could result into a higher quality all combining research or paper. The results of these papers give a good indication what to expect or what can be concluded about Islamic banking compared to conventional banking. When combining the DEA structured papers with meta-analysis tools, new or more extensive research can be done to empower those previous results. meta-analysis could be the tool to empower the empirical researches.

5.1 Build up

As mentioned before meta-analysis has proved itself as a valuable tool for economic research. If dealt with in a academically responsible manner, it is able to overcome fundamental differences or widen previous research. Controlling for selection biases, quality, and input variables will be the critical points of this part of the thesis. The actual build up of the meta-analysis will be described below. Some critical quality standards will be addressed and the specific problems that will be dealt with in this research discussed. By aggregating the results of the 41 papers, it is possible to examine if there is a significant difference between Islamic and conventional banking and what possibly caused these differences.

5.1.1 Strong shoulders

One of the primary objections to the application of Meta-analysis hinges on the fact that the quality of empirical work varies greatly across papers (Djankov and Murrell, 2002) Students focus most often on best practices thereby ignoring low quality papers or papers with an unclear (over)-view. Meta-analysis can describe middle road and interprets the consequences of this act. As this paper takes the quality of the empirical results in consideration a clear rating system is described below which is recapitulated in table 12 and table 15 based upon the specific characteristics of the papers included and the value to this paper.

Explaining differences must be supported from the most homogeneous dataset possible. Therefore only information is included from common frontiers as opposed to a separate frontier. Measuring banks to a separate frontier will almost always enlarge efficiency data as more groups are included and therefore dataset are smaller. More frontiers do not attribute to a homogeneous dataset and lowers comparability between groups. Therefore, if there is a choice between common or separate frontier, the common frontier will be included in this research. Further attention points in this thesis are: (1) the hazard of double counting; (2) evenly distributed statistics; (3) number of observations for CRS[16] and VRS[17] efficiency estimates. Hazard of double counting is present as some researchers publish parts or publish more than one paper with the same underlying efficiency estimates or countries[18]. Evenly distributed years for both panels in the same timeframe is the goal as the effect of years is worthwhile to consider. The third point to be considered is a substantial amount of efficiency estimates to draw conclusions on for both banking systems. Both panels must therefore have substantial CRS and VRS estimates in them.

5.1.2 Panel A featuring Islamic Banking

Panel A contains 27 DEA studies. This panel consists of data from Islamic banks and sometimes Islamic windows as they are incorporated in researches. Data is centered around the year 2002, and the median is 2006. 134 average CRS efficiency estimates, and 123 average VRS efficiency estimates are incorporated in this panel. Which countries and regions that are considered in this paper are described in detail in the table 1. As may be expected the Muslim populated countries are represented more in this dataset. Middle

[16] When CRS is mentioned hereafter, it is used as an abbreviation of average technical efficiency estimates.

[17] When VRS is mentioned hereafter, it is used as an abbreviation of average pure technical efficiency estimates.

[18] Noor et al. constructed three different publications with the same dataset. Therefore, the biggest and latest comprehensive study is included in this research (The most similar publication is however already retracted) Hazard of double counting could also be found in Hassan (2005), and Hassan (2006), as the same period 1995-2001 and same efficiency estimates were used.

Eastern, North Africa, and Asian countries represent the largest share of Islamic banks in the world and have the best developed Islamic banking industry. The CRS and VRS efficiency figures will be compared with panel B data. In the second part of this section special attention to the quality of different papers will be made. First however, the differences of the researches included in panel A will be described. Table 1 presents, beside the papers included, the type of efficiency included in panel A. Not every paper divides technical efficiency in pure technical and scale efficiency. Therefore both CRS and VRS are included in this research and separately compared with panel B data.

Eleven papers state also efficiency estimates of conventional banks and will therefore also be incorporated in panel B which is described in table 2. The inclusion of papers after compliancy with the selection criteria is a 100% as a wider empirical base could ensure for a more profound research. Possible correction needed because of quality restriction are controlled for with a rating system. This rating system will control for the quality of the underlying efficiency estimates and the outcome of the differences found between Islamic banks and conventional banks. For example: Omar Majid and Rulindo (2007) analyzed only two Islamic banks to 19 conventional banks to arrive at strong conclusion that the Islamic banks were more efficient. A paper like this will be given a lower point than as it could affect the research as it has an uneven sample size. In section 5.1.5. the further implication of this rating system to the analysis and the robustness of this thesis are described.

Further differences can be found between quality and reference material. The next examples will explain this in more detail: (1) Some DEA studies only estimate scores of technical efficiency for Islamic banks and compare their results to a worldwide estimate for their conventional counterparts, as in Kamaruddin, Safa, Mohd (2008). (2) Some researchers use information from banks that are not mentioned by name (Yudistira, 2004). (3) Some researches only compare banks from the same country, for instance Zainal and Ismail (2012), and Batchelor and Wadud (2004). (4) Others use banks from different countries but from the same region Hassan (2003) and Hassan (2005) for instances, took a worldwide look at Islamic banking using information of 22 countries for the period 1995-2001. (5) Some researchers use an oblique comparison model because of comparing for instances twenty conventional operating banks with two Islamic banks from the same country (Mokhtar, Abdullah, and Alhabshi (2007)[19]. (6) Kamaruddin et al.

[19] The authors included also 20 Islamic windows in their research but concluded that those were much less technical efficient than the full-fledged Islamic banks. They stated to have included 95 % of the Islamic banking system population but conclusion have to be taken as stated earlier with caution as the comparison could be off because of unequal sample size.

(2008) did not deviate Islamic banking and Islamic windows but state them as one Islamic banking operation; (7) Ahmad and Luo (2010), made a comparison between Islamic banks and conventional banks for the European market.

Panel A therefore exist of a multidimensional features but still all represent Islamic banking. More information of panel A, besides table 1 is to be found in table 2. Table 2 includes more information as a description/title of the included papers and also the publication years.

5.1.3 Panel B featuring conventional banking

Evaluating the efficiency of Islamic banking to conventional banking asks for relevant comparison material. As mentioned in chapter 3 it is necessary to compare and use relevant efficiency measurements. The economic development stage of the economic in which the bank is competing is a critical point in this comparison as this could affect overall efficiency estimates. Panel B contains 25 DEA studies. Eleven papers from Panel A include also efficiency estimates for Panel B. Fourteen other papers are selected with the same selection criteria of Panel A. However the four selection criteria that need to be emphasized for panel B are: (1) Evenly distributed period/year selection (multiple years); (2) Diversification around the world is sought (see table 4); (3) Economic development stage; (4) Share of Muslim population and non-Muslim population. The years included must be evenly selected and accordingly with the development stage of the country or region. A divers panel B is selected which represents different development stages and different parts of the world in accordance to the years included. Therefore, the presence of a large Muslim population in the these countries is not necessary but a mix of both is sought as this could enhance comparability.

There are numerous ways to constructed a panel to compare Islamic banking with. Almost every country has its own substantial banking system. First of all, as economies differ, efficiency data do too. In highly developed countries measured by GDP, banking systems are characterized with more competition, more activity, and in general higher efficiency estimates (Demirguc-Kunt and Levine, 1999). Kablan and Yousfi (2011), however, find that percentage of urban population had a negative impact on efficiency, suggesting that Islamic banks are more efficient in countries or regions with small urban population. Competition and development stage of a country are believed to be related as low income economies may face a lower competition level relative to rich countries (Yaumidin, 2007). The general timeline is also an important factor to consider as technological change is an important factor in the two decades taken into consideration. Development stage of the economies included is therefore a point to consider. Although the

observed countries may differ on important factors as size of the economy or banking industry, the formation of Panel B is also influenced by other factors. For instances the size of economies could be influenced by the presence of a large oil industry. Another aspect to consider is mentioned as Oliveira and Tabak (2006) used market information to rank countries using a DEA study over a period of 1995-2002. The input is estimated risk factors of the banking sector each and the output with profitability of the stocks of banking sector in each country. This alternative ranking of each banking sector per country strengthens the choices made which countries to include in panel B as this alternative ranking could state valuable information.[20]

The data is centered around the year 1999, the median is 1996. 155 average CRS efficiency estimates, and 179 average VRS efficiency estimates are incorporated in this panel. Which countries and regions that are considered in this paper are described in detail in the table 3 and 4. Nine countries of the Next Eleven[21] and all of the BRIC countries are explicitly mentioned in panel B. Islamic banking has in more than half of these countries a direct influence on the banking industry. Commercial banks in these countries are competing directly with Islamic banks or Islamic windows. The country and timeline selection of panel B efficiency estimates are depending on the fit of the development stages of the panel A incorporated efficiency estimates.[22]

Panel B differs from panel A in several ways: (1) several researches included different countries and mention them separately. This gives us the opportunity to select the best fitting countries for the best comparison possible under the given selection criteria; (2) panel B does not include all the available datasets as panel A does. There are more combination possible as there are a lot more researches about conventional banks than on Islamic banks; (3) Timeline differences cause a point of consideration as development stage of the economies is important to consider as this could affect average efficiency estimates. In general, the conventional banking industry is more mature than the Islamic banking industry.

[20] Tabak and Oliveira (2006) selected 41 countries to be compared on market efficiency data. Greece, Peru, Philippines and India ended for the period 1995-2002 in the top twelve above the United states (sixteenth), and the United Kingdom (23th)

[21] Indonesia, Iran, Mexico, Pakistan, Philippines, Turkey, South Korea, and Vietnam are reflected in panel B as Next Eleven countries.

[22] Yaumidin (2007) gives a regional country specific overview of Muslim populated countries including GDP per capita (2004) and number of Islamic banks incorporated in these countries. Indonesia, , Malaysia, and Bahrain had the greatest number of Islamic banks.

It takes a number of years for banks to become technical efficient in a growing competitive industry. The mean of the researches included does not differ significantly with panel A (2002 to 1999)[23].

Differences can be found in the number of countries which are included in the researches of panel B. Darrat et al. (2002), for instance only considered conventional banks in Kuwait, and Laeven (1999) estimated efficiency estimates of 5 East Asian countries. The lowest efficiency estimates included came from the Ukraine, Bulgarian, and Kenia. The highest efficiency estimates were found in research concerning Greece, India, Turkey, Peru, and Malaysia. Small modification had to be made to fit certain efficiency estimates in to the selection criteria and timeline of panel B. For instance, Yildirim (2010) included also the years 1988 and 1989 in his research. As these average efficiency estimates fall out of the timeline of this research they are not included. Because each year is accounted separately there are no further implications to panel B because of this modification. Further, not all countries used in the research of Hermes and Nhung (2008) are included in panel B[24]. This research does not implicitly state to include only commercial banks, some countries are excluded as the banking sample used could be affected with noncommercial banking activities from these Muslim populated countries.

5.1.4 Statistical effects and considerations

The incorporation of the lesser quality but more quantitative based papers will improve the overall quality of this thesis as it will widen its base in a quantitative manner and the rating system will incorporate it in a qualitative way. Not every paper gives for instances a standard deviation of each parameter, which makes additional research more difficult.

In addition to Djankov and Murrell (2002) and Kysucky and Norden (2012) and extra control variable is inserted in the meta-analysis based upon the possible quality differences between the researches. Djankov and Murrel (2002) gave a rating for the way selection biases are handled, and a rating for the overall quality of the researches. Kysucky and Norden (2012) used a dummy variable if the paper was published in one of the three leading journals as a quality variable. This research has chosen for one rate per

[23] The median of panel B is 1996. A ten year difference with the median of panel A. This is easily explained as research of the included more developed countries were centered around that date.

[24] Several countries in the research of Hermes and Nhung (2008) are not included in panel B as the study does not explicitly state to investigate commercial banks only. Other countries could be included as no Islamic banks are active in these economies.

research. Therefore each research is given one classification based upon the following variables: (1) years included; (2) both CRS efficiency estimates and VRS efficiency estimates in one paper; (3) number of banks included; (4) regional spread/double counting in countries; (5) overall quality of the paper. For each variable one point or zero points can be given and therefore maximum five points in total. In this way each average efficiency estimate in panel A and panel B is given a rating. In the following section the significance of this rating on the overall conclusions is tested. Overall descriptive values of the rating system can be found in table 12 and table 15.

Determining if there are significant differences for technical efficiency and pure technical efficiency between banking groups per year is not possible, as groups will become too small and conclusion will become unreliable and therefore possibly generated biased conclusions.

Vote-counting is a point to be considered. This thesis considers all available suitable empirical research to check for differences in efficiency measures between Islamic and conventional banking. All available efficiency measures for Islamic banking are incorporated in this thesis so therefore the issue of vote-counting is determinate. Vote-counting could let to biased output of a Meta-analysis as all available studies are categorized. This leads more than often to biased output as votes are manipulated to get the preferred output. Meta-analysis provides, even though it could let to vote-counting biased output, or even conclusion, to a more formal and above all objective processes of reviewing empirical studies. Vote-counting is therefore a factor to consider while categorizing the efficiency estimates of panel A and panel B. To lower the chance of vote-counting, a rating was only given ones and not adjusted afterwards.

Before concluding this part of the research and discuss the overview in which statistical test will be conducted it is important to notice, in what manner sampling error was controlled for: (1) controlling for double counting; (2) controlling for number of banks included through rating system; (3) taking into account regional and yearly spread for panel B; (4) control for number of years/average efficiency estimates. In this way the selection problems were treated to overcome biased efficiency estimates as an input to the meta-analysis in order to overcome biased output. In the next paragraph the overview of the different steps used to fulfill the Meta-analysis will be explained.

5.2 Overview

The initial process of a meta-analysis was started to investigate if there are differences to be found between Islamic and conventional banking, based upon technical efficiency. To test for differences in

technical efficiency, technical and pure technical efficiency, estimates were collected and tested for differences. In addition, other possible factors that could influence differences in efficiency are considered.

To test whether there is a differences between Islamic and conventional banking in technical and pure technical efficiency estimates, an independent samples t-test is reported in table 6 and table 7. The average technical efficiency is slightly higher for conventional banks, although this difference was not statistically significant. ((M = 0.791, SD = 0.151) for Islamic banks to (M = 0.794 SD = 0.157) for conventional banks $t(283.8) = -0.125$, $p = 0.901$). Average pure technical efficiency of Islamic banks (M = 0.873, SD = 0.119) however does significantly differ from pure technical efficiency of conventional banks (M = 0.837, SD = 0.135) $t(282.3) = 2.479$, $p = 0.014$ (table 6 and table 7). These findings are congruent with Johnes, Izzeldin and Pappas (2012) and Hassan (2003) but in contrast with Mokhtar, Abdullah, Alhabshi (2007) and Grigorian and Manole (2005). Mokhtar, Abdullah, Alhabshi (2007) stated lower technical efficiency estimates for Malaysian Islamic banks to conventional banks. Grigorian and Manole (2005) found Bahrain Islamic banks pure technical inefficient relative to conventional banks, however, still finding Islamic banks more technical efficient. From this t-test it can also be concluded that conventional banks are on average more scale efficient: Islamic banks perform better on pure technical efficiency, however performing more or less the same on technical efficiency, the difference therefore is caused by scale inefficiency for Islamic banks relative to conventional banks.

Controlling for years separately is as stated above not possible. It is however possible to control for the influence of the years for the total dataset of technical and pure technical efficiency between banking groups. Regression analyses showed that year is a factor that influenced the technical efficiency under constant returns to scale for Islamic banks, $\beta = -.14$, $t(133) = -2.683$, $p \leq 0.001$ (Table 8 and table 9). In addition regression analyses showed that year influenced pure technical efficiency for Islamic banks, $\beta = -.007$, $t(122) = -2.683$, $p = 0.008$. Regression analyses showed that year was not a significant factor for conventional banks for both the CRS and VRS efficiency estimates (table 10 and table 11).

The next step is to test if quality of the efficiency estimates is a point to consider: does the quality of the papers have an effect on the efficiency results? To consider this question we need to control for technical and pure technical efficiency estimates for the variable quality generated by the rating system. After that, we entered quality as covariate in the analyses, to check whether the rating system influenced the effect of bank type on technical and pure technical efficiency estimates. ANOVA analyses showed that quality

influenced technical efficiency, $F(4, 284) = 21.287$, $p \leq 0.001$. When entering quality as a covariate in the ANCOVA with banktype as a independent variable and technical efficiency as dependent variable, results remained significant, $F(4, 283) = 22.392$, $p \leq 0.001$ (table 12-14). Furthermore, an ANOVA showed that quality also influenced pure technical efficiency, $F(4, 297) = 26.199$, $p \leq 0.001$. When entering quality as a covariate in an ANCOVA with banktype as a independent variable and pure technical efficiency as a dependent variable, results also remained the same, $F(1, 299) = 33.689$, $p \leq 0.001$ and therefore significant (table 15-17).

Although overall primary efficiency studies found mixed empirical evidence of technical efficiency estimates this meta-analysis finds evidence that there is not a significant differences between technical efficiency for Islamic and conventional banking. However and thereby concluding section 5, this research shows that Islamic banking and conventional banks although performing almost the same on technical efficiency, they significantly differ on pure technical efficiency and thereby on scale efficiency. The results of this research also show that quality of the research used as an input does influence the efficiency estimates.

6. Comparison between other efficiency estimates

The comparison of DEA with other efficiency estimates from other research methods is important. As mentioned earlier it is important to recognize the importance of consistent information to enhance the economic value of the efficiency estimates and the employability to further research. The conclusions of this comprehensive research are compared to other academic efficiency studies to check for consistency.

6.1 Differences and compliance

Other efficiency estimates that are used for consistency and compliance to the conclusions of this thesis can help to confirm if conclusions are sustainable. Therefore, taking a look from another angle, can help to find consistency through efficiency data comparison. First, SFA based studies will be incorporated and one single DEA study considering cost and profit efficiency, and after that a couple of non-frontier based efficiency estimates will help to find a benchmark.

Kablan and Yousfi (2011) state that commercial banks, although not assessed with the same cost frontier, are more cost efficient than Islamic banks, and that average efficiency scores are very much the same over

the region investigated[25]. They however not estimated technical efficiency apart from cost efficiency. Mokhtar, Abdullah, and Al-Habshi (2006) state in a SFA study concerning Malaysia, that although increased, technical efficiency and cost efficiency is still lower for Islamic banks in the period 1997-2003 than conventional banks. Mokhtar et al. (2006) also tested for bank type and ownership differences in contrast to efficiency performance. Srairi (2010) found in a SFA study, considering the GCC with a large sample of 71 banks, conventional banks on average more cost and profit efficient than Islamic banks.

Using an output distance function Abdul-Majid, Saal, and Battisti (2010) find in a ten-country wide research generally more input usage for Islamic banks making them more technically inefficient. They however state that the potential output is limited compared to conventional banks. They also stated that Bahrain, Bangladesh, and Malaysia achieved relatively high efficiency scores.

In contrast to the findings above the next researchers do not find any significant differences. Mohamad, Hassan, and Bader (2008) used the SFA approach to compare the efficiency of Islamic banks and conventional banks across countries. The results indicate that there is there is no significant difference between cost and profit efficiency of conventional versus Islamic banks. However, there is still room for improvement for both efficiency measures for both banking types as they could further minimize cost and maximize profits. Interestingly, Mohamad et al. (2008) did not found significant differences for old versus new banks and big or small firms in terms of average efficiency for both banking types. Islamic banks doing business in the Middle East and Turkey performed best on cost efficiency while African Islamic banks were underperformers. Large conventional banks scored the highest profit efficiency however stating one of the lowest cost efficiencies. The conclusion of Hassan (2003) stating that Islamic banks are generally more cost efficiency rather than profit efficiency is confirmed by Mohamad et al. (2008). Bader, Mohamad, Ariff, Hassan (2008) found in a DEA structured paper, no significant differences between Islamic and conventional banks while concerning profit, revenue and cost efficiency. This research is also from considerable size and uses a relatively long timeframe (1990-2005)

The research below found Islamic banks more efficient using alternative methods prior to the DEA used in this research. Al-Jarrah and Molyneux (2007), in their cross-country SFA study concerning: Bahrain,

[25] Islamic banks in Asia, however, perform better in their comparison between regions. This is meanly because of the strong performance of Malaysian and Pakistani banks in their sample.

Egypt, Jordan, and Saudi Arabia, find that both cost and profit efficiency are higher for Islamic compared to conventional banks. Financial ratio analysis was used by Hassan and Bashir (2005). They found that Islamic banks are more efficient than conventional banks in terms of: resource usage; cost effectiveness; profitability; asset quality; capital adequacy; and liquidity ratios. Lastly, the cost to income ratio analysis of Iqbal and Molyneux (2005) stated earlier in this research, stated Islamic banks more cost efficient.

This section incorporated some alternative research methods to investigated if there is consensus to be found which bank type is more efficient. The next section will further shortly address consistency issues before concluding this research.

6.2 Constistency

As above described there is no real consensus on what bank type is more efficient. What is important to notice that no consensus has to be found but that consistency can help to empower conclusions of additional research. Another factor to consider is the different performance of Islamic and conventional banks in different countries and regions what makes consensus on the performance of the general banking methods even harder. Mohamad et al. (2008) stated that bank efficiency is greatly affected by internal and external factors which makes conclusions only valuable for the sample under investigation. It is therefore important, that further research is scheduled and must be comparable to enhance consistency and usability of such a research for more than one goal.

Therefore, it can be concluded that consensus of which bank type is more efficient cannot be summarized in one single research. Both bank types can and must learn from each other in a competitive globalizing market. Understanding differences can be the basis on which governments and other regulatory management can improve the regulatory framework for both Islamic and conventional banks to ensure economic sustainable growth.

7. Conclusion and recommendations

Conclusions of the aggregation of 42 DEA efficiency studies generating a comprehensive view on technical efficiency of the Islamic and conventional banking sector are stated below. Concluding remarks and the importance of future research are stated and emphasized in the recommendations.

7.1 Conclusion

This research attempted to find consensus on what bank type is more efficient. However, mixed primary research, different principles, and other financial products could be a good conclusion of a research investigating the differences of Islamic banking and conventional banking. This research included a more comprehensive insight in the form of meta-analysis helps to structure these mixed primary studies. The buildup of the meta-analysis was given a basis of mixed DEA studies structured in two panels. Panel A was constructed of 27 studies stating Islamic efficiency estimates under the DEA research method. Panel B stated 25 studies of mixed sources and also included eleven papers of panel A stating efficiency estimates of conventional banks. The timeframe under investigation was 1990-2010.

This meta-analysis has shown that Islamic banking and conventional banks although performing almost the same on technical efficiency ((M = 0.791, SD = 0.151) for Islamic banks to (M = 0.794 SD = 0.157) for conventional banks), they significantly differ on pure technical efficiency and thereby on scale efficiency. Average pure technical efficiency of Islamic banks (M = 0.873, SD = 0.119) and for conventional banks (M = 0.837, SD = 0.135) $t(282.3) = 2.479$, $p = 0.014$. Thereby concluding that Islamic banks are more pure technical efficient than conventional banks. The results of this research also show that quality of the researches used as an input does influence the efficiency estimates.

In research consensus is found in the fact that Islamic banking is growing, and growing fast. In contrary, it can be concluded that no consensus is found comparing Islamic banks to conventional banks on efficiency estimates. Therefore it is important to recognize that Islamic banking is not all about lowering cost or achieving more profit as often conventional banking is known for as a business model. The fulfillment of social goals and social responsibility is of its upmost priority even if this means lower profit as social development will justify. Therefore using cost and profit efficiency estimates to measure efficiency could be subject to ambiguous reasoning.

7.2 Recommendations

Although maybe subject to ambiguity it is valuable to compare cost and profit efficiency of both banking types. It is however, not possible to do a thorough academic research on cost and profit efficiency using meta-analysis as of too little comparable academic research. The hope is that another researcher will do this in the near future as combining technical efficiency and allocative efficiency can produce more accurate findings. This could also enhance the explanatory value of this estimates for Islamic banking

compared to conventional banking, what could help policymakers and managers to improve policy or productivity.

The fact that the dataset of this research is small for meta-analysis and selection biases is one of the most frequent problems in a research like this, differentiating and expanding the thesis with variables and figures as foreign owned, and or medium and small enterprises was virtual impossible. Some researchers make the difference for foreign and domestic banks and for instances Islamic windows or investment banks. When more researchers would incorporated these details a more precise comparison between conventional banks, investment banks and Islamic banks and or Islamic windows is possible. In addition, including more country specific factors and a more precise subdivision of countries included is a must to be able to include such information in a similar future research. Although this research uses almost every available paper on this matter, it is still small in size. Therefore a similar research in 5 years time will hopefully improve the quality through a quantitative expansion considerably and could make it possible to divers between separate years in a statistical sound manner.

Banking methods and products are always evolving. Efficiency is affected by numerous factors that not always can be explained in advance and even after an incident there is not always consensus how to react at extreme incidents. The value of these conclusions is thereby not indefinitely. Time can erode the way of banking we know now. Economic development and ongoing globalization can change the competitive market enormously the next decades. Future research is necessary to recapitulated on this manner. Therefore it is important underlining the thought: “being efficient is good, staying efficient even better”.

References

Abdul-Majid, M., Saal, D.S., Battisti, G. (2010), "Efficiency in Islamic and conventional banking: an international comparison", *Journal of Productivity Analysis*, Vol. 34, pp. 25-43

Abu-Alkheil, A.M., Burghof, H.P., Khan, W.A. (2012), "Islamic Commercial Banking In Europe: A Cross-Country And Inter-bank Analysis Of Efficiency Performance", *International Business and Economics Research Journal*, Vol. 11, No. 6, pp. 647-676

Ahmad, W., Luo, R.H. (2010), "Comparison of Banking Efficiency in Europe: Islamic versus conventional banks", *International Finance Review*, Vol. 11, pp. 361-389

Ahmad, N.H.B.T., Noor, A.N.M., Sufian, F. (2010), "Measuring Islamic Banks Efficiency: The case of World Islamic Banking Sectors", *Journal of Islamic Banking and Finance* , Vol. 27, No. 4, pp. 1-24

Ahmad, W., Radzi, R.M. (2010), "Sustainability of Sukuk and Conventional Bonds during Financial Crisis: Malaysian Capital Market", *Working paper School of Economics and Finance*, La Trobe University Australia

Al-Delaimi, K.S.K., Al-Ani, A.H.B. (2006), "Using Data Envelopment Analysis To Measure Cost Efficiency With an Application on Islamic Banks", *Scientific Journal of Administrative Development*, Vol. 4, pp. 134-156

Akthar, M.F., Ali, K., Sadaqat, S. (2011), "Liquidity Risk Management: A comparative study between Conventional and Islamic Banks of Pakistan", *Interdisciplinary Journal of research in Business*, Vol. 1, No. 1, pp. 35-44

Al-Jarrah, I., Molyneux, P. (2007), "Efficiency in Arabian Banking", *Jordan Journal of Business Administration*, Vol. 3, No. 3, pp. 373-390

Alkhathlan, K., Malik, S.A. (2010), "Are Saudi Banks Efficient? Evidence Using Data Envelopment Analysis (DEA)", *International Journal of Economics and Finance*, Vol. 2, No. 2, pp. 53-58

Alpay, H., Hassan, M.K. (2006), "A Comparative Efficiency Analysis of Interest Free Financial Institutions and Conventional Banks: A Case Study on Turkey", *Conference paper, ERF's 13th Conference in Kuwait*, December 2006

Arslan, B.G., Ergec, E.H. (2010), "The Efficiency of Participation and Conventional Banks in Turkey: Using Data Envelopment Analysis", *International Research Journal of Finance and Economics*, Vol. 57, pp. 156-168

Bader, M.K., Mohamad, S., Ariff, M., Hassan, T. (2008), "Cost, Revenue, and Profit Efficiency of Islamic versus Conventional Banks: International Evidence Using Data Envelopment Analysis", *Islamic Economics Studies*, Vol. 15, No. 2, January 2008

Baele, L., Farooq, M., Ongena, S. (2011), "Of Religion and Redemption: Evidence from Default on Islamic Loans", *CentER Discussion paper*, No. 2010-136, ISSN 0924-7815

Banker, R.D., Charnes, A., Cooper, W.W. (1984), "Models for the Estimation of Technical and Scale inefficiencies in Data Envelopment Analysis", *Management Science*, Vol. 30, pp. 1078-1092

Bauer, P., Berger, A., Ferrier, G. and Humphrey, D. (1998), "Consistency Conditions for Regulatory Analysis of Financial Institutions: A Comparison of Frontier Efficiency Methods", *Journal of Economics and Business*, Vol. 50, No. 2, pp. 85–114

Batchelor, V.B., Wadud, I.K.M.M. (2004), "Technical and Scale Efficiency of Islamic Banking Operations in Malaysia: an Empirical Investigation with a Longitudinal Perspective", *Labuan Bulletin of International Business and Finance*, Vol. 2, No. 1, pp. 51-69

Beck, T., Demirgüc-Kunt, A., Merrouche O. (2010), "Islamic vs. Conventional Banking, business model, efficiency and stability", *The World Bank, Policy research working paper*, No. 5446

Charnes, A., Cooper, W.W., Rhodes, E. (1978), "Measuring Efficiency of Decision making Units", *European Journal of Operational Research*, Vol. 2, pp. 429-444

Chen, X., Skully, M., Brown, K. (2005), "Banking efficiency in China: Application of DEA to pre- and post- deregulation eras: 1993-2000", *China Economic Review*, Vol. 16, pp. 229-245

Chong, B. S., Liu, M. (2009), "Islamic banking: Interest-free or interest based", *Pacific-Basin Finance Journal*, Vol. 17, No. 1, pp. 125-144

Cihak, M., Hesse, H. (2010), "Islamic Banks and Financial Stability: An Empirical Analysis", *Journal of Financial Services Research*, Vol. 38. No. 2-3, pp. 95-113

Dar, H.A., Presley, J.R. (2000), "Lack of profit loss sharing in Islamic banking: management and control imbalances", *Louborough University, Economic Research Paper*, No. 00/24

Darrat, A.F., Topuz, C., Yousef, T. (2002), "Assessing Cost and Technical Efficiency of Banks in Kuwait", *Conference paper, ERF's 8th Conference in Cairo*, January 2002

Demirguc-Kunt, A., Levine, R. (1999), "Bank-based and Market-based Financial Systems, Cross-Country Comparison ", *The World Bank, Policy Research Working Pape*r, No. 2143

Djankov, S., Murrell, P. (2002), "Enterprise Restructuring in Transition: A Quantitative Survey", *Journal of economic literature*, Vol. 40, No. 3, pp. 739-792

Ebrahim, M.S., Joo, T.K. (2001), "Islamic Banking in Brunei Darussalam", *International Journal of Social Economics*, Vol. 28, No. 4, pp. 314-337

El-Gamal, M. (2000), "A basic Guide to Contemporary Islamic Banking and Finance", Rice University, Houston, *Available at: http://www.lariba.com/dev/knowledge-center/islamic-banking-guide.pdf*

Ellahi, N., Khattak, N.A., Rehman, K., Jamil, N. (2011),"Testing Technical and Cost Efficiency of Pakistani Islamic Banking System", *Conference paper, 8th International Conference on Islamic Economics and Finance*, Qatar, December 2011

Farooq, M. (2011), "Literature Survey and Anatomy of Islamic Banking", *CentER – Tilburg University, The Netherlands*

Farrell, M.J. (1957), "The measurement of productive efficiency", *Journal of Royal Statistical Society, Serie A (general)*, Vol. 120, No. 3, pp. 253-290

Ferro, N. (2005), "value through diversity: microfinance and Islamic finance and global banking", *Nota Di Lavoro* 87.2005

Fiorentino, E., Karmann, A., Koetter, M. (2006), "The cost of efficiency of German banks: a comparison of SFA and DEA", *Deutsche Bundesbank, Discussionpaper Series 2: Banking and Financial studies*, No. 10/2006

Galagedera, D.U.A., Edirisuriya, P. (2004), "Performance of Indian commercial banks (1995-2002): an application of data envelopment analysis and Malmquist productivity index", *Available at SSRN: http://ssrn.com/abstract=577922 or http://dx.doi.org/10.2139/ssrn.577922*

Grigorian, D., Manole, V. (2005), "A Cross-Country Nonparametric Analysis of Bahrain's Banking System", *International Monetary Fund, Working Paper* 05-117

Hassan, M.K. (2003), "Cost, Profit and X-efficiency of Islamic Banks in Pakistan, Iran, Sudan", *International Seminar on Islamic Banking: Risk Management, Regulation and Supervision*, September 2003, Jakarta, Indonesia

Hassan, M.K. (2005), "The cost, Profit and X-efficiency of Islamic Banks", *University of New Orleans 12th ERF conference Paper*

Hassan, M.K. (2006), "The X-Efficiency in Islamic Banks", *Islamic Economic Studies*, Vol. 13 No. 2, pp. 49-78

Hassan, M.K., Bashir, A.M. (2003), "Determinants of Islamic banking profitability", *Conference paper, Economic Research Forum Conference 10th annual conference*.

Hassan, M.K., Bashir, A.M. (2005), "Determinants of Islamic banking profitability", In Iqbal, M., Wilson, R., *Islamic Perspectives on Wealth Creation*, Edinburgh University Press, Edinburgh

Hassan, K.M., Dicle, M.F. (2005), "Basel 2 and Regulatory Framework for Islamic Banks", *Journal of Islamic Economics, Banking and Finance*, Vol. 1, No. 1

Hassan, T., Mohamed, S., Bader, M.K.I. (2009), "Efficiency of conventional versus Islamic banks: Evidence from the Middle East", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 2, No. 1, pp. 46-65

Hasan, Z. (2004), "Measuring efficiency of Islamic banks: criteria, methods, and social priorities", *Review of Islamic Economics*, Vol. 8, No. 2, pp. 5-30

Havrylchyk, O. (2006), "Efficiency of the Polish banking industry: Foreign versus domestic banks", *Journal of Banking & Finance*, Vol. 30, pp. 1975-1996

Hermes, N., Nhung, V.T. (2010), "The Impact of financial liberalization on bank efficiency: evidence from Latin America and Asia", *Applied Economics*, Vol. 42, No. 26, pp. 3351-3365

Hung, N.V. (2007), "Measuring Efficiency of Vietnamese Commercial Banks: An Application of Data Envelopment Analysis (DEA)", *Minh, N.K. and Long, G.T. (Eds.): Technical Efficiency and Productivity Growth in Vietnam*, pp. 60-70 (Publishing House for Social Labor)

Imam, P., Kpodar, K. (2010), "Islamic Banking: How Has it Spread?", *Working Paper of the International Monetary Fund* (march 2010)

Isik, I., Gunduz, L., Omran, M. (2004), "Managerial and Scale Efficiency in the MENA Banking: A Panel study of the Jordan Banking Sector", *Working Paper Series. SSRN: http://ssrn.com/ abstract=494224.*

Isik, I., Hassan, M.K. (2002), "Technical, scale and allocative efficiencies of Turkish banking industry", *Journal of Banking & and Finance*, Vol. 26, pp. 719-766

Jobst, A.A. (2007), "The Economics of Islamic Finance and Securitization", *IMF working paper*, No. 07/117

Johnes, J., Izzeldin, M., Pappas, V. (2009), "The efficiency of Islamic and conventional banks in the Gulf Cooperation Council (GCC) countries: An analysis using financial ratios and data envelopment analysis", *working paper Lancaster University* 2009/023

Johnes, J., Izzeldin, M., Pappas, V. (2012), "A comparison of performance of Islamic and conventional banks 2004 to 2009", *Available at SSRN: http://ssrn.com/abstract=2071615*

Kablan, S., Yousfi, O. (2011), "Efficiency of Islamic and Conventional Banks in Countries with Islamic Banking", *MPRA Paper*, No. 32951

Kamarruddin, B.H., Safa, M.S., Mohd, R. (2008), "Assessing Production Efficiency of Islamic Banks and Conventional Bank Islamic Windows in Malaysia", *International Journal of Business and Management Research*, Vol. 1. No.1, pp. 31-48

Kashyap, A.K., Stein, J.C. (2000), "What Do A Million Observations on Banks Say About the Transmission of Monetary Policy?," *American Economic Review* , Vol. 90, pp. 407-428

Khan, M. S. (1986), "Islamic interest-free banking", *IMF Staff Papers* 33, pp. 1-27

Koopmans, T.C. (1951), "Activity Analysis of Production and Allocation",

Kumbhakar, S.C., Lovell, C.A.K. (2003), "Stochastic Frontier Analysis", *Cambridge: Cambridge University Press*

Miani S., Daradkah D. (2009), "The Islamic Banking Industry in Jordan", *Transition Studies Review*, Vol. 16, No. 3, pp. 635-654

Kyj, l., Isik, I. (2008), "Bank x-efficiency in Ukraine: An analysis of service characteristics and ownership", *Journal of Economics and Business*, Vol. 60, pp. 369-393

Kysucky, V., Norden, L. (2012), "Relationship Lending: A Meta-Analysis", *Working paper of Rotterdam School of Management, Erasmus University*

Laeven, L. (1999), "Risk and Efficiency in East Asian Banks", *The World Bank Policy, Research Working Paper*, No. 2255

Majid, M.A., Nor, N.G., Said, F.F. (2003), "Efficiency of banks in Malaysia", *Conference paper, fifth International conference on Islamic Economics and Finance*, Bahrain, Vol. 2, pp. 405-416

Mohamad, S., Hassan, T., Bader, M.K.I. (2008), "Efficiency of conventional versus Islamic Banks: International Evidence using the Stochastic Frontier Approach (SFA)", *Journal of Islamic Economics, Banking and Finance*, Vol. 4, pp. 107-130

Mokhtar, H.S.A., Abdullah, N., Al-habshi, S.M. (2006), "Efficiency of Islamic Banking in Malaysia: Stochastic Frontier Approach", *Journal of Economic Cooperation*, Vol. 27, No. 2, pp. 37-70

Mokhtar, H.S.A., Abdullah, N., Al-habshi, S.M. (2007), "Technical and Cost Efficiency of Islamic Banking in Malaysia", *Review of Islamic Economics*, Vol. 11, No. 1, pp. 5-40

Moussawi, C.E., Obeid, H. (2011), "Evaluating the productive Efficiency of Islamic Banking in GCC: A non- Parametric Approach", *International Management Review*, Vol.7, No. 1, pp. 10-21

Mwega, F. (2011), "The Competitiveness and Efficiency of the Financial Services Sector in Africa: A Case Study of Kenya", *African Development Review*, Vol. 23, No. 1, pp. 44-59

Nenovsky, N., Chobanov, P., Mihaylova, G., Koleva, D. (2008), "Efficiency of the Bulgarian Banking System: Traditional approach and Data Envelopment Analysis", *Working Paper, International Centre for Economic Research*, No. 22/2008

Noor, M.A.N.M., Ahmad, N.H.B.T. (2012), "The Determinants of Islamic Banks' Efficiency Changes: Emperical Evidence from the World Banking Sectors", *Global Business Review*, Vol. 13, No. 2, pp. 179-200

Oliveira, C.V., Tabak B.M. (2005), "An International Comparison of Banking Sectors: A DEA Approach", *Global Economic Review: Perspectives on East Asian Economics and Industries*, Vol. 34, No. 3, pp. 291-307

Omar, M.A., Majid, M.S.A., Rulindo, R. (2007), "Efficiency and Productivity Performance of the National Private Banks in Indonesia", *Gadjah Mada International Journal of Business*, Vol. 9, No. 1, pp. 1-18

Omar, M.A., Rahman, A.R.A., Yusof, R.M., Majid, M.S.A., Rasid, M.E.S.M. (2006), "Efficiency of commercial banks in Malaysia", *Asian Academy of Management Journal of Accounting and Finance*, Vol. 2, No. 2, pp. 19-42

Ono, S. (2008), "Efficiency of the Domestic and Foreign Banks in Russia", *Economic Journal of Hokkaido University*, Vol. 37, pp. 29-43

Onour, I.A., Abdalla, A.M.A. (2010), "Scale and Technical Efficiency of Islamic Banks in Sudan: Data Envelopment Analysis", *Arab Planning Institute Working Paper* Series 1012

Pang, F., Drummond, M., Song, F. (1999), "The use of Meta-analysis in Economic Evaluation", *Discussion paper* 173, Centre for Health Economics of the University of York

Pellegrina, L.D. (2007), "Adequacy Ratios, Efficiency and Governance: a comparison Between Islamic and Western Banks", *Working Paper of the University of Bocconi*, Milan, Italy

Piliang, E., Ritha, H., Hadiyati, P. (2010), "Technical and Scale Efficiency of Syariah Banking In Indonesia: Data Envelopment Analysis Approach", *Journal of Economics, Business & Accountancy*, Vol. 13, No. 1, pp. 27-38

Pramuka, B.A. (2011), "Assessing profit efficiency of Islamic banks in Indonesia: An intermediation approach", *Journal of Economics, Business and Accountancy Ventura*, Vol. 14, No. 1, pp. 79-88

Rahman, A.A. (2010), "Financing structure and insolvency risk exposure of Islamic banks", *Financial Markets and Portfolio Management*, Vol. 24, No. 4, pp. 419-440

Rethel, L. (2011), "Whose Legitimacy? Islamic Finance and the global financial order", *Review of International Political Economy*, Vol. 18, No. 1, pp. 75-98

Rettab, B., Kashani, H., Obay, L., Roa, A. (2010), "Impact of Market Power and Efficiency on Performance of Banks in the Gulf Cooperation Council Countries", *International Research Journal of Finance and Economics*, Vol. 50, pp. 189-203

Rezitis, A.N. (2006), "Productivity Growth in the Greek Banking Industry: A Non-Parametric Approach", *Journal of Applied Economics*, Vol. 9, No. 1, pp. 119-138

Said, A. (2012), "Efficiency in Islamic Banking during a Financial Crisis-an Empirical Analysis of Forty-Seven Banks", *Journal of Applied Finance & Banking*, Vol. 2, No. 3, pp. 163-197

Said, A. (2012), "Comparing the Change in Efficiency of the Western and Islamic Banking Systems", *Journal of Money, Investment and Banking*, Vol. 23, pp. 150-180

Saleh, A.S., Zeitun, R. (2006), "Islamic Banking Performance in the Middle East: A Case study of Jordan", *University of Wollongong, Working Paper* 06-21

Sarker, A.A. (1999), "Islamic Banking in Bangladesh: Performance, Problems and Prospects", *International Journal of Islamic Financial services*, Vol. 1, No. 3

Shadid, S. (2007), "Role of Islamic Banks in Economic Development", *Working paper of the Hailey College of banking and finance (PAK) and C.I.M.A. (UK)*

Shadid, H., Rehman, R., Naizi, G.S.K., Raoof, A. (2010), "Efficiencies Comparison of Islamic and Conventional Banks of Pakistan", *International Research Journal of Finance and Economics*, Vol. 49, pp. 24-42

Shah, I.A., Shah, S.Z., Ahmad, H. (2012), "Comparing the efficiency of Islamic versus conventional banking: through data envelopment analysis (DEA) model", *African Journal of Business Management*, Vol. 6, No. 3, pp. 787-798

Sufian, F. (2006), "Size and Returns to Scale of the Islamic Banking Industry in Malaysia: Foreign versus Domestic Banks", *Journal of Economics and Management*, Vol. 14, No. 2, pp. 147-175

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

Sutton, A.J., Song, F., Gilbody, S.M., and Abrams, K.R.. (2000), "Modeling publication bias in meta-analysis: a review", *Statistical Methods in Medical Research*, Vol. 9, pp. 421-445

Srairi, S.A. (2010), "Cost and profit efficiency of conventional and Islamic banks in GCC countries", *Journal of Productivity Analysis*, Vol. 34, No. 1, pp. 45-62

Stanley, T.D. (2001), "Wheat From Chaff: Meta-Analysis As Quantitative Literature Review", *Journal of Economic Perspective*, Vol. 15, No. 3, pp. 131-150

Tahir, I.M., Bakar, N.M.A., Haron, S. (2011), "Evaluating Efficiency of Islamic Banks Using Data Envelopment Analysis: International Evidence", *Journal of Islamic Economics, Banking, and Finance*, Vol. 7, No. 1, pp. 11-24

Tahir, I.M., Haron, S. (2008), "Technical efficiency of the Malaysian commercial banks: a stochastic frontier approach", *Bank and Bank Systems*, Vol. 3, No. 4, pp. 65-72

Yaumidin, U.K. (2007), "Efficiency in Islamic Banking a Non-parametric Approach", *Buletin Ekonomi Moneter dan Perbankan*, Vol. 9, No. 4, pp. 23-54

Yildirim, C. (2002), "Evolution of banking efficiency within an unstable macroeconomic environment: the case of Turkish commercial banks", *Applied Economics*, Vol. 34, No. 18, pp. 2289-2301

Yudistira, D. (2004), "Efficiency in Islamic Banking: An Empirical Analysis of Eighteen banks", *Islamic Economics Studies*, Vol. 12, No. 1, pp. 1-24

Zaheer, S., Ongena, S., Wijnbergen, J.G. (2011), "The transmission of monetary policy through conventional and Islamic banks", *CentER Discussion paper*, No. 2011-078, ISSN 0924-7815

Zaher, T.S., Hassan, M.K. (2001), "A comparative literature survey of Islamic finance and banking", *Journal of Financial Markets, Institutions and Instruments*, Vol. 10, No. 4, pp. 155-199

Zainal, N.S., Ismail, M. (2012), "Islamic banking efficiency: A DEA approach", paper presented at third *International conference on Business and Economic Research*, March 2012, ISBN: 978-967-5705-05-2

Books:

Coelli, T., Prasada, R.D.S., and Battese G.E. (1998), Introduction to Efficiency and Productivity Analysis, *Kluwer Academic Publishers*, Boston

Glass, G.V., McGaw, B., Smith, M.L. (1981), Meta-analysis in Social Research. *Sage publications*, Beverly Hills

Iqbal, M. and Llewellyn, D.T. (2002), Islamic Banking and Finance: New Perspective on Profit-Sharing and Risk, *Edward Elgar publishing limited*

Iqbal, M. and Molyneux, P. (2005), Thirty years of Islamic banking: History, performance and prospects, *Palgrave Mac Millan*

Koopmans, T.C. (1951), "An analysis of production as an e:cient combination of activities" In: Activity Analysis of Production and Allocation. Cowles Commission for Research in Economics Monograph 13, *Wiley*, *New York*

Appendix

Input meta-analysis

Table 1: Papers considered in panel A

Authors	Type of Efficiency	Countries/regions	Research method	Time span
Abu-Alkheil, Burghof, Khan	CRS/VRS	Worldwide	DEA	2005/2008
Ahmad, Luo	CRS	Europe	DEA	2005/2008
Ahmad, Noor, Sufian[a]	CRS/VRS	25 countries	DEA	2003/2009
Al-Delaimi, Al-Ani	CRS	Worldwide	DEA	1999/2001
Alpay, Hassan[b]	CRS/VRS	Turkey	DEA	1990/2000
Arslan, Ergec	CRS	Turkey	DEA	2006/2009
Batchelor, Wadud	CRS/VRS	Malaysia	DEA	1997/2002
Ellahi, Khattak, Rehman, Jamil	CRS	Pakistan	DEA	2004/2008
Hassan	CRS/VRS	world	DEA	1995/2001
Hassan	CRS/VRS	Pakistan, Iran, Sudan	DEA	1995/2001
Hassan[a]	CRS/VRS	world	DEA/SFA	1996/2003
Isik, Gunduz, Omran	CRS/VRS	Jordan	DEA	1996/2001
Johnes, Izzeldin, Pappas	CRS/VRS	GCC	DEA	2000/2007
Johnes, Izzeldin, Pappas	CRS/VRS	Worldwide	DEA	2004/2009
Kamarruddin, Safa, Mohd	CRS/VRS	Malaysia	DEA	1998/2004
Mokhtar, Abdullah, Al-Habshi	VRS	Malaysia	DEA	1997/2003
Moussawi, Obeid	CRS	GCC	DEA	2005/2008
Noor, Ahmad	CRS/VRS	25 countries	DEA	1992/2009
Noor, Ahmad[a]	CRS/VRS	25 countries	DEA	1997/2009
Omar, Mijad, Rulindo	CRS/VRS	Indonesia	DEA	2000/2004
Onour, Abdalla[b]	CRS/VRS	Sudan	DEA	2007/2008
Piliang, Ritha, Hadiyati	CRS/VRS	Indonesia	DEA	2005/2007
Rettab, Kashani, Obay, Roa	CRS/VRS	GCC	DEA	2001/2005
Said	VRS	worldwide	DEA	2006/2009
Said	CRS	worldwide	DEA	2006/2009
Shadid, Rehman, Naizi, Raoof	CRS/VRS	Pakistan	DEA	2005/2009
Sufian	CRS/VRS	Malaysia	DEA	2001/2004
Sufian, Noor, Majid	CRS/VRS	16 countries (MENA and Asian countries)	DEA	2001/2006
Tahir, Bakan, Haron	CRS/VRS	4 regions	DEA	2003/2008
Yaumidin	CRS/VRS	4 south Asia countries and 10 Middle East countries	DEA	2000/2004
Yudistira	CRS/VRS	12 countries	DEA	1997/2000
Zainal, Ismail	CRS/VRS	Malaysia	DEA	2006/2010

This table presents all the DEA researches considered to create panel A. Other researches do not exist to the researcher's knowledge or didn't comply to the selection criteria. Marked researches are not included for various reasons: Double counting[a], and period data[b].

Table: 2 Extended Panel A

Authors	Description/Title	Publication Year
Abu-Alkheil, Burghof, Khan	Islamic commercial banking in Europe: A cross-country and inter-bank analysis	2012
Ahmad, Luo	Comparison of banking efficiency in Europe	2010
Al-Delaimi, Al-Ani	Cost efficiency of 24 Islamic banks	2006
Arslan, Ergec	The efficiency of participation and conventional banks in Turkey	2010
Batchelor, Wadud	Technical and scale efficiency	2004
Ellahi, Khattak, Rehman, Jamil	Testing technical and cost efficiency on pakistan Islamic financial system	2011
Hassan	The X-efficiency in Islamic banks	2003
Hassan	Cost , Profit and X-efficiency of Islamic banks in Pakistan, Iran and Sudan	2005
Isik, Gunduz, Omran	Managerial and scale efficiency in the Mena banking: panel study of Jordan	2004
Johnes, Izzeldin, Pappas	The efficiency of Islamic and conventional	2012
Johnes, Izzeldin, Pappas	A comparison of performance of Islamic and conventional banks	2009
Kamarruddin, Safa, Mohd	Assessing production efficiency, Malaysia	2008
Mokhtar, Abdullah, Al-Habshi	Technical and cost efficiency	2007
Moussawi, Obeid	Evaluating the productive efficiency	2011
Noor, Ahmad	The determinants of Islamic banks' efficiency changes: empirical evidence from the world banking sectors	2012
Omar, Majid, Rulindo	Efficiency and productivity performance of the national private banks in Indonesia	2007
Onour, Abdalla	Scale and technical efficiency of Islamic Banks	2010
Piliang, Ritha, Hadiyati	Technical and scale efficiency of Sharia banking in Indonesia	2010
Rettab, Kashani, Obay, Roa	Impact of market power and efficiency on performance of GCC banks	2010
Said	Efficiency in Islamic banking during a financial crisis	2012
Said	Comparing the change in efficiency of western and Islamic banking systems	2012
Shadid, Rehman, Naizi, Raoof	Efficiency comparison of Islamic and conventional banks in Pakistan	2010
Sufian	Size and returns to scale of the Islamic banking industry in Malaysia	2006
Sufian, Noor, Majid	The efficiency of Islamic banks: empirical evidence	2008
Tahir, Bakan, Haron	Evaluating efficiency of Islamic banks	2011
Yaumidin	Efficiency in Islamic banking: a non-parametric approach	2007
Yudistira	Efficiency in Islamic banking: an empirical analysis of eighteen banks	2004
Zainal, Ismail	Comparative efficiency performance of local and foreign Islamic banks	2012

Publications used for panel A. It is also an overview of all DEA method based research on Islamic banking.

Table 3: Papers considered in Panel B

Authors	Type of Efficiency	Countries/regions	Research method	Time span
Ahmad, Luo	CRS	Europe	DEA	2005/2008
Alkhathlan, Malik	CRS/VRS	Saudi Arabia	DEA	2003/2008
Arslan, Ergec	CRS	Turkey	DEA	2006/2009
Chen, Skully, Brown	CRS/VRS	China	DEA	1993/2000
Darrat, Topuz, Yousef	CRS/VRS	Kuwait	DEA	1994/1997
Ellahi, Khattak, Rehman, Jamil	CRS	Pakistan	DEA	2004/2008
Galagedera, Edirisuriya	CRS/VRS	India	DEA	1995/2002
Hermes, Nhung	CRS/VRS	Latin America	DEA	1991/2000
Hung	CRS/VRS	Vietnam	DEA	2001/2003
Isik, Gunduz, Omran	CRS/VRS	Jordan	DEA	1996/2001
Johnes, Izzeldin, Pappas	CRS/VRS	GCC	DEA	2000/2007
Johnes, Izzeldin, Pappas	CRS/VRS	Worldwide	DEA	2004/2009
Kyj, Isik	CRS/VRS	Ukraine	DEA	1998/2003
Laeven	VRS	East Asia	DEA	1992/1996
Mokhtar, Abdullah, Al-Habshi	VRS	Malaysia	DEA	1997/2003
Mwega	CRS/VRS	Kenya	DEA	1997/2006
Nenovsky, Chobanov, Mihaylova, Koleva	CRS/VRS	Bulgaria	DEA	1999/2006
Omar, Majid, Rulindo	CRS/VRS	Indonesia	DEA	2000/2004
Omar, Rahman, Yusof, Majid, Rasid	CRS/VRS	Malaysia	DEA	2000/2004
Ono	CRS/VRS	Russia	DEA	2004/2006
Rettab, Kashani, Obay, Roa	CRS/VRS	GCC	DEA	2001/2005
Rezitis	CRS/VRS	Greece	DEA	1990/1997
Said	CRS	worldwide	DEA	2006/2009
Shadid, Rehman, Naizi, Raoof	CRS/VRS	Pakistan	DEA	2005/2009
Yildirim	CRS/VRS	Turkey	DEA	1990/1999

Panel B data. This table presents the data used in the meta-analysis to benchmark Islamic efficiency estimates.

Table 4: Extended Panel B (country specific)

Countries included	Years included	Countries included	Years included
Greece	1990/1997	Bulgarian	1999/2006
Turkey	1990/1999	Malaysia	2000/2004
Argentina	1991/2000	Indonesia	2000/2004
Brazil	1991/2000	GCC	2000/2007
Mexico	1991/2000	Vietnam	2001/2003
Peru	1991/2000	GCC	2001/2005
Indonesia	1992/1996	Indonesia	2002/2004
Korea	1992/1996	Saudi Arabia	2003/2008
Malaysia	1992/1996	Russia	2004/2006
Philippines	1992/1996	GCC	2004/2007
Thailand	1992/1996	Pakistan	2004/2008
China	1993/2000	World	2004/2009
Kuwait	1994/1997	Germany	2005/2008
India	1995/2002	United Kingdom	2005/2008
Jordan	1996/2001	Turkey	2005/2008
Malaysia	1997/2003	Pakistan	2005/2009
Kenya	1997/2006	Turkey	2006 and 2009
Ukraine	1998/2003	World	2006/2009

Countries included in Panel B, structured chronologically and in total. When world or GCC is stated it can be assumed that the researcher does not state all countries involved specifically or/and that including these countries separately will cancel out the explanatory value of this table as some researches included many countries.

Table 5: Extended Panel B

Authors	Description/Tittle	Publication Year
Ahmad, Luo	Comparison of banking efficiency in Europe	2010
Alkhathlan, Malik	Are Saudi banks efficient	2010
Arslan, Ergec	The efficiency of participation and conventional banks in Turkey	2010
Chen, Skully, Brown	Banking efficiency in China	2005
Darrat, Topuz, Yousef	Assessing cost and technical efficiency of banks in Kuwait	2002
Ellahi, Khattak, Rehman, Jamil	Testing technical and cost efficiency on Pakistan Islamic financial system	2011
Galagedera, Edirisuriya	Performance of Indian commercial banks	2004
Hermes, Nhung	The impact of financial liberalization on bank efficiency	2010
Hung	Measuring efficiency of Vietnamese commercial banks	2007
Isik, Gunduz, Omran	Managerial and scale efficiency in the Mena banking: panel study of Jordan	2004
Johnes, Izzeldin, Pappas	The efficiency of Islamic and conventional	2012
Johnes, Izzeldin, Pappas	A comparison of performance of Islamic and conventional banks	2009
Kyj, Isik	Bank x-efficiency in Ukraine	2008
Laeven	Risk and efficiency in East Asian banks	1999
Mokhtar, Abdullah, Al-Habshi	Technical and cost efficiency	2007
Mwega	The competitiveness and efficiency of the financial services sector in Africa	2011
Nenovsky, Chobanov, Mihaylova, Koleva	Efficiency of the Bulgarian banking system	2008
Omar, Majid, Rulindo	Efficiency and productivity performance of the national private banks in Indonesia	2007
Omar, Rahman, Yusof, Majid, Rasid	Efficiency of commercial banks in Malaysia	2006
Ono	Efficiency of the Domestic and Foreign Banks in Russia	2008
Rettab, Kashani, Obay, Roa	Impact of market power and efficiency on performance of GCC banks	2010
Rezitis	Productivity growth in the Greek banking industry	2006
Said	Comparing the change in efficiency of western and Islamic banking systems	2012
Shadid, Rehman, Naizi, Raoof	Efficiency comparison of Islamic and conventional banks in Pakistan	2010
Yildirim	Evolution of banking Efficiency within an unstable macroeconomic environment	2002

This table presents the publications used for panel B. It is a further extension of table 3 and table 4.

Overview of statistical tests

Table 6:
Statistics of Islamic and conventional banks

	Banktype	N	Mean	Std. Deviation
CRS	Islamic	134	,791	,151
	Conventional	155	,794	,157
VRS	Islamic	123	,873	,119
	Conventional	179	,837	,135

This table presents group statistics for panel A (Islamic Banking) and Panel B (conventional banking).
CRS = average technical efficiency estimates, VRS = pure technical efficiency estimates.

Table 7:
Independent Samples t-test

				t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
CRS	Equal variances assumed	,435	,510	-,125	287	,901
	Equal variances not assumed			-,125	283,831	,901
VRS	Equal variances assumed	6,511	,011	2,421	300	,016
	Equal variances not assumed			2,479	282,354	,014

This table presents t-test statistics between panel A en panel B efficiency estimates. When there was an inequality of variances (Levene's test), corrected degrees of freedom are reported for t-tests, as they are more precise.

Table 8:
Descriptive Statistics

Banktype		Mean	Std. Deviation	N
Islamic	CRS	,791	,151	134
	Year	13,8	4,165	134
Conventional	CRS	,794	,157	155
	Year	11,0	5,138	155

Descriptives of technical efficiency under constant returns to scale and the variable year.
(Year in a scale of 1-21 (1990-2010))

Table 9:
Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
Banktype	Model	B	Std. Error	Beta	t	Sig.
Islamic	(Constant)	,980	,042		23,354	,000
	Year	-,014	,003	-,378	-4,697	,000
Conventional	(Constant)	,815	,030		27,234	,000
	Year	-,002	,002	-,063	-,784	,434

a. Dependent Variable: CRS

Table 10:
Descriptive Statistics

Banktype		Mean	Std. Deviation	N
Islamic	VRS	,873	,119	123
	Year	13,2	4,141	123
Conventional	VRS	,837	,135	179
	Year	9,5	4,734	179

Descriptives of technical efficiency under variable returns to scale and the variable year.
(Year in a scale of 1-21 (1990-2010))

Table 11:
Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
Banktype	Model	B	Std. Error	Beta	t	Sig.
Islamic	(Constant)	,963	,035		27,472	,000
	Year	-,007	,003	-,237	-2,683	,008
Conventional	(Constant)	,825	,023		36,388	,000
	Year	,001	,002	,044	,583	,561

a. Dependent Variable: VRS

Table 12:
Testing influence of quality with Anova/Ancova CRS

		Value Label	N
Rating	1	Low quality	12
	2	Below average quality	60
	3	Average quality	13
	4	Above average quality	83
	5	High quality	121

Banktype			Value Label	N
Islamic	Rating	1	Low quality	2
		2	Below average quality	18
		3	Average quality	10
		4	Above average quality	33
		5	High quality	71
				134
Conventional	Rating	1	Low quality	10
		2	Below average quality	42
		3	Average quality	3
		4	Above average quality	50
		5	High quality	50
				155

Ratings given to CRS efficiency estimates. The rating of efficiency estimates is based on the fit to the selection criteria described in section 5.1.4.

Table 13:
Anova

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1,578[a]	4	,395	21,287	,000
Intercept	85,312	1	85,312	4602,651	,000
Rating	1,578	4	,395	21,287	,000
Error	5,264	284	,019		
Total	188,410	289			
Corrected Total	6,842	288			

a. R Squared = ,231 (Adjusted R Squared = ,220)
Dependent Variable: CRS

Table 14:
Ancova

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1,645[a]	5	,329	17,917	,000
Intercept	84,432	1	84,432	4597,632	,000
Rating	1,645	4	,411	22,392	,000
Banktype	,067	1	,067	3,647	,057
Error	5,197	283	,018		
Total	188,410	289			
Corrected Total	6,842	288			

a. R Squared = ,240 (Adjusted R Squared = ,227)
Dependent Variable: CRS

Table 15:
Testing influence of quality with Anova/Ancova on VRS

		Value Label	N
Rating	1	Low quality	8
	2	Below average quality	59
	3	Average quality	20
	4	Above average quality	90
	5	High quality	125

Banktype			Value Label	N
Islamic	Rating	2	Below average quality	17
		3	Average quality	10
		4	Above average quality	25
		5	High quality	71
			Total:	123
Conventional	Rating	1	Low quality	8
		2	Below average quality	42
		3	Average quality	10
		4	Above average quality	65
		5	High quality	54
			Total:	179

Ratings given to VRS efficiency estimates. The rating of efficiency estimates is based on the fit to the selection criteria described in section 5.1.4.

Table 16:
Anova

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1,322[a]	4	,330	26,199	,000
Intercept	86,721	1	86,721	6876,637	,000
Rating	1,322	4	,330	26,199	,000
Error	3,745	297	,013		
Total	224,172	302			
Corrected Total	5,067	301			

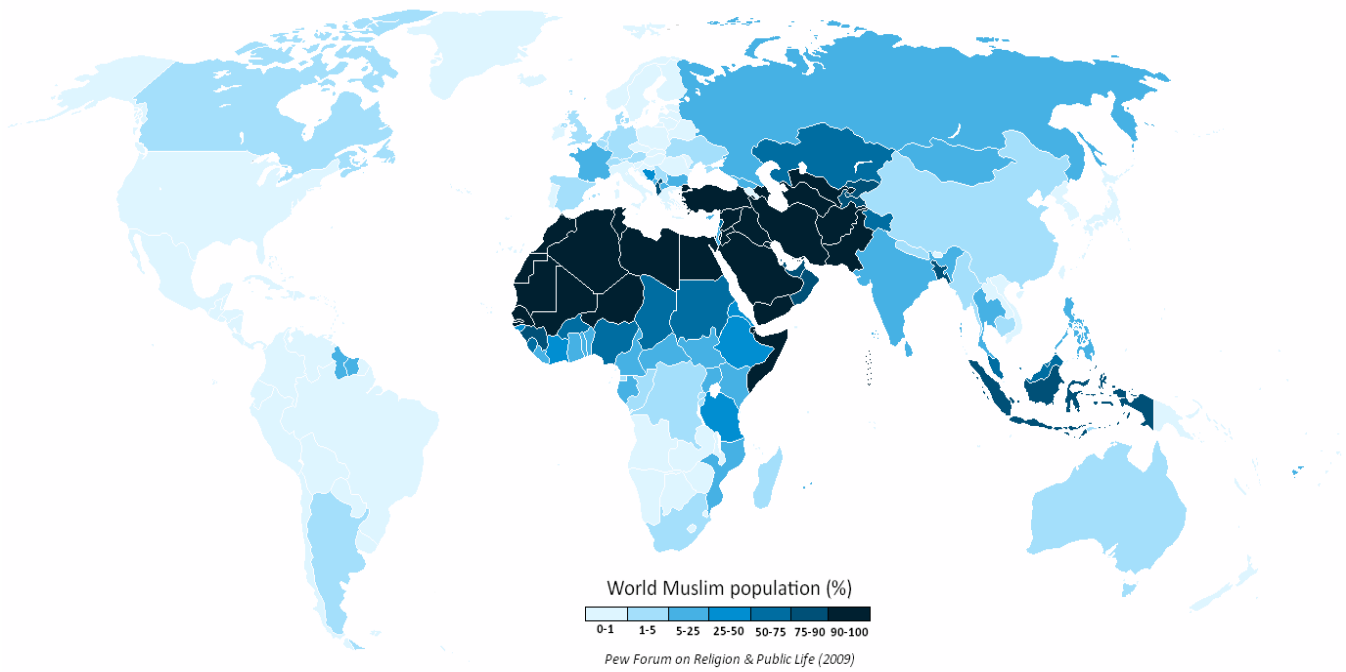
a. R Squared = ,261 (Adjusted R Squared = ,251)
Dependent Variable: VRS

Table 17:
Ancova

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	,600[a]	2	,300	20,093	,000
Intercept	12,997	1	12,997	870,041	,000
Rating	,503	1	,503	33,689	,000
Banktype	,019	1	,019	1,274	,260
Error	4,467	299	,015		
Total	224,172	302			
Corrected Total	5,067	301			

a. R Squared = ,118 (Adjusted R Squared = ,113)
Dependent Variable: VRS

Figure 5:



Concentration of Muslim population and indication of Islamic banking in the world[26]

[26] Source: Pew Forum on Religion & Public Life (2009)