A COMPARATIVE STUDY OF EFFICIENCY AND ITS DETERMINANTS IN ISLAMIC, CONVENTIONAL, AND SOCIALLY RESPONSIBLE BANKS

Majed Alharthi*

*Assistant Professor in Finance, Department of Finance, King Abdul Aziz University, Saudi Arabia, Rabigh

Abstract

This study empirically estimates efficiency and its determinants in 190 Islamic (IBs), conventional (CBs), and socially responsible banks (SRBs) in 22 countries during the period 2005-2012. The study first uses non-parametric approaches to estimate the efficiency measures (scale efficiency (SE), technical efficiency-constant returns to scale (CRS), and technical efficiency-variable returns to scale (VRS)) and second employs ordinary least squares, fixed effects, random effects, and TOBIT models to get the efficiency determinants. The findings indicate that the average efficiency is 0.966, 0.952, and 0.983 for the SE, CRS, and VRS, respectively. However, efficiency measures show that the SRBs are most efficient banks whereas, the least efficiency scores archived by Islamic banks. Islamic bank efficiency is positively correlated with size, loan intensity, ROA, inflation rates, market capitalization and financial crisis. However, conventional banks' TE and CRS efficiency are positively and significantly correlated with size, ROA, and market capitalization, while their VRS efficiency is negatively and significantly related to capital ratio, age and GDP. In addition, SRBs' efficiency is increased by size, capital ratio, loan intensity, ROA, foreign ownership, domestic ownership, inflation and financial crisis. Furthermore, the financial crisis affects the SE and CRS efficiency measures in Islamic banks while socially responsible banks SE efficiency measure is positively affected by the financial crisis, which means that socially responsible banks were stabled and resisted during the crisis period. Finally, there is no significant correlation between financial crisis and efficiency indictors in conventional banks during the period.

Keywords: Islamic Banks, Conventional Banks, Socially Responsible Banks, Ethical Banks, Data Envelopment Analysis, Bank's Efficiency, Global Financial Crisis

1. INTRODUCTION

Research on efficiency in the banking sector has increasingly become significant in recent times because all banks strive for high efficiency by minimising inputs (e.g. expenses) and maximising outputs (e.g. profits). It is also important because calculating the efficiency in banks can be helpful for policymakers, managers, and market analysts in competing banks. Furthermore, studying the banks' efficiency can help investors and government regulators (Rahman & Islam, 2011). In addition, when monetary policies are effective, then the banks are likely to be more efficient (Aikaeli, 2006). Berger and Humphrey (1997) argue that the success or failure of all firms refers to transforming their inputs into outputs. Therefore, banks have to know ideal ways to use their inputs to increase their efficiency. The importance of the study stems from two sides: the first side is the clients of banks, and the second side is the banks themselves. With respect to clients, by knowing the efficiency of any bank, clients can raise their trust of dealing with efficient banks rather than inefficient banks. Therefore, banks can have more clients, and this can lead to outstanding profits; in addition, banks can be more competitive when efficiency measures are high.

There have been many studies that have estimated the determinants of efficiency (e.g. Girardone et al., 2004; Garza García; Gardener et al., 2012; Han et al., 2012). These studies have found that larger banks are more efficient than small banks. They have also found many different determinants that affect efficiency, as will be discussed in the literature review section. Most banks have been affected by the global financial crisis that occurred in 2008. This crisis was the result of many direct and indirect factors, but it started with the bankruptcy of Lehman Bank in September 2008 in the USA. The bankruptcy happened after the huge loss in the American mortgages. It was considered the worst regression since the great recession of the 1930s. However, this crisis has negatively affected the entire world, as the gross domestic product (GDP) was reduced internationally following the crisis (World Bank, 2014). In this study, we include the financial crisis to estimate its impact on the banks' efficiency.

Socially responsible banks (SRBs) are also called ethical banks, alternative, civic, green and sustainable banks. Regardless of the name used,

those banks do the following activities: to sponsor community events, to provide local scholarships, to encourage literacy, to provide valuable prices for houses, and to care about the environment (Global Alliance for Banking on Values, 2014). Many banks have recently followed the approaches adopted by SRB banks, so it is very important to focus on this type of banks, which is neglected in previous studies. Therefore, our study compares the efficiency of SRBs, Islamic, and conventional banks, and then estimates the association between efficiency and its determinants.

This study investigates three types of banks: Islamic, conventional, and social responsible banks (SRBs). According to Noman (2003), Islamic banks are considered as commercial banks that operate with a free interest rate. However, the majority of recent studies on measuring efficiency pertained to conventional banks due to the availability of data, as compared to Islamic banks, which is completely new and where few data is available. However, there have been no studies on SRB banks. Therefore this study fills in this gap. This study estimates banks' efficiency by using the data envelopment analysis (DEA) approach, namely; Scale Efficiency (SE), Technical Efficiency-Constant Returns on Scale (TE-CRS), and Technical Efficiency-Variable Returns on Scale (TE-VRS). These measures were employed in input oriented (intermediation) method. Furthermore, the correlation between efficiency and its determinants have been analysed using four models, namely; the Ordinary Least Squares (OLS) (Han et al, 2012; Fang et al., 2011; Abu-Alkheil et al., 2012), Fixed-Effect model (Sufian & Habibullah, 2009; Hermes & Nhung, 2008), Random-Effect model (Feng & Zhang, 2012), and Tobit model (Garza-García, 2012; Vu and Turnell, 2004; Noor & Ahmed, 2012). Although OLS and Tobit models are widely used in previous studies, fixed-effects and rand-effects models are used to provide robust evidence of the association between efficiency and its determinants. The study employs 190 banks (26 Islamic banks, 28 SRB banks and 136 commercial banks from 2005 to 2012. Our data was extracted from the Bankscope and Bloomberg databases. In fact, this study makes several contributions to the current literature. Firstly, it is the first study that concerns socially responsible banking system. Secondly, comparing Islamic, conventional and socially responsible banks is a contribution to the literature.

The study is organised as follows. Section 2 reviews the previous literature. Section 3 presents for the data and methodology. Section 4 discusses the empirical results. Finally, Section 5 concludes the study.

2. LITERATURE REVIEW

2.1. Efficiency in Banks

Hassan (2006) investigates Islamic banks' efficiency using the parametric (cost and profit efficiency) and the nonparametric (Data Envelopment Analysis and Malmquist productivity index (MPI)) to obtain cost, profit and X-efficiency over the period from 1995 to 2001. The average cost efficiency in this study was 73.5% and the average profit efficiency was 84.4%. The results concluded that the Islamic banks were relatively inefficient in containing costs but they were efficient in generating profits. ElMoussawi and Obeid (2011) evaluate the productive efficiency of 23 Islamic banks in GCC countries during the period 2005-2008 using DEA measures: technical efficiency, allocative efficiency and cost efficiency. Their results suggest that Islamic banks were inefficient, achieving average efficiency of 0.86, 0.69 and 0.61 for technical efficiency, allocative efficiency and cost efficiency, respectively. Noor and Ahmed (2012) examine the 78 Islamic banks' efficiency in 25 countries over the period 1992-2009. They utilised DEA including: technical efficiency, pure technical efficiency and scale efficiency. The results show that the Islamic banks score a low average technical efficiency and scale efficiency. They conclude that the Islamic banks are inefficient. Sufian (2007) investigates 17 Malaysian Islamic banks using DEA over the period 2001-2005. The study compared the Islamic domestic banks and the foreign Islamic banks in Malaysia. The findings concluded that the foreign banks exhibit more technical efficiency than the domestic banks. Said (2012) measures the efficiency of 47 Islamic banks around the world using DEA during a financial crisis period of 2006-2009. He finds that that the smaller banks were more efficient and resistant against the financial crisis. Pramuka (2011) compares 31 full-fledged Islamic banks with Islamic windows in Indonesia during the period 2003-2009. He finds that the fully-fledged Islamic banks were slightly more profited efficient than the Islamic window banks.

Onour and Abdalla (2012) employe the DEA approach to measure the efficiency of 36 conventional banks operating in the Gulf Cooperation Council (GCC) countries over the period of 2006 to 2008. The results show that the most efficient year was 2007. On the other hand, the most inefficient year was 2008 for two reasons: first, because the international financial crisis happened in that year and second, because the prices of the oil dropped to under a hundred dollars in that year. Ray and Das (2010) utilise DEA to estimate cost and profit efficiency in the Indian banking sector using data from 73 conventional banks during the period 1997-2003. Their results indicated the average profit efficiency was very low, scoring 0.525 compared to the average cost efficiency 0.915. In general, the state-owned banks performed better than foreign and domestic bank.

Shamsuddin and Xiang (2012) investigate the efficiency of sample of 10 Australian banks during the period 1995-2008. The results noted that the efficiency has improved in large and small Australian banks in the technical, cost and profit efficiencies. Feng and Serletis (2010) employ the DEA approach to find the technical efficiency of 292 USA conventional banks over the period 2000-2005. The results of DEA indicate that the US banks were relatively efficient during the period. Chiu *et al.* (2011) use DEA, BCC and Slack-based Measure SBM super efficiency models in 43 conventional Taiwanese banks during the period 1998-2002. Gardener *et al.* (2012) investigate the efficiency of 40 banks in 5 South East Asia countries: Indonesia, Malaysia, Philippines, Thailand and Vietnam using DEA during the period 1998-2004. In general, the average technical efficiencies in the South East Asian banks were low because of the financial crisis in

1997. Mostafa (2007) examine the efficiency of the top 100 Arab conventional and Islamic banks from 14 countries in 2005 using DEA. The results showed that the Arabian banks of the study were inefficient, as only 4 banks scored 100% efficiency from Egypt and the United Arab Emirates. Zhang *et al.* (2012) investigate the technical efficiency of a panel sample of 133 city commercial banks in China around 31 regions during the period 1999-2008. Their results indicated that the banks' efficiency could be heavily affected by the law enforcement effectiveness of the 31 regions used. Comparing the cost and profit efficiency of Islamic and conventional banks, Olson and Zoubi (2011) study the efficiency of 10 Middle Eastern and North African (MENA) countries, namely Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia and the United Arab Emirates. The conventional banks scored higher cost and profit efficiency than Islamic banks with the conventional banks scoring cost and profit efficiency of 71.2% and 74.4%, respectively whereas Islamic banks scored 66.4% and 59% respectively.

Ariss, *et al.* (2007) examine the efficiency of 6 measures of the non-parametric frontier approach: overall efficiency, allocative efficiency, overall technical efficiency, pure technical efficiency, non-technical efficiency and scale efficiency. The sample was 45 GCC banks over the period 1999-2004 using the inputs as borrowed funds, labour and book value of fixed assets whereas the outputs were net loans, securities and other earning assets. Their results suggested that the most efficient banks were in Oman. On the other hand, the most inefficient banks were in Saudi Arabia. Al-Farisi and Hendrawan (2012) examine Islamic and conventional banks in Indonesia during the period 2002-2008 examining 105 Indonesian banks. The study suggests that the average profit efficiency was 0.6037, showing that the Indonesian banks in the study were inefficient. Qureshi and Shaikh (2012) analyse the comparative efficiency of Pakistani Islamic banks (IB), conventional banks (CB) and conventional banks with Islamic banking divisions (IBD) during the period 2003-2008. The findings suggested that the Islamic banks attained more cost efficiency and less revenue efficiency. Al-jarrah and Molyneux (2006) investigate the cost efficiency of four Arabian countries namely, Bahrain, Egypt, Saudi Arabia and Jordan utilising SFA for the period 1992-2000. The findings suggest that the cost efficiencies in those countries were relatively high scoring average cost efficiency equals 95%. The most efficient banks' group was the Islamic banks attained average cost efficiency equals 98% when the least was the investment banks scored 93%. Bahrain was the most efficient country in banking sector obtained average cost efficiency equals 99% whereas; Jordan was the least efficient country scoring 89%. Wang *et al.* (2014) analysed the efficiency of 16 major commercial banks during the period 2003-2011 using DEA measures. The findings suggest that the overall efficiency improved during the period. Even the efficiency in the first stage (deposits production) was found to have risen in DEA measures over the period. According to DEA estimators in the second stage (profit-earning), the graph of DEA fluctuated and dropped sharply in 2006 and 2009; in contrast, the graph slightly increased in the rest of the years. In general, they found that state-owned banks are more efficient than joint-stock banks during the period.

Svitalkova (2014) compared the efficiency of six European countries namely, Czech Republic, Slovakia, Austria, Poland, Hungary and Slovenia during the period 2004-2011 using the DEA approach. According to CRS and VRS values, the efficiency of Hungary, Austria and Czech Republic are relatively high compared with Slovenia, Slovakia and Poland. This study shows the effect of the financial crisis in these countries as in 2009 the CRS and VRS had a sharp decline and kept reducing until 2011 apart from Slovakia, Slovenia and Poland for the CRS and VRS estimators. Řepková (2014) analysed the efficiency of 11 Czech commercial banks over the period 2003-2012 using DEA method. The study finds that the mean CRS reaches 84–89% and the VRS scores 70–78%. In addition, larger banks were found to be less efficient than the smaller banks due to the excess of deposits in the balance sheet and inappropriate size of operation. Recently, Ohsato and Takahashi (2015) focused on management efficiency in the Japanese banking sector for the years 2012 and 2013. All regional banks had inefficient scoring efficacies (DEA) with 0.352 and 0.266 in 2012 and 2013. This study suggests that Japanese banks need to minimise the inputs and maximise the outputs through policy makers' strategies, otherwise the efficiency will keep decreasing over time.

2.2. The Determinants of Efficiency

Mamatzakis et al. (2015) is the most recent study that focused on determinants of efficiency. This study focused on Japanese commercial banking system through the period 2000-2012. The most important results suggest that better capitalised banks were more technical efficient. In addition, banks with higher profitability (net interest margins) performed efficiently due to higher earnings allow banks to diversify the services and generate more operations. Focusing on Islamic and conventional banking sectors, Johnes et al. (2014) addressed that smaller banks were more efficient than larger banks. They investigated that providing more loans lead to support efficiency. However, in terms of macroeconomic variables, the growth of GDP and stock market highly encourage banks to operate better due to availability of individual purchase power. A study of Garza García (2012) focuses on the determinants of banks' efficiency in Mexico during the period from 2001–2009 using DEA. DEA measures inefficiency as 0.15, 0.29, and 0.14 for technical, pure technical, and scale efficiencies, respectively. Using Tobit model, the study suggests that the determinants that increase the efficiency are GDP, loan intensity, foreign ownership, and growth. Spulbar & Nitoi (2014) focused on Latin America, Central and Eastern Europe, and Southeast Asia using cost efficiency analysis during the period from 2005–2011. This study finds that higher GDP lead to increase inefficiency, and the impact of the financial crisis was low on banks in the study. Gardener et al. (2011) estimate the efficiency of banks in five Southeast Asian countries: Indonesia, Malaysia, the Philippines, Thailand, and Vietnam over the period from 1998–2004 utilising DEA and Tobit. The results suggest that efficiency declined during the study

period. They find that state-owned and foreign banks were more efficient than domestic banks. Moreover, a study by Sufian (2009) was conducted on the Malaysian banking sector during the period from 1995–1999 using DEA employing three methods: intermediation, operating, and value added approaches. The results suggest that banks became inefficient after 1997 due to the Asian financial crisis. Moreover, the intermediation approach achieved less efficiency than the operating and value added approaches. Furthermore, the study finds that there was a negative relationship between efficiency and economic conditions; in addition to expense preference behaviour reduces the banks' efficiency. Conversely, bank efficiency was positively related to loan intensity. Flamini et al. (2009) find that credit risk has a significant positive impact on profitability, which means that shareholders need more earnings to compensate for the higher credit risk. Saad & ElMoussawi (2009) analyse the cost efficiency of Lebanese commercial banks using DEA and stochastic frontier analysis (SFA) between 1992 and 2005. The findings indicate that the cost efficiency is slightly higher and increases over the period. Furthermore, there is a significant correlation between efficiency scores and internal and economic environment factors. Han et al. (2012) estimate the profit efficiency in Korean savings banks over the period from 2002–2008. Their findings show a drop in 2004 and 2005, and then the efficiency increases after 2005. The study also finds that small banks were more efficient than large and affiliated banks. In addition, the efficiency is reduced as banks' size increases, while the interest rates increase efficiency. Overall a 1% increase in the interest rate equals 20% more in profit efficiencies. Focusing on the global financial crisis, Moradi-Motlagh and Babacan (2015) found that global financial crisis in Australia badly affected the efficiency commercial banks. To save space, Table 1 summarises the efficiency determinants found in previous studies. According the literature, recent studies ignored the social activities that can be provided by banks. This limitation can be filled by including socially responsible banks and compare it with Islamic and conventional banking sector to find which type of banks perform better.

Table 1. Previous studies of the determinants of bank efficiency

Study	Banks	Independent Variables
Rosman et al. 2014. 12 Middle Eastern countries	Islamic	ROA (+), Size (-), Capital ratio (+), Credit Risk.
Noor & Ahmed, 2012. 25 Countries	Islamic	ROE, operating expenses/ total assets (+), Capital ratio (+), Size (+), Loan intensity (-), Market power, Bank's market share (+), GDP (+), Inflation (-), Stock market capitalisation, size, Asian Financial Crisis (+), Global Financial Crisis (-).
ElMoussawi & Obeid, 2011. GCC countries	Islamic	GDP (-), Inflation (+), Capital ratio (-), Size (-), Credit risk (-), ROA (+/-).
Mamatzakis *et al.* (2015) Japan (DEA) 2000-2012	Conventional	- OLS: Capital ratio (+), Net interest margin (+), Nikkei index (+), Industrial production (+), Herfindahl–Hirschman Index (-), Quantitative easing (+/-), Z-score (-), Bankrupt loans, Restructured loans. - FEM: Capital ratio, Net interest margin (+), Nikkei index (+), Industrial production (+), Herfindahl–Hirschman Index (-), Quantitative easing (-), Z-score, Bankrupt loans (+), Restructured loans (+).
Moradi-Motlagh and Babacan (2015) Australia (DEA) 2006-2012	Conventional	Global financial crisis (-).
Vu & Nahm, 2013. Vietnam	Conventional	Capital ratio (-), Size (+), Non-performing loans (-), Loan intensity, Non-interest expense to total assets, Costs to total assets (+), ROE (+), Ownership (+), International commitments (-), Reform process, Stock market capitalisation (+), 1GDP (+), Inflation (-), Difference between lending and deposits rates (+).
Gardener et al. 2012. 5 East Asian countries	Conventional	Size (-), Profit (+/-), Capital (+), Bank private credit (+), Regulation (+/-), Economic growth (+), Inflation, Ownership (+/-).
Garza Garcia, 2012. Mexico	Conventional	Degree of capitalisation (+/-), Net interest rate margin (-), ROA (+), Credit risk (-), Market share (+/-), Size, Loan intensity (+), GDP (+), Market capitalisation (+/-), Market concentration, Ownership (+), Inflation (-), Market interest rate volatility.
Han et al.-2012. Korea	Conventional	Size (-), Interest rate (+), Credit loan ratio (-), Branches, Liquidity ratio, Financial affiliate.
Fang et al. 2011. South Eastern Europe	Conventional	Ownership (-), Privatisation (+), Banking reform, Enterprise re-structuring, Time trend (-), Loan ratio (+), Capital ratio (-), Non-performing loan ratio (-), ROA (-).
Sufian, 2009. Malaysia	Conventional	Bank's market share (-), Loan intensity (-), Size (+), Bank's risk (+), Bank's management quality (+), Bank's diversification (-), Leverage intensity (-), ROA (+), GDP (-).
Sufian & Habibullah, 2009. Korea	Conventional	Capital ratio, Loan intensity (+), Market power (-), Size (+), Loan loss provisions to total loans (-), Non-interest expense to total assets (+), Non-interest income to total assets, ROA, Loans to deposits, GDP (-), 1Inflation (-), Assets concentration, Stock market capitalisation (+/-), 1Financial crisis (-).

Table 1 Continue

Study	Banks	Independent Variables
Hermes & Nhung, 2008. Latin America and Asia	Conventional	Liberalisation (+), Capital ratio (-), Density of demand (-), Growth rate of GDP (+), Inflation, Loans to deposits ratio, ROE (+).
Grigorian & Manole, 2006. 17 Countries	Conventional	GDP per capita (+), Inflation, Size of financial sector, Capital ratio (+), Market concentration (+), Age, Ownership (+), Capital adequacy (+), Enterprise re-structuring (+), Market capitalisation (-), Securities market (-), Maximum exposure to a single borrower, Limit on foreign exchange (+), Legal/Institutional quality.
Pasiouras, 2006. Greece	Conventional	Average capital ratio (+), Return on average equity (+), Loan intensity (+), Market power (+), Number of ATMs Number of branches (+).
Havrylchyk, 2004. Poland	Conventional	Size (+/-), Ownership (+/-), Overhead costs (+), Growth of loans Capitalisation (+), Loan intensity, Provisions to loans (-).
Girardone et al. 2004. Italy	Conventional	Size (-), Interest margin (-), Number of branches (+), Retail that equals (customer loans (+) customer deposits)/total assets (+), Ownership (-), Performance (+), Capital ratio (-), Area (-), Type of banks (+/-).
Casu & Molyneux, 2003. 5 European countries: France, Germany, Italy, Spain, and the UK	Conventional	Average capital ratio (-), Return on average equity (-).
Hasan & Marton, 2003. Hungary	Conventional	Current assets to total assets (+), Short-term loan to total assets, Financial investment to total assets (+/-), Loan intensity, Credit risk, Capital ratio (+), Cost inefficiency (+), Size (-), Age, Number of hours of bank service available, Asset owned by foreign banks, Acquisition (-), Foreign involvement (-), Dummy of year.
Saad & El Moussawi, 2003. Lebanon	Conventional	GDP (+), Inflation, Ratio of capital (+), Size (+), Credit risk (+), ROA (+).
Johnes *et al.* (2014) 18 Countries (DEA) 2004-2009	Islamic & Commercial	Assets (-), Loan loss to loans (+), Loan intensity (+), Net loans over assets (-), Herfindahl index (-), Market capitalisation (+), GDP growth (+), Inflation, GDP per capita.
Rozzani & Abdul Rahman, 2013. Malaysia	Islamic & Conventional	Size (+), Operation costs (-), Credit risk (-), Ownership.
Qureshi & Shaikh, 2012. Pakistan	Islamic & Conventional	Cost to income ratio, Non-interest expenses to asset ratio (-), Net interest margin ratio (-), Other operating income ratio, ROA, ROE (+).
Abul Alkheil et al. 2012. Malaysia, UK, Turkey and GCC	Islamic & Conventional	ROA (+), Salaries to total assets (-), Liquid asset ratio (+/-), Size (+), Loan intensity, Bank's market share (+), Effect of independency (+/-), Age (+), Financial leverage (-), GDP (+/-), Diversification effect (+), Geographical location (+), Bank's type (+/-).
Assaf et al. 2011. Saudi Arabia	Islamic & Conventional	Size, Liquidity (+), Net profit margin (+), Pay-out ratio, Ownership (-), Time trend (+).

(+): Significant positive relationship, (-): Significant negative relationship, (+/-): Both

3. METHODOLOGY AND DATA

The DEA approach is used to estimate the banks' efficiency. Three measures: Scale Efficiency, Technical Efficiency (CRS) and Technical Efficiency (VRS) are employed (Abu Alkhail et al. 2012). Sturm and Williams (2004) define the DEA as an indicator that represents non-parametric, linear programming approach, which excludes input and output prices. In addition, DEA can measure the same type of examined organisations (in this case, banks) – in other words, decision-making units (DMUs) allocated as banks in this study. This study employs an intermediation approach (input oriented) where deposits are treated as inputs (Garza García, 2012 and Gardener et al. 2011). The reason is that banks are regarded as financial intermediaries. Bhagavath (2008) provides a mathematical model for DEA, as represented by the following:

$$\text{Max h} = \frac{\sum r\, ur\, yr\, j0}{\sum i\, vi\, xij0}$$

subject to

$$\frac{\sum r\, ur\, yr\, j}{\sum i\, vi\, xij} \le 1,\ j = 1,\wedge,n \text{ (for all j)} \qquad (1)$$

Conversely, Delis (2009) used the following DEA fractional form in his study on Greek commercial banks:

$\theta^{*} = \min \theta$, subject to:

$$\sum_{j=1}^{n} \lambda j\ x_{ij} \le \theta x_{ij} \quad i = 1,2,\ldots..,m;$$

$$\sum_{j=1}^{n} \lambda j\ y_{rj} \le y_{r0} \quad r = 1,2,\ldots..,s;$$

$$\sum_{j=1}^{n} = 1 \qquad (2)$$

$$\lambda \ge 0 \qquad j = 1,2,.....,n;$$

where,
x, y - are inputs of DMU
r - is the output of DMU

In addition, four models are used to estimate the determinants of banks' efficiency: OLS model (Han et al., 2012), fixed effects model (Shamsuddin & Xiang, 2012), random effects regression (Zhang and Matthews, 2012), and Tobit regression (Gardener et al., 2011). Efficiency scores, as derived from DEA approach are used as dependent variable. Two types of determinants are used: bank-specific variables and macroeconomic variables. The bank-specific variables are size, capital ratio, loan intensity, credit

risk, ROA, age and ownership whereas, the macroeconomic variables are GDP, GDP per capita, inflation, market capitalisation and financial crisis. The following model is used:

$$Eff_{it} = \alpha + \beta_1 SIZE_{it} + \beta_2 EQTA_{it} + \beta_3 LOANSTA_{it} + \beta_4 CRISK_{it} + \beta_5 ROA_{it} + \beta_6 AGE_t + \beta_7 FORE_i + \beta_8 DOM_i + \beta_9 GOV_i + \beta_{10} GDP_t + \beta_{11} GDPPER_t + \beta_{12} INFLATION_t + \beta_{13} MCAP_t + \beta_{14} FCRISIS_t + \varepsilon_{it}$$
$$i=1....185;\ t=1....n \quad (3)$$

where,

- Eff_{it}, efficiency scores derived from DEA approach
- α is the constant
- SIZE is the natural logarithm of total assets of banks.
- EQTA is the capital ratio (leverage intensity), which is measured by equity over total assets
- LOANSTA is a measure of a bank's loan intensity, calculated as the ratio of total loans to a bank's total assets, and the ratio of loans to deposits is a proxy of credit risk
- CRISK is credit risk and calculated as loans divided by deposits and short term funding.
- ROA is the return on assets ratio that measured by net income over total assets
- AGE is the age of the banks of their time of establishment (a dummy variable is used for age, as 1 indicates new banks that operating for less than 10 years, 0 indicates old banks)
- Ownership served as a dummy variable, where employing foreign, domestic, and government banks were represented as FORE, DOM, and GOV in the model, respectively
- GDP is the gross domestic product of countries, which is measured as the natural logarithm of GDP
- GDPPER is GDP PPP (per capita), calculated as the natural logarithm of GDP PPP.
- INFLATION is the percentage of inflation that was announced from the various countries
- MCAP is the market capitalisation
- FCRISIS is the financial crisis that occurred in 2008 (dummy variables were utilised: 0 represented the period from 2005–2007 and 1 represented the period from 2008–2012)
- β denotes the regression coefficient
- ε_{it} is the error term.

The data was extracted from the balance sheets and income statements of 190 banks (26 Islamic, 136 conventional, and 28 SRB banks) covering 22 countries that were available in the BankScope database from 2005-2012. The majority of Islamic and conventional banks analysed in this are from the GCC area. In addition, there is one Islamic bank from the UK: Al Rayan Bank formerly, Islamic Bank of Britain (IBB), (Al Rayan Bank, 2014). However, SRB banks spread globally, so we gathered data from 16 different countries: Australia, Bangladesh, Bolivia, Canada, Denmark, France, Germany, Nepal, Netherlands, Mongolia, New Zealand, Norway, Spain, Switzerland, the UK and the USA. Two types of software have been used: Frontier Analyst programme was used to estimate the efficiency, whereas STATA 13 software was used to test the determinants of banks' efficiency.

4. EMPIRICAL RESULTS

4.1. Descriptive Statistics

Three inputs and outputs were used in this study. The inputs are the fixed assets, deposits and short term funding, and equity. The outputs are the net income, total securities, and total loans. Table 2 shows the descriptive statistics of the inputs and outputs of banks used in this study. From Table 2, conventional banks have a bigger average of fixed assets than Islamic and SRB banks do. Further, conventional banks have more deposits and short term funding, equity, securities and loans followed by socially responsible banks. However, SRBs achieve the highest average net income scoring US$610.87m compared to conventional and Islamic banks (US$487.50m and US$150.86m). Apart from the net income, conventional banks make higher averages of inputs and outputs.

4.2. DEA Measures

Table 3 shows that SRB banks make the highest score in the three efficiency measures (SE: 0.977, CRS: 0.970 and VRS: 0.992, respectively). In contrast, the Islamic banks score the least average in the three measures (SE: 0.954, CRS: 0.933 and VRS: 0.976, respectively). Overall, looking into all banks, we find that the highest average is the VRS measure scoring 0.983 followed by the SE then VRS achieving 0.964 and 0.950, respectively. In addition, Table 3 shows that standard deviation is quite low which means that the measures are relatively consistent. To sum up, conventional banks are more efficient than Islamic banks. This is consistent with Shahid et al., 2010; Qureshi and Shaikh, 2012; and Johnes et al., 2009. However, Rattab et al., 2010 and Mokhtar et al., 2007) conclude a contrast result as they claim that Islamic banks attain better efficiencies than conventional banks do. Table 3 also shows that there is a slight drop in SE and CRS in 2008. This could be due to the effect of financial crisis. In addition, the lowest efficiency score obtained by the VRS was in 2009 with an average of 0.972. Table 3 also reveals that 2012 is the most efficient year in terms of the SE (0.975) and VRS (0.994) while the highest efficiency score of the CRS (0.970) was in 2005. It is noted that the VRS approach always makes the highest score during the study period which means that the banks are able to efficiently use the inputs through technology to generate the outputs under variable-return-to-scale method with an average score of 0.976, 0.983 and 0.989 for Islamic, conventional and SRB banks, respectively. In addition, the efficiency (inefficiency) occurred when using the CRS scoring an average of 0.933 (6.7%), 0.941 (5.9%) and 0.980 (2%) for Islamic, conventional and SRB banks, respectively.

Table 2. Descriptive statistics of the inputs and outputs (Million US$)

Bank Type	Variables	Obs.	Mean	Std. Dev.	Min	Max
	Inputs					
Islamic	Fixed assets	183	106.81	175.10	0.10	1018.10
	Deposits & Short term funding	183	5092.37	8490.48	0.04	59620.70
	Equity	183	1178.60	1629.61	21.90	9725.00
	Outputs					
	Net income	183	150.86	387.40	-559.40	2102.60
	Securities	183	809.41	1467.96	2.70	10901.40
	Loans	183	4136.81	6860.39	0.50	45929.00
	Inputs					
Conventional	Fixed assets	1022	487.50	2126.20	0.03	28031.70
	Deposits & Short term funding	1022	47653.58	160644.90	0.70	1369820.00
	Equity	1022	4127.41	12620.44	5.30	100757.60
	Outputs					
	Net income	1022	246.29	1774.51	-19801.50	16662.90
	Securities	1022	38692.47	170803.30	0.10	1881055.00
	Loans	1022	37781.41	131333.10	0.30	1104887.00
	Inputs					
SRB banks	Fixed assets	206	27.01	41.55	0.10	172.40
	Deposits & Short term funding	206	7494.89	15503.92	31.20	89664.60
	Equity	206	1859.04	8601.64	0.10	60669.30
	Outputs					
	Net income	206	309.44	1724.98	9026.80	12994.60
	Securities	206	2546.75	7895.42	0.20	52381.10
	Loans	206	5763.70	13848.15	10.00	75948.40
	Input					
All banks	Fixed assets	1411	381.83	1847.75	0.03	28031.70
	Deposits and short-term funding	1411	37230.04	140135.90	0.04	1369820.00
	Equity	1411	3480.92	11411.47	0.10	100757.60
	Output					
	Net income	1411	209.37	1573.18	-19801.50	16662.90
	Total securities	1411	29343.25	148515.40	0.10	1881055.00
	Loans	1411	29540.54	114522.40	0.30	1104887.00

4.3. The Determinants of Banks' Efficiency

Tables 4-6 show the regression results of the determinants of efficiency measures in Islamic, conventional and SRB banks using OLS, fixed-effects, and random-effects models. Table 4 presents the results of the determinants of Islamic banks' efficiency. From the table, it is noted a positive association between efficiency measures and size, loan intensity, profitability, age, inflation, market capitalisation and financial crisis. We find that larger banks tended to show increases in the SE efficiency measure. This is consistent with the results obtained by Rozzani and Abdul Rahman (2013) and Saad and El Moussawi (2009). However this result is inconsistent the results of Johnes et al. (2014), Girardone et al. (2004) and Han et al. who claim that smaller banks are able to achieve more efficiency. The Loan intensity (LNOANTA) increases the SE and CRS measures. This means that loans can increase the bank efficiency through lowering costs and serving better quality loans. This result is consistent with the findings of Johnes et al. (2014), Garza Garcia (2012) and Sufian and Habibullah (2009). In contrast, Noor and Ahmed (2012) and Sufian (2009) investigated that loans decrease the efficiency. In addition, the ROA has a positive relationship with efficiency SE and CRS measures. This suggests that more efficient banks are able to achieve more profits in Islamic banks. As a result, customers prefer dealing with banks with higher profitability ratios. Therefore, banks with higher ROA can attract the significant borrowers and depositors. This is supported by Abul Alkheil et al. (2012) and Saad and El Moussawi (2003). On the other hand, Fang et al. (2011) results suggest that banks achieving lower ROA ratios found to be more efficient during the period of study. Further, the results suggest that the older banks are more efficient by using the Tobit model for the SE and CRS, also using the OLS model for the SE. Consequently, older banks have more experience in banking sector than smaller banks. This is supported by Grigorian and Manole (2006). Another factor that could explain the efficiency measures in Islamic banks is the inflation rate. We find that it positively impacts the SE efficiency when using the fixed-effects models. This can be explained as overtime, inflation leads to raise costs, which can be covered by banks' clients. As a result, high lending rates could be possible which tend to raise loans, profits and efficiency. ElMoussawi and Obeid (2011) find similar result. Vu and Nahm (2013) have a different relation of this study; the inflation impacts the efficiency negatively in their study. Additionally, the results from Table 4 suggest that the increase in market capitalisation leads to an increase in SE measure. This is consistent with Havrylchyk (2004). This conflicts with Grigorian and Manole (2006) study, which proposes a negative relationship between market capitalisation and efficiency. Finally the results show that SE and CRS measures of Islamic banks are positively affected by the financial crisis. This can be explained, as the Islamic banks were not severely affected by the crisis the same way as conventional banks (Inconsistent with Moradi-Motlagh & Babacan, 2015).

Table 3. Descriptive statistics of the efficiency measures in Islamic, conventional and SRB banks

Type	Islamic Banks			Conventional Banks			SRB Banks			All Banks		
DEA Measures	SE	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS
By year												
2005	0.954	0.950	0.994	0.985	0.97	0.985	0.955	0.989	0.995	0.965	0.97	0.991
2006	0.959	0.920	0.951	0.966	0.954	0.985	0.991	0.989	0.992	0.972	0.954	0.976
2007	0.961	0.930	0.962	0.954	0.947	0.992	0.99	0.987	0.988	0.968	0.955	0.981
2008	0.903	0.864	0.96	0.949	0.932	0.981	0.994	0.993	0.983	0.949	0.93	0.975
2009	0.938	0.902	0.956	0.950	0.930	0.978	0.997	0.986	0.981	0.962	0.939	0.972
2010	0.970	0.960	0.99	0.946	0.916	0.967	0.995	0.996	0.99	0.97	0.957	0.982
2011	0.955	0.955	1.000	0.954	0.937	0.979	0.996	0.948	0.988	0.968	0.947	0.989
2012	0.992	0.986	0.995	0.950	0.945	0.995	0.984	0.954	0.993	0.975	0.962	0.994
Descriptive												
Mean	0.954	0.933	0.976	0.957	0.941	0.983	0.988	0.980	0.989	0.966	0.952	0.983
Std. Dev.	0.1014	0.1364	0.0834	0.0999	0.1215	0.0639	0.1005	0.1002	0.0426	1.1005	0.1211	0.0643
Min	0.493	0.24	0.247	0.043	0.043	0.332	0.093	0.093	0.709	0.043	0.043	0.247
Max	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 4. The determinants of efficiency in Islamic banks

Efficiency measure	SE				CRS				VRS			
Variables	OLS	Fixed	Random	Tobit	OLS	Fixed	Random	Tobit	OLS	Fixed	Random	Tobit
Bank specific												
SIZE	0.0123	0.0517*	0.0138	0.0144	0.00687	0.0307	0.00798	0.00757	-0.00704	-0.0265	-0.00905	-0.0593
EQTA	0.0140	0.0835	0.0432	0.0368	-0.00212	0.110	0.0406	0.0250	-0.0265	0.0292	-0.0143	-0.201
LOANSTA	0.0527	0.192**	0.0927*	0.121	0.0772	0.234*	0.131*	0.169	0.0299	0.0523	0.0358	0.139
CRISK	0.00015	0.00014	0.00015	0.00181	0.00021	0.000085	0.00014	0.00637	0.00007	-0.00006	-0.00001	0.0120
ROA	0.383***	0.456***	0.414***	0.727**	0.392**	0.468**	0.432***	0.799*	0.0215	0.0249	0.0266	0.410
AGE	0.0424*		0.0428	0.118*	0.0406		0.0417	0.138*	-0.00300		-0.00388	0.0517
FORE	-0.0221	-0.0493	-0.0220	-0.0714	-0.0470	-0.0963	-0.0563	-0.130	-0.0267	-0.0582	-0.0411	-0.237
DOM	-0.0132	-0.0475	-0.0171	-0.0085	-0.0190	-0.0703	-0.0296	-0.0120	-0.00519	-0.0228	-0.0114	-0.0518
Macroeconomic												
GDP	-0.00183	-0.0130	-0.0015	-0.0055	-0.00214	0.00184	-0.000517	-0.00889	-0.0007	0.0187	0.00130	-0.0124
GDPPER	0.0004	-0.0094	-0.0016	-0.0021	-0.000614	-0.00855	-0.00359	-0.00528	-0.0009	0.00156	-0.00141	-0.00201
INFLATION	0.107	0.181*	0.128	0.218	0.153	0.228*	0.185	0.303	0.0571	0.0594	0.0680	1.218
MCAP	0.0435*	0.0767**	0.0520*	0.0833	0.0318	0.0763	0.0502	0.0688	-0.0167	-0.00645	-0.00738	-0.105
FCRISIS	0.0385*	0.0437*	0.0447**	0.0869*	0.0550*	0.0623*	0.0631**	0.118*	0.0194	0.0213	0.0205	0.101
CONSTANT	0.800***	0.809	0.763***	0.923*	0.844***	0.551	0.772*	1.107	1.068***	0.676	1.029***	2.162*
sigma				0.200***				0.281***				0.294***
_cons				(9.47)				(9.50)				(6.23)
R^2	0.2240	0.2393	0.3185	0.2528	0.1635	0.1766	0.2521	0.1655	0.0702	0.0632	0.1069	0.1771
N	183	183	183	183	183	183	183	183	183	183	183	183

*Notes: SIZE bank size, EQTA: capital ratio, LOANSTA: loan intensity, CRISK: credit risk, ROA: the return on assets ratio, AGE is the age dummy, GOV: dummies for government banks, FORE: foreign, DOM: domestic banks, GDP: the gross domestic product, GDPPER is GDP PPP (per capita), INFLATION: inflation rate, MCAP: the market capitalisation, FCRISIS: dummy for financial crisis. * p < 0.05, ** p < 0.01, *** p < 0.001; t statistics in parentheses. Notes: SE, Scale Efficiency; TE (CRS), Technical Efficiency (Constant returns on scale); TE (VRS), Technical Efficiency (Variable returns on scale).*

Table 5. The determinants of efficiency in conventional banks

	SE				CRS				VRS			
Variables	OLS	Fixed	Random	Tobit	OLS	Fixed	Random	Tobit	OLS	Fixed	Random	Tobit
Bank specific												
SIZE	0.00140	0.0446***	0.00212	0.00325	-0.00231	0.0324**	-0.00158	-0.00502	-0.00409***	-0.0133*	-0.00412***	-0.0165**
EQTA	-0.0568**	-0.0393	-0.0597**	-0.137	-0.0767**	-0.0566	-0.0769**	-0.206**	-0.0234	-0.0223	-0.0214	-0.109
LOANSTA	0.0103	0.0349	0.0121	0.0331	0.0149	0.0357	0.0177	0.0498	0.00582	0.00307	0.00679	0.0139
CRISK	0.00013	0.00019	0.00017	0.0014	0.00014	0.0002	0.0002	0.0006	0.000013	0.00003	0.00002	-0.00001
ROA	0.206*	0.118	0.217*	0.659*	0.299*	0.186	0.294*	0.971**	0.106	0.0832	0.0919	0.852*
AGE	-0.0216*		-0.0195	-0.0296	-0.0263*		-0.0250	-0.0414	-0.00672		-0.00736	-0.0391
FORE	-0.0104		-0.00592	-0.0298	-0.0141		-0.00783	-0.0400	-0.00392		-0.00258	-0.0138
DOM	-0.0093	-0.0099	-0.0077	-0.0256	-0.0196	-0.00699	-0.0142	-0.0491	-0.0126	0.0018	-0.00961	-0.0584
GOV		-0.00696				-0.0169				-0.0117		
Macroeconomic												
GDP	-0.0075**	-0.0432	-0.0076*	-0.0238**	-0.0109***	-0.0366	-0.0113**	-0.0295**	-0.00385*	0.00452	-0.00405*	-0.0310**
GDPPER	0.00388	0.00906	0.00519	0.0290	0.0126	0.0416	0.0171	0.0478	0.00974	0.0362	0.0118	0.0562
INFLATION	-0.0334	-0.00900	-0.0301	-0.183	-0.0680	-0.0436	-0.0635	-0.229	-0.0348	-0.0345	-0.0335	-0.302
MCAP	0.00402	0.00936	0.00447	0.0353	0.00855	0.0207	0.00999	0.0517*	0.00494*	0.0104	0.00556*	0.0914*
FCRISIS	-0.00273	-0.00903	-0.00325	-0.0142	-0.00568	-0.00960	-0.00610	-0.0238	-0.00287	-0.000303	-0.00286	-0.0201
CONSTANT	1.127***	1.645**	1.105***	1.481***	1.148***	1.208	1.098***	1.525***	1.026***	0.589	1.006***	1.662***
sigma				0.249***				0.296***				0.259***
_cons				(20.37)				(20.87)				(13.63)
R^2	0.0419	0.0590	0.1017	0.0462	0.0442	0.0284	0.1135	0.0450	0.0365	0.0166	0.1286	0.0627
N	1014	1014	1014	1014	1014	1014	1014	1014	1014	1014	1014	1014

*Notes: SIZE bank size, EQTA: capital ratio, LOANSTA: loan intensity, CRISK: credit risk, ROA: the return on assets ratio, AGE is the age dummy, GOV: dummies for government banks, FORE: foreign, DOM: domestic banks, GDP: the gross domestic product, GDPPER is GDP PPP (per capita), INFLATION: inflation rate, MCAP: the market capitalisation, FCRISIS: dummy for financial crisis. * p < 0.05, ** p < 0.01, *** p < 0.001; t statistics in parentheses. Notes: SE, Scale Efficiency; TE (CRS), Technical Efficiency (Constant returns on scale); TE (VRS), Technical Efficiency (Variable returns on scale).*

Table 5 shows the results of the determinants of conventional banks' efficiency. The table shows that bank size has two implications; first, larger banks are more efficient than smaller banks using SE and CRS measures. Second, smaller banks are more efficient than the larger banks during the study period in terms of the VRS measure. Havrylchyk (2004) finds negative and positive relationships between size and efficiency. In particular, banks' size negatively affects cost and allocative efficiencies whereas size positively impacts technical efficiency. The capital ratio has a significant and negative impact on efficiency for the SE and CRS measures in conventional banks. Mamatzakis et al. (2015) and Fang et al. (2011) and Girardone et al. (2004) have the same conclusion. On the other hand, Rosman et al. (2014) and Pasiouras (2006) find the opposite relationship. There is a positive significance of profitability on the efficiency of Islamic, conventional and SRB banks. Profitability (measured by the ROA) positively influences the SE, CRS and CRS measures, which is consistent with Rosman et al. (2014). Furthermore, OLS reveals that age of banks negatively impacts on the SE and CRS measures. In details, new banks found to be more efficient than older during the study period. This contrasts with Abul Alkheil et al. (2012) findings. In addition, Table 5 reveals that two macroeconomic variables found to be affecting efficiency: GDP and MCAP. The findings indicate that growth in GDP leads to decrease the SE, CRS and VRS measures. Sufian (2009) also argues that GDP negatively affects efficiency (similar to Johnes et al., 2014) however, Hermes and Nhung (2008) find a positive relationship. Furthermore, the results in Table 5 show that when market capitalisation increases the conventional banks become more efficient in terms of the CRS and VRS measures (in line with Johnes et al., 2014). Finally, conventional banks were stable during the period against the inflation and financial crisis.

Table 6 shows the results of the determinants of SRB banks' efficiency. The results in Table 6 show that larger sized banks are more efficient than smaller banks in terms of the VRS measure in the fixed effects model. This result is supported by Sufian and Habibullah (2009). The table also shows that the loan intensity increases the SE, CRS, and VRS scores. However, the ROA is positively and significantly correlated with the VRS when employing the OLS and random-effects models. Table 6 also shows that foreign and domestic banks achieve a higher VRS score. Garza Garcia (2012) and Grigorian and Manole (2006) conclude that ownership positively influences the efficiency. However, Assaf et al. (2011) argue that ownership negatively impacts on the efficiency. The GDP per capita positively affects only the SE of SRB banks. The GDP per capita measures the wealth of individuals in countries. Grigorian and Manole (2006) is the only study that considers the GDP per capita as one of the efficiency determinants. This study supports the significant positive correlation between GDP per capita and efficiency. Furthermore, the inflation is negatively significantly affects efficiency, as increases in inflation lead to reductions in the SE and VRS using the fixed effects model. Moreover, the scale efficiency in SRB banks is significantly positively affected by the financial crisis. Though Sufian and Habibullah (2009) find a negative effect on their sample, our sample of SRB banks vary in their response to the financial crisis, which means that SRB banks, were stable and resisted during the crisis period.

5. CONCLUSION

This study analysed efficiency and its determinants of 190 Islamic, conventional, and SRB banks in 22 countries during the period 2005-2012 using the DEA approach. Three measures of efficiency are used: scale efficiency (SE) and technical efficiency CRS and VRS. The main findings indicated that the average efficiency measures for all banks are relatively high scoring 0.966, 0.952, and 0.983 for the SE, CRS, and VRS measures, respectively. However, the efficiency measures show that the most efficient banks are the SRB banks whereas the less efficient banks are the Islamic banks. In addition, the VRS scores are the highest for all banks over the period followed by the CRS method. Furthermore, SE and CRS scores were collapsed in 2008 and VRS was dropped in 2009. From the regression results, we find that size, loan intensity, ROA, inflation rates, market capitalisation and financial crisis are the main determinants of Islamic banks' efficiency. Further, there is a positive and significant relationship between the SE and CRS efficiency of conventional banks and the size, ROA, and market capitalisation. On the other hand, there is a negative and significant correlation between the VRS efficiency measure and banks' size, capital ratio, age and GDP. In addition, the main determinants that increase efficiency in SRB banks are size, capital ratio, loan intensity, ROA, foreign ownership, domestic ownership, inflation and financial crisis. Moreover, financial crisis affects the SE and CRS efficiency measures in Islamic banks. However, SE efficiency measure is positively affected by financial crisis in the SRB banks, which means that SRB banks were stabled and resisted against the crisis. Finally, there is no significant correlation between financial crisis and efficiency indictors in conventional banks during the period.

Table 6. The determinants of efficiency in SRBs banks

	SE				CRS				VRS			
Variables	**OLS**	**Fixed**	**Random**	**Tobit**	**OLS**	**Fixed**	**Random**	**Tobit**	**OLS**	**Fixed**	**Random**	**Tobit**
Bank specific												
SIZE	0.000247	0.0149	0.000558	0.00367	0.000539	0.0121	0.000409	0.0245	0.000184	0.0290*	0.000771	0.0166
EQTA	0.031	0.262*	0.0572	0.147	0.0267	0.25	0.041	0.15	0.0437	0.284*	0.000111	3.04
LOANSTA	0.0338*	0.0620*	0.0376*	0.123	0.0652*	0.0345	0.0596	0.36	0.00114	0.0640*	0.0168	0.0618
CRISK	0.0375	-0.0423	0.0390	0.229	0.0436	-0.0346	0.0453	0.225	0.00608	0.00880	0.00608	0.0525
ROA	0.0115	0.0892	0.0179	0.107	0.00401	0.0327	0.00062	0.67	0.106*	0.0439	0.105*	0.518
AGE	0.000367		0.000462	0.0664	0.034		0.0346	1.484	0.00398		0.00402	0.107
FORE	0.00381		0.00383	0.0227	0.00434		0.00423	7.749	0.0685***		0.0693**	1.068
DOM	0.00681		0.00878	0.00264	0.00158		0.00339	7.632	0.0410**		0.0394	1.067
Macroeconomic												
GDP	0.000745	0.0527	0.00153	0.0427	0.00466	0.0681	0.00403	0.0104	0.00592	0.0276	0.00827	0.0673
GDPPER	0.00971	0.0696	0.0116	0.214*	0.00612	0.13	0.00831	0.067	0.0168	0.0673	0.0115	0.149
INFLATION	0.00234	0.247*	0.000966	0.279	0.0224	0.134	0.0226	1.137	0.00397	0.316**	0.00234	0.137
MCAP	0.00144	0.00146	0.00114	0.0312	0.00036	0.00021	0.00062	0.019	0.0009	0.00156	0.0000967	0.0123
FCRISIS	0.00993	0.0185*	0.0106	0.0406	-0.0196	-0.00726	-0.0191	-0.09	-0.000771	0.0122	-0.000165	0.0139
CONSTANT	1.066***	0.182	1.070***	4.655*	0.894	0.886	0.946	6.444	1.046***	1.56	0.921**	1.21
Sigma				0.119***				0.271**				0.156**
_cons				(7.10)				(8.50)				(623)
R^2	0.0780	0.1195	0.3696	0.1583	0.0908	0.1768	0.4342	0.1453	0.0887	0.0975	0.6188	0.3271
N	184	184	184	184	184	184	184	184	184	184	184	184

*Notes: SIZE bank size, EQTA: capital ratio, LOANSTA: loan intensity, CRISK: credit risk, ROA: the return on assets ratio, AGE is the age dummy, GOV: dummies for government banks, FORE: foreign, DOM: domestic banks, GDP: the gross domestic product, GDPPER is GDP PPP (per capita), INFLATION: inflation rate, MCAP: the market capitalisation, FCRISIS: dummy for financial crisis. * p < 0.05, ** p < 0.01, *** p < 0.001; t statistics in parentheses. Notes: SE, Scale Efficiency; TE (CRS), Technical Efficiency (Constant returns on scale); TE (VRS), Technical Efficiency (Variable returns on scale)*

This study has important implications. One of the important implications of this study is that efficiency measures facilitate the publication of 'league tables' or rankings of the entire banking industry. Some authors believe that such rankings catch public interests in the performance of banks, promote accountability and stimulate a search for improvement (Hibbard et al. 2003). Finally, it is hoped that managers have the possibility to analyze best practices of the counterparts and that they are able to improve their future efficiency by adapting these practices for their inefficient banks. In addition, measuring efficiency in banking point the right amount of inputs to be reduced to reach the maximum profits, which supports the policy makers in banks. On the other hands, the banks' customers have the right to know which bank is having more efficiency to deal with by offering the best quality of service. This could lead to improve the banks' profits by attracting more customers. One of the main limitations of the study is the data availability, which was the reason to drop many banks from the final sample especially in Islamic and SRB banks. Further, the selected variables in the present study might not be exhaustive, and the dataset is short. Staat (2001) claims that DEA efficiency measures are affected by sample size. Additionally, it may not always be possible for a bank to ever become efficient because several of the inputs may not be under the full control of management. Therefore, it must be clear that some DEA targets might be impossible to be achieved in practice. DEA results are obtained from the application of a mathematical algorithm, without considering specific conditions and restrictions of a bank. It is in the hands of managers to skillfully use these results as a support for decision-making. However, the study can be expanded to analyse the differences among developing, emerging and developed countries. The future research can examine specific areas such as MENA, GCC, and BRICS etc. Therefore, future studies can use larger sample size and panel data with different sets of inputs and outputs to test the robustness of the results. Further investigation can be done using longer periods and other efficiency indicators such as Stochastic Frontier Analysis, which is related to the parametric approach to supplement DEA approach. Moreover, the research can be extended to investigate the effect recent crisis or revolutions such as the 2010 Arab Spring on bank efficiencies.

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