A comparison of performance of Islamic and conventional banks 2004 to 2009

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Abstract

We compare, using data envelopment analysis (DEA), the performance of Islamic and conventional banks prior to, during and immediately after the recent financial crisis (2004-2009). There is no significant difference in mean efficiency between conventional and Islamic banks when efficiency is measured relative to a common frontier. A meta-frontier analysis, new to the banking context, however, reveals some fundamental differences between the two bank categories. In particular, the efficiency frontier for Islamic banks typically lies inside the frontier for conventional banks, suggesting that the Islamic banking system is less efficient than the conventional one. Managers of Islamic banks, however, make up for this as mean efficiency in Islamic banks is higher than in conventional banks when efficiency is measured relative to their own bank type frontier. A second-stage analysis demonstrates that the differences between the two banking systems remain even after banking environment and bank-level characteristics have been taken into account. Our findings have policy implications. In particular, Islamic banks should explore the benefits of moving to a more standardized system of banking. Conventional banks should investigate why their managers are apparently underperforming relative to those in Islamic banks by examining, for example, the ongoing bonus culture.

Keywords: Banking sector; Islamic banking; Efficiency; Data Envelopment Analysis; Meta-frontier analysis

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1. Introduction

The recent financial crisis led to difficulties in many conventional[3] banks across the globe. Islamic banks, in contrast, were largely insulated from the crisis (Willison 2009; Yılmaz 2009). It appeared that their highly regulated operational environment guided by Shariah principles prohibited investment in the type of instruments which adversely affected conventional banks and which prompted the crisis (Hasan and Dridi 2010).

The success of Islamic banks relative to conventional banks in the macroeconomic environment is in contrast to expectations of their performance (by which we mean technical efficiency) in a microeconomic context. Islamic banks might be expected to have lower technical efficiency than conventional banks for a number of reasons. First, the strict application of Shariah rules means that many of the Islamic banking products are unstandardised thereby increasing operational costs. Second, Islamic banks are typically small compared to conventional banks, and there is evidence that technical efficiency increases with size in the banking industry (see, for example, Miller and Noulas 1996; Abdul-Majid *et al.* 2005a; Chen *et al.* 2005; Drake *et al.* 2006). Third, Islamic banks are typically domestically owned and there is evidence to support the contention that foreign-owned banks are more technically efficient than their domestically-owned counterparts (see, for example, Sturm and Williams 2004; Matthews and Ismail 2006).

The evidence regarding the performance of Islamic banks relative to conventional banks is limited and inconclusive. We therefore fill a gap in the literature by investigating two questions to which previous studies have failed to provide adequate answers. First, which banking system (Islamic or conventional) is the more (technically) efficient? Second, what are the underlying reasons for any differences in efficiency between the two banking systems?

The first modern commercial Islamic bank was founded in 1975 (the Dubai Islamic Bank) at which point only the most fundamental contracts were available (safekeeping accounts, sale and profit-and-loss sharing contracts). Islamic bonds were launched in 1978 followed by Islamic equity funds and Islamic insurance during the 1990s. More recently we have seen the introduction of Islamic

[3] We use the term conventional to refer to commercial banks not involved in Islamic banking products.

indexes such as the Dow Jones Islamic Markets and the Financial Times Stock Exchange Shariah. The first Islamic products were largely developed to cater for government and corporate requirements. But the growth in the size and wealth of the Muslim population alongside an increasing desire of Muslims to have available financial instruments which are Shariah-compliant have created a challenge to provide consumers with products with a similar or higher rate of return to those on offer in the conventional sector, yet which still conform to Islamic principles. This has led to banking innovations at the consumer level including Islamic bank accounts, Islamic credit cards and Islamic mortgages.

Pressure on Islamic banks to continue to innovate is provided by the increasing appeal of the traditional values of Islamic finance to Western investors who are disillusioned with the banking practices of conventional banks in the wake of the global financial crisis (Arthur D Little Report 2009). Appetite for Islamic investment products grows stronger as Islamic banks are found to be less likely to fail than conventional ones (Čihák and Hesse 2010). As a consequence, Islamic banks are no longer only a feature of traditional Muslim regions: there are more than 300 Islamic financial institutions spread across 70 countries. Indeed, there are now 5 Islamic banks in the UK (the only EU country to date to have Islamic banks), and 19 Islamic financial institutions in the USA. Thus a direct and in-depth comparison of Islamic and conventional banking will clearly be of widespread interest.

We focus our empirical study on countries with a substantial (at least 60%) Muslim population and where there are both Islamic and conventional banks in operation. There is strong competition *within* each of these sectors (Ariss 2010), and there is likely also to be a growing degree of competition *between* them, as Islamic banking products increasingly appeal to consumers other than Muslims, and large ratings agencies such as Moody's have begun to get involved in Islamic finance (Alexakis and Tsikouras 2009). As a consequence, in a first stage analysis, we compute and directly compare the efficiencies 45 Islamic banks with 207 conventional banks across 18 countries over the period 2004 to 2009. Furthermore, we adopt a meta-frontier approach which decomposes efficiency into two components: one due to the *modus operandi* and one due to managerial competence at converting inputs into outputs. This allows us to reveal previously unseen aspects of efficiency in

Islamic compared to conventional banking. In a second stage we investigate the determinants of the different components of efficiency (rather than just the overall efficiency) and are thereby able to uncover and discuss more effective ways in which managers and policy-makers can improve efficiency.

The paper is in six sections of which this is the first. Section 2 discusses the methodological approaches to efficiency measurement while a brief literature review is presented in section 3. Sample data and the empirical model are described in section 4 and results are presented and interpreted in section 5. Conclusions and policy implications are discussed in section 6.

2. Methodology

Studying banking efficiency can be done in two ways: by use of traditional financial ratio analysis (FRA); or by the distance function approach whereby a firm's observed production point is compared to a production frontier which denotes best practice. This approach leads to frontier estimation methods such as data envelopment analysis (DEA) and stochastic frontier analysis (SFA).

The pros and cons of FRA as a method of efficiency measurement are well known (Ho and Zhu 2004; Hasan 2005). In the context of Islamic banking, the most severe drawback is the assumption underlying financial ratios of cost minimisation or profit maximisation; these are unlikely to be the most pressing objectives in the context of Islamic banking (Abdul-Majid *et al.* 2010). For this reason we eschew FRA (and, indeed, any methodology with an underlying assumption of cost minimization or profit maximization) as a means of analysis in this paper. Instead we adopt a distance function approach, which does not assume any specific optimizing objective on the part of the firms, and has an added bonus that it easily allows for both multiple inputs and multiple outputs.

It is worth reflecting at this point upon our intention to perform a direct comparison of Islamic and conventional banks[4]. Given the growth of Islamic banking and its increasing appeal across the spectrum of consumers, it makes sense to compare the two types of banks directly in order to identify the best aspects of each. Critics might argue that the objectives of the two banking systems

[4] This is not an entirely original approach and there are examples in previous literature (see section 3 for details).

differ to such an extent that such a comparison is invalid: for example, conventional banks can be seen to be motivated by profit, while Islamic banks may have social objectives such as promoting Islamic values amongst their staff and clients, and social welfare in the community (Dusuki 2008). We believe that this criticism can be rejected using one or other of two possible arguments. In the first case, we question the extent to which Islamic and conventional banks differ: a recent paper concludes that Islamic banking and finance '... simply replaces conventional banking terminology with terms from Classical Arabic and offers near-identical services to its clients but at a higher cost.' (Khan 2010 p818). If this is truly the case then directly comparing Islamic and conventional banks is clearly legitimate.

In the second case, we allow for the eventuality that the objectives of the two types of banks are indeed different. In this case, we believe that it is still possible to make a direct comparison so long as the estimation method appropriately allows for differences between (and within) the banking systems. We have a choice of estimation methods, namely the parametric stochastic frontier analysis (SFA) or the non-parametric data envelopment analysis (DEA) (Majumdar 1995; Coelli *et al.* 2005). While the general advantages and disadvantages of each of these are well-known one aspect must be emphasized: both approaches make the assumption that production units are comparable, but DEA, by estimating a frontier which envelops the observed production points with piecewise linear segments, allows each firm (banks in our case) to have its own objectives as it will only be compared with banks of similar input and output mix. For example, a small Islamic bank, financing its loans using a balanced mix of equity and deposits, would not in DEA be compared with a large conventional bank with a different input-output mix financing its loans predominantly using deposits. In the same way, an Islamic bank mainly involved in sale and mark-up transactions will not be compared with one which undertakes joint venture finance a they will have different mixes of outputs. SFA, on the other hand, applies the same parameters[5] to all observations in the sample; it does not allow for differences between units and so allows inappropriate comparisons between very

[5] A random parameter variant of SFA would also allow firms to differ in their objectives. But this method requires large numbers of degrees of freedom and can be difficult to fit in practice.

different banks. By choosing DEA rather than SFA as our estimation method, we therefore overcome any criticism of pooling the different banks as DEA only compares like with like.

It would be particularly useful if our method of assessing efficiency could also answer the question: do the rules under which Islamic banks must do business affect the efficiency with which they can operate? Clearly, policies to improve bank efficiency will depend on whether the source of inefficiency is the banking system or managerial incompetence. Thus we introduce to the financial literature a meta-frontier methodology (similar to one introduced by Charnes *et al.* 1981) for decomposing the efficiency of banks into two components: one which is due to the *modus operandi* i.e. the context in (or rules under) which the bank operates (namely conventional or Islamic); and one which is due to managerial competence at converting inputs into outputs *within the context in which the bank operates*.

This decomposition can be illustrated by means of a simple example whereby we assume that each bank produces one output (for example loans) from one input (for example deposits). The hypothetical production points for a number of banks are plotted in figure 1. The boundary ABCDE envelops all banks in the sample, and banks lying on the frontier are efficient relative to others. Bank Y lies inside the frontier and has an efficiency score of $0y/0y''$.

[Figure 1 here]

In order to assess the sources of inefficiency of bank Y, we need to consider each bank's efficiency relative only to the banks of the same bank type. Let us assume that banks can be categorised into two types: type 1 and type 2. The original boundary ABCDE is the *gross efficiency boundary*. ABCDE, in this example, is also the boundary for type 1 banks, and FGHIJ is the boundary for type 2 banks. We call these the *net efficiency boundaries*. Bank Y, a type 2 bank, has a net efficiency score of $0y/0y'$ which represents the proportion of output obtained by bank Y relative to the best possible output achievable by type 2 banks only and given bank Y's input level. The distance between the net and gross boundaries measures the impact on output of bank type. The type efficiency score of bank Y is therefore $0y'/0y''$ and indicates the impact on bank Y of operating under a type 2 system.

The computation of the gross, net and type efficiencies is simply a first stage. Any differences between Islamic and conventional banks in these measures of efficiency might be a consequence of some other underlying character(s) of each group of banks and not purely operation within the given system. Thus we intend to perform a second stage analysis which will ascertain the determinants of each efficiency component (and which will include as one of the explanatory variables an indicator of bank type). Such an analysis will not only assess the extent of the effect on efficiency of banking system (having taken into account other characteristics), it will also provide further information to policy-makers and bank managers about factors which affect the efficiency with which banks operate.

The performance of a second stage analysis of DEA efficiencies is often undertaken using a Tobit regression model (examples in the banking context include: Jackson and Fethi 2000; Casu and Molyneux 2003; Drake *et al.* 2006; Ariff and Can 2008; Sufian 2009). The choice of a Tobit model is based on the premise that the dependent variable comprising DEA efficiency scores is a censored variable. In fact, recent literature argues that efficiency scores are not censored but are fractional data (McDonald 2009), thus making Tobit analysis inappropriate. Evidence from a comparison of various possible second stage approaches (Hoff 2007; McDonald 2009) suggests that ordinary least squares regression analysis (with White heteroscedastic-consistent standard errors) is the most appropriate second stage approach in terms of producing consistent estimators and valid (large sample) hypothesis tests which are robust to heteroscedasticity and the distribution of disturbances. Owing to the panel nature of the data here, we choose to use a (bank) random effects estimation approach with heteroscedasticity corrected standard errors in our second stage analysis.

3. Literature review

There is an abundant literature on the efficiency of banking institutions: detailed (albeit somewhat outdated) reviews can be found elsewhere (Berger and Humphrey 1997; Berger and Mester 1997; Brown and Skully 2002). A small subset of this literature focuses on Islamic banking either in isolation or in comparison to conventional banking (see table 1 for details of studies which use

frontier estimation methods to derive measures of efficiency). The remainder of this section will focus predominantly on the comparative literature.

[Table 1 here]

We have previously hypothesized that Islamic banks will typically have lower efficiency than conventional banks. The evidence from previous empirical studies of Islamic and conventional banking is mixed: some find no significant difference in efficiency between the two types of banking (Abdul-Majid *et al.* 2005b; El-Gamal and Inanoglu 2005; Mokhtar *et al.* 2006; Bader 2008; Hassan *et al.* 2009; Shahid *et al.* 2010); some studies (in some cases because the sample size is small) do not test whether observed differences in efficiency are significant (Hussein 2004; Al-Jarrah and Molyneux 2005; Said 2012); one study claims that Islamic banks are significantly more efficient than conventional banks, but results of significance tests are not shown and, in any case, the result is based on a sample which only contains 7 Islamic banks (Al-Muharrami 2008). Only a small number of studies find, as expected *a priori*, that Islamic banks are significantly less efficient than conventional banks, but the possible reasons for the difference are not explored further (Mokhtar *et al.* 2007; 2008; Srairi 2010).

One group of studies deserves particular mention because they make a distinction between 'gross' and 'net' efficiency (Abdul-Majid *et al.* 2008; Johnes *et al.* 2009; Abdul-Majid *et al.* 2010; 2011a; 2011b). Gross efficiency incorporates both managerial competence and efficiency arising from *modus operandi*; net efficiency isolates the managerial component and therefore provides a measure of managerial efficiency. In one study based on banks in Malaysia, gross efficiency scores are derived from a SFA estimation of a cost function which makes no allowance for various characteristics of each bank (including whether or not it is Islamic), while net efficiency scores are estimated by taking into account the operating characteristics of banks in the SFA cost function (Abdul-Majid *et al.* 2008; 2011a; 2011b). Gross efficiency is found to be highest for conventional banks and lowest for Islamic banks, and the significance of the Islamic dummy in the cost equation including the environmental variables suggests that this difference is significant. There are, however, only slight differences in net efficiency between the different types of banks. The findings

from this study are questionable for two reasons. First they are derived from an estimated cost function for a sample of Islamic and conventional banks, and this implicitly assumes an objective of cost minimization on the part of all the banks in the data set. Second, the estimation technique (SFA) applies the same parameter to all observations and hence does not allow for differences in objectives between banks in the sample.

A later study by the same authors corrects the first problem by estimating an output distance function; the shortcomings of the estimation technique, however, remain (Abdul-Majid *et al.* 2010). This study, based on a sample of banks across 10 different countries, finds that the Islamic dummy is not a significant determinant of net efficiency; hence any inferior performance of Islamic banks is mainly due to the constraints under which they operate rather than the shortcomings of their managers.

Johnes *et al* (2009) take a different approach by examining gross and net efficiency using an output distance function estimated using DEA. They define gross efficiency as the efficiency score derived from pooling both types of banks, while net efficiency is derived by comparing banks only to others of the same type. They find (like Abdul-Majid *et al.* 2008; 2011a; 2011b) that the lower performance of Islamic banks in Gulf Cooperation Council (GCC) is due to *modus operandi* rather than managerial incompetence.

These studies are interesting and offer a way forward in terms of isolating the underlying causes of the differing performance of Islamic and conventional banks. There is a need, however, for a comparison of efficiency between conventional and Islamic banks based on a large sample of banks using an approach which makes no underlying assumptions regarding the banks' objectives, and which allows for inter-bank differences in outlook. Furthermore, we need to extend the study to investigate the factors underlying the gross and net efficiency scores. Thus, it is not enough to know whether it is *modus operandi* or managerial inadequacies which underpin a bank's performance; bank managers need to know how and to what extent their behaviour can affect their efficiency. A detailed second stage analysis of both gross and net efficiency scores will provide this information.

4. Sample data and models

The empirical analysis presented in this study focuses on countries where at least 60% of the population is Muslim and where there are both Islamic and conventional banks operating. We include in the sample banks for which a complete set of data for the DEA can be compiled using the data source Bankscope, for the period 2004 to 2009[6]. This is an interesting time period over which to undertake this study as it also allows us to gain insights into the effects of the macroeconomic turmoil and instability experienced later in this period on the efficiency of the banking sector (see Rokhim and Rokhim 2011 for another study of Islamic and conventional banks over the same period).

Banks are designated Islamic or conventional on the basis of the Bankscope definition, and conventional banks which operate Islamic windows are not included in our sample. Figures for 252 banks (207 conventional and 45 Islamic) across 18 countries (see table 2) are extracted from the consolidated data in US dollars (USD) having been converted from own currencies by end of accounting year exchange rates. In addition, all variables are deflated to 2005 prices using appropriate deflators[7]. Both banking sectors (conventional and Islamic) in the sample countries are required to follow national and international regulatory requirements under the supervision of the banking authorities of their host country, and both bank types adhere to the same accounting standards (Alexakis and Tsikouras 2009). Thus data should be consistent across the two bank types, but any discrepancy in practice (for example, Islamic banks must also conform to the requirements of the Shariah supervisory board) is allowed for in the first stage by the use of DEA. The number and type of banks included in the sample and population is shown in table 2.

[Table 2 here]

4.1 First stage analysis: estimation of efficiencies

The choice of variables qualifying for the DEA model is guided by previous literature and data availability. We define bank output in accordance with the intermediation approach (Pasiouras 2006). We therefore assume the banks perform an intermediary role between borrowers and

[6] Note that Bankscope moved to International Financial Reporting Standards (IFRS) from 2004 onwards, and so data should be comparable over time.

[7] These were calculated using data from World Development Indicators (WDI) and Global Development Finance (GDF).

depositors and use *deposits and short term funding*, *fixed assets*, *general and administration expenses* and *equity* as inputs to produce *total loans* and *other earning assets*.

Islamic banks do not offer loans in the same way as conventional banks, and so the term 'total loans' is a generic term used to encompass the equity financing products they use. Conventional banks earn money from the spread between lending interest and borrowing interest rates. Islamic banks have a similar spread which is defined in terms of profit share ratios between the entrepreneurs (borrowers) and the depositors (lenders).

Fixed assets are included to represent capital input, while general and administration expenses are used as a proxy for labour input. While it may not be a perfect reflection of labour input, it is more easily available than better measures (e.g. employee numbers or expenditure on wages) and has been used in previous studies (e.g. Drake and Hall 2003) where it is argued that personnel expenses make up a large proportion of general and administration expenses.

It has been suggested that an indicator of risk-taking should explicitly be incorporated into any model of banking efficiency (Charnes *et al.* 1990), and this aspect is likely to be particularly important in a context which compares Islamic and conventional banks where one would expect a difference in risk-taking behaviour (Sufian 2006). The difficulty with incorporating risk-taking activity is the choice of variable to capture the effect. Some studies use off-balance sheet items (Pasiouras 2008; Lozano-Vivas and Pasiouras 2010) but this variable has the disadvantage that data are not widely available and the sample is consequently severely reduced by its inclusion. Other studies use equity which is more widely available; moreover bank attitudes to holding equity have responded quickly to changes in the financial climate, and this makes it particularly attractive in a study which encompasses a period of financial crisis. Indeed, equity has been used to reflect risk in previous studies which have covered times of financial crisis: the East Asian crisis (Abdul-Majid *et al.* 2008), and the savings and loans crisis in the USA (Alam 2001). We therefore feel that the variable equity captures the general attitudes towards risk (enforced or preferred) of the two types of banks over the period, and use it to reflect risk in our own study.

Descriptive statistics of the DEA variables are presented in table 3. Over the whole period of study, the typical conventional bank has just over US $6000 million in total loans and US $2500 million in other earning assets. These are 1.5 and 3 times the values for Islamic banks (respectively). There has been growth in these output variables in both banking sectors over the period but this has slowed down (understandably given the world economic climate) towards the end of the period. Input variables are typically up to twice as big in the conventional compared to the Islamic banking sector.

[Table 3 here]

4.2 Second stage analysis: determinants of efficiency

In a second stage, an investigation of the possible determinants of the different types of efficiency scores (gross, net and type) of the banks is undertaken. We will divide these into two broad categories: the characteristics of the individual banks, and the banking context, over which managers have no control, and which is particularly relevant in cross-country studies (Dietsch and Lozano-Vivas 2000; Lozano-Vivas *et al.* 2002). Eight variables are included in the second stage analysis to reflect bank-level characteristics.

- *A binary variable to reflect whether the bank is classified by Bankscope as fully-fledged Islamic* (ISLAMIC). This variable is included in the second stage to assess whether any differences in efficiency remain after the economic environment and the bank's own characteristics have been taken into account.
- *A dummy variable to reflect whether the bank is listed on the stock market* (LIST) and *an interaction term between* ISLAMIC *and* LIST (ISLIST). Listing on the stock market has been found to have a positive effect on efficiency in the context of conventional banks in Europe (Casu and Molyneux 2003) but a negative effect in the context of Islamic banks (Yudistira 2004) – hence the inclusion of both the listing dummy and interaction term.
- *The value of a bank's total assets* (ASSETS). This variable is included to reflect bank size. Islamic banks are typically smaller than conventional banks and so it might be size which causes any observed differences in efficiency. Previous research in the context of Islamic banking suggests a non-linear relationship between bank *stability* and size (Abdul-Majid *et*

al. 2005b); we check for a non-linear relationship between *efficiency* and size by also including the square of ASSETS (ASSETSSQ).

- *The ratio of loan loss reserves to loans* (LOANLOSS/LOANS). This variable acts as a proxy for credit risk (the higher the loan loss reserves ratio the lower the credit risk). In managing increasing credit risk, banks may incur additional expenses to monitor their loans (Barajas *et al.* 1999) which might lead to lower efficiency; on the other hand, a lower ratio has been associated with increased profit margins (Miller and Noulas 1997) and this may lead in turn to higher efficiency. Islamic and conventional banks may well manage credit risk differently, and this variable is included to capture any potential effect of that possibility. Previous evidence finds no significant relationship between the ratio of loan loss reserves to loans and efficiency (Staikouras *et al.* 2008).
- *The ratio of total loans to assets* (LOANS/ASSETS) and *the ratio of net loans to assets* (NETLOANS/ASSETS). Total loans is the sum of reserves for impaired loans (relative to non-performing loans) and net loans. By including both variables we obtain the effect on efficiency of the components of total loans. Thus the sum of the coefficients on these two variables will reflect the effect on efficiency of net loans (relative to assets), and the coefficient on LOANS/ASSETS will indicate the effect on efficiency of the value of reserves for impaired loans (relative to non-performing loans): the greater are these reserves, the higher is the bank's liquidity and hence the lower its exposure to defaults; on the other hand, the lower are the reserves, the higher are potential returns. Thus the potential overall effects of NETLOANS/ASSETS and LOANS/ASSETS on efficiency are unclear, *a priori*, although previous research has suggested a positive relationship between liquidity and efficiency in both Islamic and European banks (Hasan and Dridi 2010).

Five variables – sourced from World Development Indicators (WDI) and Global Development Finance (GDF) databases – are included to reflect the overall banking environment.

- *The normalised Herfindahl index* (HHI). This variable reflects the competitive environment of each country's banking sector. The index is calculated using all the banks (contained in

Bankscope[8]) for a given country and hence assumes that Islamic and conventional banks compete against each other[9]. The 'quiet life' theory suggests that increased industry concentration is related to lower technical efficiency as there is little incentive to be efficient when competition is low (Berger and Mester 1997). The 'efficiency hypothesis', on the other hand, argues that concentration and efficiency are positively related. There is evidence from previous studies in the context of conventional banks to support both the 'quiet life' theory (Yudistira 2004; Staikouras *et al.* 2008) and the 'efficiency hypothesis' (Dietsch and Lozano-Vivas 2000; Koutsomanoli-Filippaki *et al.* 2009).

- *The degree of market capitalization* i.e. the percentage valuation of listed firms across all sectors relative to the country's GDP (MCAP). This is included to reflect the level of stock market activity in the economy, and its possible effect on bank efficiency is unknown *a priori*.
- *Growth in real GDP* (GDPGR) and *Inflation* (INF). These variables are included to capture the buoyancy of the economy in which the bank is located. While their precise effects are unknown *a priori*, previous evidence has shown a positive relationship between GDP growth and banking efficiency (Staikouras *et al.* 2008; Awdeh and El Moussawi 2009).
- *Per capita GDP* (GDPPC). This variable reflects the level of institutional development and the supply and demand conditions in the market in which the bank is located. While previous evidence has shown a positive relationship between *per capita* income and *costs* (Dietsch and Lozano-Vivas 2000), the precise effect of this variable on *efficiency* is ambiguous *a priori*.

Finally *year dummies* are included to allow for changes in banking efficiency over time (year dummies are used in preference to a trend variable in order to allow different effects on

[8]The normalized Herfindahl index is $HI^* = \frac{HI-1/N}{1-1/N}$ where *HI* is the Herfindahl index, calculated using market shares (based on total assets) at year end, and *N* is the number of firms (Bikker and Haaf 2002; Čihák and Hesse 2010). The normalised Herfindahl index ranges from 0 to 1 and gives lower rankings than the original Herfindahl index for industries with small number of firms (Busse *et al.* 2007). It is therefore more appropriate in the present context. Bankscope is not entirely comprehensive in its coverage, but omitted banks are likely to be small and hence the HHI calculated on this basis should adequately reflect the competitive environment.

[9] This is justified on the grounds that Islamic banking products increasingly appeal to non-Muslim customers; and large ratings agencies are getting involved in Islamic finance (Alexakis and Tsikouras 2009; Arthur D Little Report 2009).

performance in different years). These dummies may also pick up the effect on efficiency of any idiosyncratic (year by year) changes in data recording or bank behaviour. In addition the interactions between the Islamic dummy and year dummies are included to examine whether Islamic and conventional banks have experienced different effects on their efficiency over the time period.

Region dummies are included to allow for differences in efficiency between three broad regions[10].

We will therefore estimate, using random effects, with heteroscedasticity-corrected standard errors, the following equation:

$$y_{n,t} = \alpha + \beta' \boldsymbol{X}_{n,t} + \gamma' \boldsymbol{Z}_{c,t} + \delta'' \boldsymbol{D}_r + \varphi' \boldsymbol{F}_t + \mu_n + \varepsilon_{n,t}$$

where: $n = 1, \dots, N,$ represents banks; $t = 1, \dots, T$ represents time; $c = 1, \dots, C$ represents country; $r = 1, \dots, R$ represents region; and $r \subseteq c \subseteq n$. The dependent variable y denotes efficiency and separate equations are estimated for gross, net and type efficiency respectively; α is the intercept term and denotes the mean of the unobserved heterogeneity; $\mu_n \sim IID\left(0, \sigma_\mu^2\right)$ is the random heterogeneity specific to the *n*th bank and is constant over time; $\varepsilon_{n,t} \sim IID(0, \sigma_\varepsilon^2)$ and is uncorrelated over time; $\boldsymbol{X}_{n,t}$ is an *N*x8 matrix of bank-level explanatory variables (see section 4.2); $\boldsymbol{Z}_{c,t}$ is an *N*x5 matrix of country-level explanatory variables (see section 4.2); $\boldsymbol{D}_r$ is an *N*x2 matrix of regional-level dummies (see footnote 10); $\boldsymbol{F}_t$ is an *N*x10 matrix of year dummies, and year and Islamic interaction dummy variables.

Descriptive statistics of the second stage variables are presented in table 4. There are clear differences between Islamic and conventional banks in terms of these variables. Most notably Islamic banks are much smaller (less than half the size) and, through their country location, they face a much higher (nearly double) *per capita* GDP than their conventional counterparts. These differences between the two types of banks in terms of underlying factors of efficiency may therefore explain the differences in efficiency we have already observed between Islamic and conventional banks.

[Table 4 here]

[10] The regions are: Middle East = Egypt, Jordan, Mauritania, Palestine, Sudan, Tunisia, Turkey, Yemen; Gulf Cooperating Council (GCC) = Bahrain, Kuwait, Qatar, Saudi Arabia, United Arab Emirates; Asia = Bangladesh, Brunei, Indonesia, Malaysia, Pakistan. GCC and ASIA are the dummy variables included in the equation.

5. Results

5.1 First stage results

The bias corrected[11] DEA efficiencies, calculated using an output-oriented constant returns to scale (CRS) approach, are reported in table 5 and displayed in figure 2. We also calculate the bias corrected variable returns to scale (VRS) results. These provide identical findings to the CRS results and hence are not reported here[12]. We calculate the efficiencies on the assumption that production conditions vary over time. This means that the DEA is performed for each year separately[13]. Given the expanding populations and markets in many of the sample countries, this is likely to be a valid assumption.

[Table 5 here]

[Figure 2 here]

In terms of gross efficiency there is no evidence to suggest significant differences in mean efficiency levels between conventional and Islamic banks. In the context of net efficiency, however, Islamic banks consistently have higher average levels of efficiency than conventional banks and the differences are significant in all years apart from 2006. Turning now to type efficiency, we see that conventional banks have higher efficiency, on average, than the Islamic banks, and this difference is significant in all years of the study.

The implications of these results are that, when measured against a common frontier, each type of bank typically has the same level of efficiency; but, when measured against their own frontier, Islamic banks are more efficient, on average, than conventional banks. We can see how these results might be represented in a 2-dimensional situation by referring back to figure 1. The conventional banks are most closely represented by the crosses in figure 1, with a few highly efficient banks which determine the position of the overall efficiency frontier ABCDE, and plenty of other much less

[11] Bias corrected efficiencies are calculated using the homogeneous bootstrapping algorithm of (Simar and Wilson 2008). The bootstrap method provides estimates which are corrected for sampling variability. Results calculated without bootstrapping can be found here http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2071615.

[12] The VRS results are available on request.

[13] For comparison, the efficiencies were also generated on the assumption that production conditions do not vary over time. In practical terms, this means that the DEA is performed on the pooled data. Broad conclusions are identical to those reported here.

efficient banks. The Islamic banks, on the other hand, are most closely represented by the dots with many of the Islamic banks being located close to their own frontier (FGHIJ) and only a few being highly inefficient. The average overall efficiency score is therefore similar for the two types of banks, but the net efficiency score is much higher, on average, amongst Islamic banks compared to conventional banks.

The results provide clear evidence that the Islamic banking system is less efficient than the conventional one (in figure 1 frontier FGHIJ lies inside frontier ABCDE). This is in line with earlier conclusions derived using SFA and DEA (Abdul-Majid *et al.* 2008; Johnes *et al.* 2009; Abdul-Majid *et al.* 2011a). The fact that the Islamic banking *modus operandi* is less efficient than its conventional counterpart comes as no surprise for a number of reasons. First an Islamic bank operates mainly with customised contracts which are either equity-type (profit and loss sharing) or services-type (leasing agreements, mark-up pricing sale). These contracts are tailor-made as many of the relevant parameters (such as maturity, repayments and collateral) are specific for every client. The bank, as the financer, needs to conduct a feasibility and profitability analysis for equity-type contracts; this is costly and time-consuming. Second an Islamic bank needs to gain approval for its financial products from the Shariah board of the bank. This is done for every Islamic bond issue (sukuk) and also for the majority of equity-based contracts, although the fee-based contracts are more standardised and hence rarely require the approval of the Shariah board. Thus Islamic banks incur greater administration costs and higher operational risk than conventional banks.

An additional result found here, which is in contrast to Abdul-Majid *et al*. (2008; 2011a), is that the managers of Islamic banks appear to make up for the disadvantages of their banking system by being more efficient than their counterparts in conventional banks. We will discuss this result further in the following section.

5.2 Second stage results

The analysis of differences between Islamic and conventional banks in terms of their gross, net and type efficiencies is somewhat simplistic as it looks only at bank type as a cause of inter-bank disparities. There is a possibility that some other characteristic(s) apart from operating under Islamic

or conventional rules causes the differences between the two groups of banks reported in section 5.1. We therefore use econometric techniques to investigate the causes of inter-bank variations in efficiency and to assess whether, having taken various environmental and bank-specific characteristics into account, bank type (Islamic or conventional) is still a significant factor underlying gross, net and type efficiency levels. The results of the panel data analysis are presented in table 6.

[Table 6 here]

The main finding from this second stage analysis is that, having taken into account a range of macroeconomic and bank-level variables, the distinctions between Islamic and conventional banks found in section 5.1 still remain. Thus there is no significant difference between Islamic and conventional banks in terms of gross efficiency; the net efficiency of Islamic banks is significantly higher (by 0.08) than in conventional banks, while type efficiency is lower (by 0.07) for Islamic banks than conventional banks. The Islamic method of banking (with its compliance with Shariah law) therefore results in lower efficiency than conventional banking, but the managers of the Islamic banks make up for this disadvantage, and this is the case *even after taking into account* other contextual and bank-level characteristics. The efforts of the managers of Islamic banks in terms of recouping efficiency lost due to *modus operandi* is an interesting finding and is in contrast to reports from the late 1990s which suggested that the managers of Islamic banks were lacking in training (Iqbal *et al.* 1998). It seems therefore that the expansion of demand in Islamic financial products has coincided with an improvement in managerial efficiency. Why has this happened? Clearly operating with tailor-made financial products (as in Islamic banks) requires considerable human input, and so Islamic banks have spent more on human resources than conventional banks in order to emphasise reputation, trust and interpersonal relationships (Pellegrina 2008). In addition, education and knowhow in the context of Islamic finance has increased in recent years (and specifically over the period of the study) and as a consequence is promoted to the general public using, for example,

marketing campaigns[14]. These may therefore have contributed to an increase in managerial efficiency within Islamic banks.

Some other results in table 6 are worthy of further discussion. A number of variables are significant in explaining gross and net but not type efficiency. Increasing size initially decreases efficiency but beyond an asset value of around $40 billion gross and net efficiency increase with size. Given that mean size is around $7 billion, many banks (and nearly all Islamic banks) experience the negative relationship between efficiency and size.

The ratio of loans to assets and the ratio of net loans to assets are the two remaining bank-level variables which significantly affect gross and net efficiency, the former positively and the latter negatively. These results need to be considered together since total loans are the sum of net loans and reserves for impaired loans (relative to non-performing loans). Thus the coefficient on the ratio of loans to assets reflects the effect of holding reserves for impaired loans on efficiency: in this case the higher the reserves (and hence the higher the protection for the bank from bad loans) the higher is efficiency. Thus banks which behave prudently in terms of insuring against bad loans reap rewards in terms of higher efficiency. The sum of the two coefficients suggests that the size of net loans has little effect on efficiency.

Turning now to the macroeconomic (country-level) variables we can see that three of these are significant in the net and gross efficiency equations at the 10% significance level. First, the significantly negative coefficient on HHI provides support for the 'quiet life' hypothesis. Second country-level variable is worthy of mention: a higher level of market capitalization (and hence stock market activity) leads to lower gross and net efficiency. Third, increasing GDP growth is associated with higher efficiency (gross and net) as expected.

The two dummies to reflect geographical region are also significant with banks in the Asian region having higher efficiency (than the omitted region) by 0.04, and banks in the GCC having lower efficiency by around 0.08. We speculate that the size of population may be responsible for these differences between regions: Asia has the largest population, followed by the Middle Eastern region,

[14] To this end, Bank Syariah Mandiri in Indonesia sponsors documentaries on Islamic finance while Emirates Bank in the UAE waives loan payments during Ramadan as part of marketing campaigns (Bloomberg).

and then by the GCC. It is possible that the higher demand for banking products in the most populated region leads to greater standardization of products and the possibility of reaping economies of scale. The opposite may be the case for the smallest region. Further research is necessary to confirm these conjectures.

Finally, the year fixed effects indicate that, compared with the first year of the study (2004) all years have seen significantly lower gross efficiency, with 2006 and 2008 seeing the worst performance. This pattern is the same for conventional and Islamic banks. The time pattern of net efficiency, on the other hand, differs between the two types of banks. Conventional banks have seen increasing falls in net efficiency (relative to 2004) with the nadir being in 2008; there is an improvement in 2009, but the position is still low relative to 2004. Islamic banks have experienced a similar pattern in net efficiency between 2005 and 2008 – Islamic banks have seen a slightly bigger (smaller) fall in 2006 (2008) compared to conventional banks – but 2009 reveals a significant difference between the two types in that Islamic banks have seen a rise in net efficiency relative to 2004. Managers of Islamic banks seem therefore to have coped with the recent financial crisis better than managers of conventional banks. However, the crisis seems to have had a more severely adverse effect on type efficiency in Islamic than conventional banks: thus the gap between the Islamic and conventional production possibility frontiers (see figure 1) has widened in the most recent years of the study (2007 to 2009). This is an interesting result and is in contrast to the view of Islamic banks as reliable performers over the period of crisis.

6. Conclusion

The purpose of this paper has been to provide an in-depth analysis using DEA of a consistent sample of Islamic and conventional banks located in 18 countries over the period 2004 to 2009. The DEA results provide evidence that there are no significant differences in gross efficiency (on average) between conventional and Islamic banks. This result is in line with a number of previous studies (El-Gamal and Inanoglu 2005; Mokhtar *et al.* 2006; Bader 2008; Hassan *et al.* 2009).

By using a meta-frontier analysis new to the banking literature we have been able to decompose gross efficiency into two components: net efficiency provides a measure of managerial competence,

while type efficiency indicates the effect on efficiency of *modus operandi*, and by doing this we have discovered that this result of no significant difference in efficiency between banking types conceals some important distinctions. First, the type efficiency results provide strong evidence that Islamic banking is less efficient, on average, than conventional banking. Second, net efficiency is significantly higher, on average, in Islamic compared to conventional banks suggesting that the managers of Islamic banks are particularly efficient given the rules by which they are constrained. Thus the Islamic banking system is inefficient, but the managers of Islamic banks make up for this disadvantage.

Finally, a second stage analysis investigates whether these distinctions (in terms of efficiency) between Islamic and conventional banks are a consequence of banking environment or bank-level characteristics. Thus we investigate the determinants of the components of efficiency as well as gross efficiency in order to provide more information to managers and policy-makers regarding ways of improving efficiency. The panel data analysis confirms the earlier results: the *modus operandi* of Islamic banks leads to lower efficiency in these banks compared to conventional banks, but the significantly superior efficiency of the managers of the Islamic banks more than makes up for the disadvantages of banking system, and this is the case *even after taking into account* other factors.

Thus each type of banking could learn from the other. Islamic banks need to look at the conventional banking system for ideas on how to make their own system more efficient. An obvious possibility would be to standardize their portfolio of products as in conventional and the larger Islamic banks.

Conventional banks need to examine the managerial side of Islamic banking for ideas on how to improve the efficiency of their own managers. If there is little difference in the inherent ability or the training of managers in each type of bank, then other aspects, such as the remuneration systems and project viability might hold the key. Remuneration of managers in conventional banks comprises a fixed element (salary) and variable components (shares, bonuses and other benefits). Most recently, bonuses have been criticized for being attached to short-term goals. It is to be expected that managers focus upon goals to which bonuses are attached, and these are usually quantity-

oriented (i.e. the number of loans) rather than quality-oriented (i.e. viability of the project). Here, the long investment horizon of conventional financial products, which can be up to 20 or 30 years, could be an impediment to the manager's focus and judgment of the pecuniary worth. Bonuses are not part of the Islamic banking culture[15]. It is also plausible that the shorter horizon of financial projects in Islamic banks alongside the personalized services (i.e. custom-based contracts) force managers to perform more efficiently, although we can find no evidence to support this contention. There is clearly scope for further research into why the managers of Islamic banks appear to perform more efficiently than those of conventional banks.

Are there other ways in which banks can improve their performance? Despite the importance of the country level variables over which bank managers have no control, the second stage results suggest some ways in which banks can operate more efficiently. Gross, net and type efficiency, for example, can be boosted by increasing the size of banks. The relationship between efficiency and bank size is quadratic, and most banks in the sample are operating on the downward sloping part of the function. Managers should also take note of the beneficial effects on efficiency of prudent behaviour in terms of holding reserves relative to non-performing loans.

Finally, in a period of financial turmoil, the banks in this sample have typically suffered falls in their gross efficiency relative to the start of the period. The year 2008 had a particularly bad impact on gross efficiency, but there has been a limited recovery in 2009. An examination of the components of gross efficiency indicates, however, that the managers of Islamic banks have coped with the crisis better than those of conventional banks, but that the gap between the conventional and Islamic production possibility frontier has widened during this same period. This implies that the efficiency advantage of the conventional over the Islamic operating system has increased during the period of financial turmoil, suggesting that it is crucial for Islamic banks to shift to a more standardized process if they are to improve their efficiency in the face of future crises.

[15] For example, the Gulf Finance House in Bahrain does not give any form of performance related bonuses (Gulf Finance House Annual Report, 2010). The Dubai Islamic Bank gave bonuses that amounted to less than 0.1% of the total staff expenses in 2011 (Dubai Islamic Bank Annual Report, 2011).

Figure 1: DEA efficiency – derivation of gross, net and type efficiency

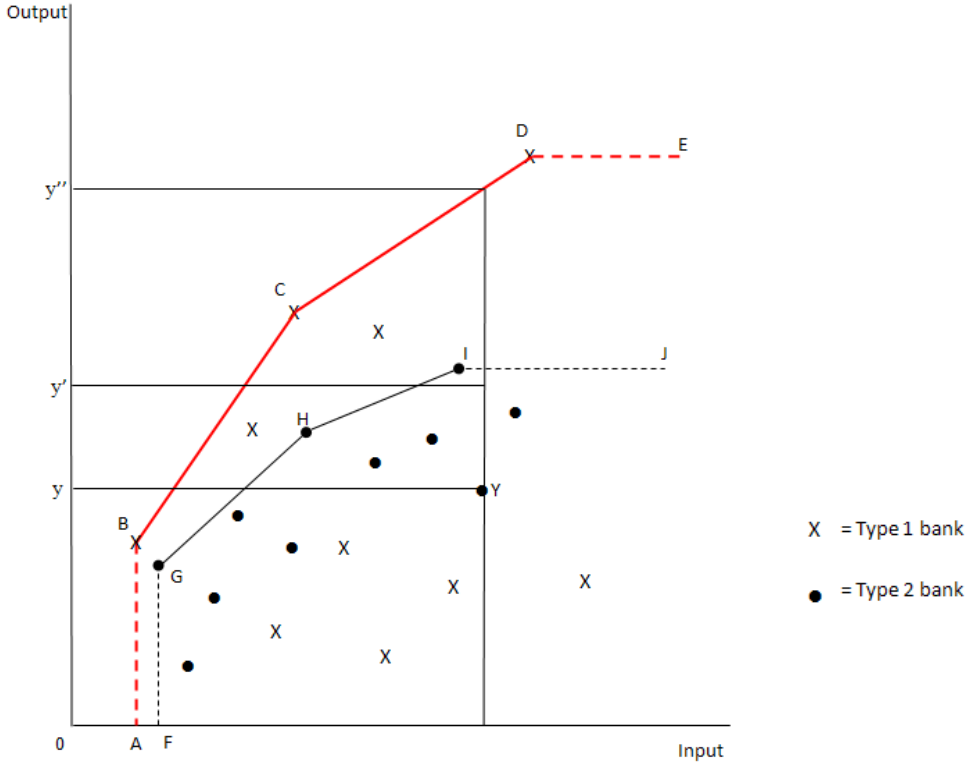

Figure 2: DEA efficiencies for the sample banks – mean values 2004 to 2009

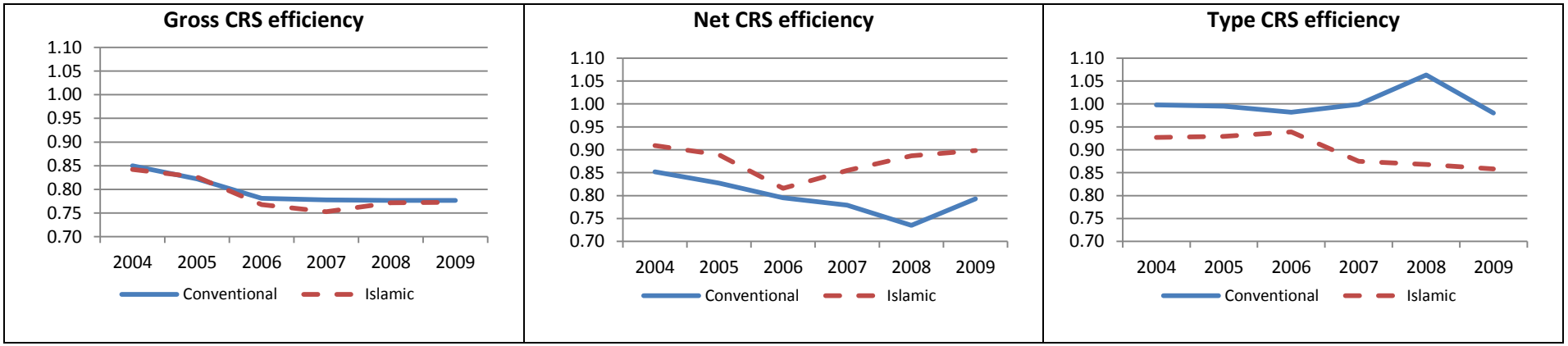

Table 1: Islamic banking efficiency studies (frontier estimation approach)

Context	Method	Studies
No significant difference in efficiency between Islamic and conventional banks		
21 countries: Algeria; Bahrain; Bangladesh; Brunei; Egypt; Gambia; Indonesia; Jordan; Kuwait; Lebanon; Malaysia; Pakistan; Qatar; Saudi Arabia; Senegal; Tunisia; Turkey; Yemen; Sudan; Iran; United Arab Emirates	DEA	(Bader 2008)
11 countries: Egypt; Bahrain; Tunisia; Jordan; Kuwait; Lebanon; Qatar; Saudi Arabia; Turkey; United Arab Emirates; Yemen	DEA	(Hassan *et al.* 2009)
5 countries: Bahrain; Kuwait; Qatar; UAE; Singapore	DEA	(Grigorian and Manole 2005)
Malaysia	SFA	(Mokhtar *et al.* 2006)
Turkey	SFA	(El-Gamal and Inanoglu 2005)
Islamic banks are significantly more efficient than conventional banks		
GCC: Bahrain; Kuwait; Oman; Qatar; Saudi Arabia; UAE	DEA	(Al-Muharrami 2008)
Islamic banks are significantly less efficient than conventional banks		
GCC: Bahrain; Kuwait; Oman; Qatar; Saudi Arabia; UAE	SFA	(Srairi 2010)
Malaysia	DEA	(Mokhtar *et al.* 2007; 2008)
Islamic banks have (significantly) lower efficiency than conventional banks and it is predominantly a consequence of *modus operandi* rather than managerial inadequacies		
10 countries: Bahrain; Bangladesh; Indonesia; Iran; Jordan; Lebanon; Malaysia; Sudan; Tunisia; Yemen;	SFA	(Abdul-Majid *et al.* 2010)
GCC: Bahrain; Kuwait; Oman; Qatar; Saudi Arabia; UAE	DEA	(Johnes *et al.* 2009)
Malaysia	SFA	(Abdul-Majid *et al.* 2008; 2011a; 2011b)
The efficiency of Islamic and conventional banks is compared, but the significance of any difference is not tested		
Cross-country: Conventional banks in the USA and randomly drawn Islamic banks	DEA	(Said 2012)
4 countries: Jordan; Egypt; Saudi Arabia; Bahrain	SFA	(Al-Jarrah and Molyneux 2005)
Bahrain	SFA	(Hussein 2004)
Studies of Islamic banks only		
21 countries: Algeria; Bahamas; Bahrain; Bangladesh; Brunei; Egypt; Gambia; Indonesia; Iran; Jordan; Kuwait; Lebanon; Malaysia; Mauritania; Qatar; Saudi Arabia; Sudan; Tunisia; UAE; UK; Yemen	SFA DEA	(Hassan 2005; 2006)
16 countries: Bahrain; Bangladesh; Egypt; Gambia; Indonesia; Iran; Kuwait; Malaysia; Pakistan; Saudi Arabia; Turkey; UAE; Qatar; South Africa; Sudan; Yemen	DEA	(Sufian 2009)
12 countries: Algeria; Bahrain; Egypt; Gambia; Indonesia; Jordan; Kuwait; Malaysia; Qatar; Sudan; UAE; Yemen	DEA	(Yudistira 2004)
13 countries: Algeria; Bahrain; Bangladesh; Brunei; Egypt; Indonesia; Jordan; Kuwait; Malaysia; Qatar; Sudan; UAE; Yemen	DEA	(Viverita *et al.* 2007)
14 countries: Algeria; Bahamas; Bangladesh; Bahrain; Brunei; Egypt; Jordan; Kuwait; Malaysia; Qatar; Saudi Arabia; Sudan; UAE; Yemen	DEA	(Brown 2003)
GCC: Bahrain; Kuwait; Oman; Qatar; Saudi Arabia; UAE	DEA	(Mostafa 2007; El Moussawi and Obeid 2010; 2011; Mostafa 2011)
Malaysia	DEA	(Sufian 2006*; 2006/2007*; 2007*; Kamaruddin *et al.* 2008)
Sudan	SFA	(Hassan and Hussein 2003; Saaid *et al.* 2003; Saaid 2005)

*The study includes both fully-fledged Islamic banks and conventional banks with Islamic windows.

Table 2: Banks in the sample and population by country and type

	Sample Banks			Total Banks in Bankscope (2009)			Total Pop 2009	Proportion Muslim
Country	Islamic	Conventional	Total	Islamic	Conventional	Total		
Bahrain	9	6	15	19	10	29	1,169,578	0.81
Bangladesh	1	27	28	3	30	33	147,030,145	0.90
Brunei	0	1	1	1	1	2	391,837	0.67
Egypt	2	20	22	2	22	24	79,716,203	0.95
Indonesia	1	35	36	1	49	50	237,414,495	0.88
Jordan	2	11	13	3	11	14	5,915,000	0.98
Kuwait	3	6	9	9	7	16	2,646,286	0.95
Malaysia	2	21	23	17	48	65	27,949,395	0.60
Mauritania	1	2	3	1	8	9	3,377,630	0.99
Pakistan	3	16	19	9	29	38	170,494,367	0.96
Palestine	1	1	2	1	2	3	4,043,218	0.98
Qatar	2	5	7	5	7	12	1,597,765	0.78
Saudi Arabia	1	9	10	3	11	14	26,809,105	0.97
Sudan	5	1	6	12	15	27	42,478,309	0.71
Tunisia	1	9	10	1	17	18	10,439,600	1.00
Turkey	2	20	22	9	27	36	71,846,212	0.98
UAE	6	13	19	9	16	25	6,938,815	0.76
Yemen	3	4	7	4	4	8	23,328,214	0.99

Source: Bankscope; World Development Indicators; Global Development Finance

Table 3: Descriptive statistics for the DEA input and output variables

	Conventional			Islamic			All		
2004	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
Deposits and short-term funding	4566	1167	7359	1697	478	3596	4060	1062	6928
Fixed assets	106	21	374	33	13	65	93	16	342
General and administrative expenses	156	29	607	40	19	71	135	26	533
Equity	1012	554	1065	693	521	540	956	550	999
Total loans	5109	3213	4123	3776	2811	3310	4874	3099	4018
Other earning assets	2329	435	4520	543	200	931	2014	377	4175
2005	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
Deposits and short-term funding	4879	1362	7730	1878	652	3717	4349	1128	7271
Fixed assets	90	24	287	38	14	77	81	18	263
General and administrative expenses	144	31	479	51	26	80	128	30	437
Equity	1070	578	1127	747	552	652	1013	568	1065
Total loans	5468	3292	4641	3975	2872,90	3544	5205	3197	4497
Other earning assets	2425	567	4716	619	265	1013	2107	462	4354
2006	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
Deposits and short-term funding	5353	1486	8386	2084	643	3908	4776	1358	7879
Fixed assets	88	25	276	64	14	184	84	22	262
General and administrative expenses	142	42	306	62	28	100	128	37	282
Equity	1116	605	1192	846	548	864	1068	598	1144
Total loans	5875	3491	5244	4034	2947	3126	5550	3345	4982
Other earning assets	2585	651	4836	885	274	1462	2285	523	4476
2007	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
Deposits and short-term funding	6164	1780	9616	2524	912	4643	5522	1596	9042
Fixed assets	97	28	297	75	15	191	93	26	281
General and administrative expenses	168	44	400	74	30	114	152	41	368
Equity	1232	655	1431	964	606	1042	1185	652	1373
Total loans	6480	3595	6179	4389	3113	3756	6111	3443	5874
Other earning assets	2804	687	5305	996	342	1762	2485	614	4917
2008	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
Deposits and short-term funding	5824	1612	9094	2697	1151	4863	5272	1562	8578
Fixed assets	87	32	232	84	20	216	87	31	229
General and administrative expenses	150	41	313	79	37	113	137	41	289
Equity	1147	631	1217	946	594	966	1111	621	1178
Total loans	6527	3562	6257	4579	3112	3958	6184	3423	5957
Other earning assets	2342	541	4311	961	318	1622	2098	507	4003

2009	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Deposits and short-term funding	7041	1738	11695	3337	1112	6272	6387	1634	11016
Fixed assets	103	37	265	105	22	283	104	34	268
General and administrative expenses	178	48	377	104	41	168	165	47	351
Equity	1402	666	1709	1083	622	1280	1346	662	1644
Total loans	7259	3560	7655	5081	3227	5136	6875	3520	7313
Other earning assets	3037	655	6173	1245	533	2165	2721	606	5713
All Years	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
Deposits and short-term funding	5638	1551	9113	2370	799	4584	5061	1362	8581
Fixed assets	95	28	291	66	15	186	90	25	276
General and administrative expenses	156	42	426	68	29	113	141	38	391
Equity	1163	615	1312	880	561	925	1113	601	1257
Total loans	6120	3453	5835	4306	2954	3850	5799	3338	5579
Other earning assets	2587	584	5012	875	313	1556	2285	518	4641

Note: All variables are reported in US $ millions at 2005 prices. The number of observations in each year is 45 Islamic banks and 210 conventional banks.

Table 4: Descriptive statistics for the second stage explanatory variables

	Conventional				Islamic				All			
2004	Mean	Median	SD	n	Mean	Median	SD	n	Mean	Median	SD	n
ASSETS	5.045	1.333	8.066	210	1.783	0.578	3.642	45	4.470	1.148	7.575	255
LOANLOSS/LOANS	7.577	4.692	8.209	208	6.366	3.765	9.175	32	7.415	4.615	8.334	240
LOANS/ASSETS	0.503	0.520	0.176	210	0.491	0.550	0.243	45	0.501	0.520	0.189	255
NETLOANS/ASSETS	0.506	0.518	0.166	210	0.483	0.548	0.237	45	0.502	0.523	0.180	255
HHI	0.142	0.111	0.079	210	0.199	0.185	0.110	45	0.152	0.111	0.088	255
MCAP	74.426	69.370	74.093	199	60.091	38.520	63.588	36	72.230	69.370	72.641	235
GDPGR	6.936	6.270	2.879	210	7.492	6.040	3.610	45	7.034	6.270	3.020	255
INF	8.212	8.550	3.734	210	9.866	9.150	4.839	45	8.504	8.550	3.991	255
GDPPC	6.970	1.250	11.048	210	13.058	6.342	14.064	45	8.044	2.200	11.836	255
2005	Mean	Median	SD	n	Mean	Median	SD	n	Mean	Median	SD	n
ASSETS	6.029	1.683	9.626	210	2.351	0.842	4.630	45	5.380	1.505	9.052	255
LOANLOSS/LOANS	6.550	3.559	7.730	209	3.683	3.146	2.872	34	6.148	3.517	7.313	243
LOANS/ASSETS	0.521	0.540	0.174	210	0.493	0.540	0.231	45	0.517	0.540	0.185	255
NETLOANS/ASSETS	0.525	0.545	0.164	210	0.493	0.542	0.231	45	0.520	0.545	0.177	255
HHI	0.134	0.101	0.073	210	0.188	0.168	0.106	45	0.144	0.104	0.082	255
MCAP	114.625	81.430	134.196	199	107.513	79.670	122.095	36	113.535	81.430	132.191	235
GDPGR	6.414	5.960	1.596	210	7.230	7.800	1.537	45	6.558	5.960	1.613	255
INF	9.736	7.030	6.086	210	12.473	11.130	6.278	45	10.219	7.080	6.196	255
GDPPC	7.248	1.304	11.326	210	13.641	6.786	14.456	45	8.376	2.326	12.154	255
2006	Mean	Median	SD	n	Mean	Median	SD	n	Mean	Median	SD	n
ASSETS	7.231	2.039	11.298	210	3.063	1.072	5.707	45	6.495	1.888	10.639	255
LOANLOSS/LOANS	6.049	3.181	7.404	208	4.023	3.155	3.770	37	5.743	3.162	7.010	245
LOANS/ASSETS	0.531	0.550	0.173	210	0.464	0.510	0.216	45	0.519	0.550	0.183	255
NETLOANS/ASSETS	0.533	0.554	0.165	210	0.463	0.514	0.214	45	0.521	0.547	0.176	255
HHI	0.135	0.096	0.082	210	0.183	0.162	0.102	45	0.143	0.104	0.088	255
MCAP	110.893	128.940	86.146	199	88.507	61.560	77.419	36	107.464	128.940	85.095	235
GDPGR	6.541	6.405	2.453	210	7.383	6.700	3.770	45	6.690	6.630	2.742	255
INF	9.896	9.490	4.780	210	11.280	10.390	4.975	45	10.140	10.390	4.834	255
GDPPC	7.592	1.359	11.803	209	14.538	7.162	15.092	44	8.800	2.625	12.681	253

2007	Mean	Median	SD	n	Mean	Median	SD	n	Mean	Median	SD	n
ASSETS	9.318	2.829	14.739	210	4.115	1.753	7.401	45	8.399	2.557	13.863	255
LOANLOSS/LOANS	5.461	3.056	6.432	207	4.353	3.018	3.922	39	5.285	3.042	6.110	246
LOANS/ASSETS	0.530	0.550	0.168	210	0.463	0.470	0.193	45	0.518	0.540	0.174	255
NETLOANS/ASSETS	0.532	0.550	0.160	210	0.463	0.469	0.193	45	0.520	0.540	0.168	255
HHI	0.133	0.100	0.080	210	0.173	0.155	0.096	45	0.140	0.101	0.084	255
MCAP	170.392	188.050	132.084	199	135.944	95.490	121.018	36	165.115	188.050	130.795	235
GDPGR	6.507	6.350	3.489	210	7.496	6.430	4.719	45	6.682	6.350	3.744	255
INF	8.271	6.790	4.249	210	8.616	7.540	5.319	45	8.332	6.790	4.446	255
GDPPC	8.105	1.427	12.906	209	15.656	7.403	16.545	44	9.419	2.727	13.871	253
2008	Mean	Median	SD	n	Mean	Median	SD	n	Mean	Median	SD	n
ASSETS	9.974	2.751	15.665	210	5.012	2.324	8.926	45	9.099	2.619	14.809	255
LOANLOSS/LOANS	5.177	2.932	5.966	206	5.101	2.930	4.815	40	5.165	2.932	5.786	246
LOANS/ASSETS	0.567	0.590	0.169	210	0.471	0.470	0.233	45	0.550	0.590	0.185	255
NETLOANS/ASSETS	0.571	0.594	0.155	210	0.472	0.470	0.233	45	0.554	0.589	0.175	255
HHI	0.133	0.100	0.083	210	0.167	0.137	0.100	45	0.139	0.101	0.087	255
MCAP	85.990	97.850	64.604	199	70.446	76.310	57.630	36	83.609	97.850	63.717	235
GDPGR	5.410	6.010	3.770	210	6.014	5.100	4.617	45	5.516	6.010	3.930	255
INF	13.686	12.220	4.532	210	15.283	16.110	4.571	45	13.968	12.220	4.571	255
GDPPC	8.527	1.495	13.931	209	16.556	7.359	17.872	44	9.923	2.729	14.966	253
2009	Mean	Median	SD	n	Mean	Median	SD	n	Mean	Median	SD	n
ASSETS	10.945	3.050	17.657	210	5.390	2.344	9.344	45	9.965	3.017	16.619	255
LOANLOSS/LOANS	5.918	3.913	6.110	196	7.906	5.067	11.619	39	6.248	4.011	7.320	235
LOANS/ASSETS	0.545	0.580	0.171	210	0.458	0.460	0.231	44	0.530	0.570	0.185	254
NETLOANS/ASSETS	0.550	0.579	0.155	210	0.458	0.459	0.231	44	0.534	0.570	0.173	254
HHI	0.137	0.105	0.085	210	0.175	0.150	0.103	45	0.144	0.105	0.089	255
MCAP	123.083	95.940	96.675	199	85.997	87.860	82.716	36	117.402	95.940	95.450	235
GDPGR	2.396	3.630	3.411	210	2.674	3.100	2.937	45	2.445	3.630	3.328	255
INF	3.443	6.520	10.172	210	1.473	5.150	10.681	45	3.095	6.520	10.270	255
GDPPC	8.456	1.543	13.731	209	16.765	6.929	17.725	44	9.901	2.727	14.805	253
All Years	Mean	Median	SD	n	Mean	Median	SD	n	Mean	Median	SD	n
ASSETS	8.090	2.245	13.435	1260	3.619	1.275	7.004	270	7.301	1.941	12.656	1530
LOANLOSS/LOANS	6.126	3.510	7.067	1234	5.248	3.542	6.908	221	5.993	3.530	7.048	1455
LOANS/ASSETS	0.533	0.560	0.173	1260	0.473	0.510	0.223	269	0.522	0.550	0.184	1529
NETLOANS/ASSETS	0.536	0.559	0.162	1260	0.472	0.504	0.222	269	0.525	0.552	0.175	1529
HHI	0.136	0.101	0.080	1260	0.181	0.155	0.103	270	0.144	0.104	0.086	1530
MCAP	113.235	89.950	105.870	1194	91.416	69.815	93.375	216	109.893	89.950	104.319	1410
GDPGR	5.701	5.850	3.393	1260	6.381	6.180	4.051	270	5.821	5.930	3.526	1530
INF	8.874	8.550	6.712	1260	9.832	10.390	7.711	270	9.043	8.790	6.906	1530
GDPPC	7.815	1.543	12.496	1256	15.023	6.929	15.928	266	9.075	2.625	13.436	1522

Note: ASSETS is in US $ billions at 2005 prices; GDPPC is in US $ thousands at 2005 prices. The number of observations in each year varies because of data availability.

Table 5: Results of the DEA by year for all countries – mean and median values

		GROSS			NET			TYPE		
		Conventional	Islamic	ALL	Conventional	Islamic	ALL	Conventional	Islamic	ALL
Pooled	Mean	0.798	0.789	0.796	0.797	0.876	0.811	1.000	0.899	0.984
	P value (t test)	0.295			0.000**			0.000**		
	Median	0.810	0.812	0.810	0.809	0.917	0.827	0.999	0.922	0.997
	P value (MW)	0.716			0.000**			0.000**		
	P value (KS)	0.134			0.000**			0.000**		
2004	Mean	0.850	0.842	0.849	0.852	0.909	0.862	0.998	0.927	0.986
	P value (t test)	0.608			0.000**			0.000**		
	Median	0.875	0.870	0.872	0.875	0.952	0.886	1.000	0.944	1.000
	P value (MW)	0.456			0.000**			0.000**		
	P value (KS)	0.490			0.000**			0.000**		
2005	Mean	0.822	0.826	0.823	0.827	0.889	0.838	0.995	0.929	0.983
	P value (t test)	0.802			0.000**			0.000**		
	Median	0.845	0.867	0.848	0.854	0.933	0.863	0.997	0.941	0.996
	P value (MW)	0.689			0.000**			0.000**		
	P value (KS)	0.742			0.000**			0.000**		
2006	Mean	0.781	0.768	0.779	0.795	0.816	0.799	0.982	0.939	0.974
	P value (t test)	0.511			0.234			0.000**		
	Median	0.797	0.801	0.798	0.809	0.853	0.817	0.987	0.935	0.984
	P value (MW)	0.780			0.101			0.000**		
	P value (KS)	0.363			0.015**			0.000**		
2007	Mean	0.778	0.753	0.774	0.779	0.855	0.793	0.999	0.875	0.977
	P value (t test)	0.300			0.000**			0.000**		
	Median	0.797	0.805	0.797	0.799	0.892	0.812	0.999	0.896	0.998
	P value (MW)	0.360			0.000**			0.000**		
	P value (KS)	0.411			0.000**			0.000**		
2008	Mean	0.777	0.772	0.777	0.735	0.887	0.762	1.063	0.868	1.028
	P value (t test)	0.807			0.000**			0.000**		
	Median	0.779	0.806	0.784	0.723	0.947	0.745	1.050	0.871	1.031
	P value (MW)	0.967			0.000**			0.000**		
	P value (KS)	0.816			0.000**			0.000**		
2009	Mean	0.777	0.773	0.776	0.793	0.898	0.812	0.980	0.858	0.958
	P value (t test)	0.825			0.000**			0.000**		
	Median	0.779	0.805	0.781	0.804	0.950	0.826	0.994	0.860	0.986
	P value (MW)	0.965			0.000**			0.000**		
	P value (KS)	0.789			0.000**			0.000**		

** = significant at 5% significance level; * = significant at 10% significance level; t test tests the null hypothesis that the means of the two samples are equal (equal variances are not assumed); MW (Mann Whitney U test) tests the null hypothesis that the two samples are drawn from the same distributions (against the alternative that their distributions differ in location); KS (Kolmogorov-Smirnov 2-sample test) tests the null hypothesis that the two samples are drawn from the same distributions (against the alternative that their distributions differ in location *and* shape)

Table 6: Second stage results

	GROSS			NET			TYPE		
	coeff	z	P>|z|	coeff	z	P>|z|	coeff	z	P>|z|
ISLAMIC	0.006	0.350	0.724	*0.081*	*4.640*	*0.000*	*-0.069*	*-5.600*	*0.000*
LIST	-0.016	-1.570	0.116	-0.013	-1.280	0.201	-0.003	-0.960	0.335
ISLAMIC*LIST	-0.028	-1.360	0.173	-0.018	-0.910	0.364	*-0.033*	*-2.310*	*0.021*
ASSETS	*-0.004*	*-4.730*	*0.000*	*-0.004*	*-4.760*	*0.000*	0.000	-0.990	0.324
ASSETSSQ	*0.000*	*5.340*	*0.000*	*0.000*	*5.270*	*0.000*	*0.000*	*2.320*	*0.021*
LOANLOSS/LOANS	*0.001*	*2.550*	*0.011*	*0.001*	*1.880*	*0.061*	0.000	0.900	0.368
LOANS/ASSETS	*0.425*	*5.830*	*0.000*	*0.373*	*9.030*	*0.000*	*0.080*	*5.020*	*0.000*
NETLOANS/ASSETS	*-0.426*	*-5.320*	*0.000*	*-0.383*	*-7.510*	*0.000*	*-0.066*	*-3.520*	*0.000*
HHI	*-0.117*	*-1.970*	*0.049*	*-0.108*	*-1.760*	*0.079*	0.026	1.030	0.304
MCAP	*0.000*	*-3.610*	*0.000*	*0.000*	*-4.060*	*0.000*	0.000	-1.340	0.181
GDPGR	*0.002*	*1.980*	*0.048*	*0.002*	*2.890*	*0.004*	-0.001	-1.260	0.209
INF	0.000	-1.370	0.171	0.000	-1.010	0.315	0.000	-0.280	0.778
GDPPC	0.001	0.760	0.449	0.001	1.120	0.263	0.000	0.030	0.974
ASIA	*0.036*	*2.950*	*0.003*	*0.032*	*2.730*	*0.006*	*0.008*	*1.800*	*0.071*
GCC	*-0.075*	*-2.910*	*0.004*	*-0.077*	*-3.420*	*0.001*	-0.001	-0.170	0.868
2005	*-0.018*	*-4.660*	*0.000*	*-0.016*	*-4.100*	*0.000*	-0.002	-1.240	0.216
2006	*-0.059*	*-10.680*	*0.000*	*-0.046*	*-8.380*	*0.000*	*-0.016*	*-7.900*	*0.000*
2007	*-0.051*	*-6.570*	*0.000*	*-0.051*	*-6.860*	*0.000*	0.002	1.340	0.180
2008	*-0.058*	*-8.500*	*0.000*	*-0.103*	*-14.890*	*0.000*	*0.065*	*9.240*	*0.000*
2009	*-0.053*	*-6.970*	*0.000*	*-0.036*	*-4.900*	*0.000*	*-0.023*	*-6.020*	*0.000*
ISLAMIC*2005	*0.021*	*1.730*	*0.084*	0.005	0.370	0.709	0.015	1.540	0.123
ISLAMIC*2006	-0.003	-0.240	0.809	-0.045	-2.670	0.008	*0.039*	*2.750*	*0.006*
ISLAMIC*2007	-0.009	-0.490	0.621	0.012	0.710	0.479	*-0.035*	*-2.170*	*0.030*
ISLAMIC*2008	0.011	0.700	0.483	*0.095*	*5.630*	*0.000*	*-0.114*	*-6.650*	*0.000*
ISLAMIC*2009	0.008	0.480	0.633	*0.052*	*3.050*	*0.002*	*-0.050*	*-3.280*	*0.001*
CONSTANT	*0.877*	*40.220*	*0.000*	*0.878*	*41.800*	*0.000*	*0.992*	*108.870*	*0.000*
No. of observations	1353			1353			1353		
No. of groups	232			232			232		
Overall R^2	0.303			0.377			0.364		
Wald χ^2_{25}	756.470			1302.320			594.160		
Prob > χ^2_{25}	0.000			0.000			0.000		

Notes: The model is estimated using bank random effects; standard errors are heteroscedasticity adjusted. Italics denote significant at 10% significance level.

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