

## **Efficiency and Risk-Taking in Dual Banking System: Evidence from Emerging Markets**

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*With the rapid growth of Islamic banking system as an alternative to an established conventional banking system many countries across the globe are embarking on dual banking system. This paper analyses and compares efficiency and risk taking of 165 commercial banks and 70 Islamic banks from 11 emerging markets between 2000 and 2010. This paper also analyzes the relationship between risk and efficiency within the two banking systems. Empirical evidence shows that bank inefficiency and risk are positively related for conventional banks and inversely related for Islamic banks which clearly highlight the inherent difference between risk–efficiency relationships among these two distinct bank types. The mean cost efficiency scores for the conventional banking industry is higher than Islamic banking sector while, Islamic banks profit efficiency scores have outperformed conventional banks profit efficiency scores. Our evidence also shows that environmental factors can considerably prejudice the banking efficiency scores.*

**JEL classification:** G15, G21, C14

**Key words:** Dual banking, Bank efficiency, Bank performance, Risk

### **1. Introduction**

During the last two decades the banking sector across the globe has experienced major transformations due to advent of alternative profit based financial system. Islamic finance in Gulf Cooperation Council (GCC), South East Asia (SEA) and many European countries has now become an important element in their economic development agendas and it is also gaining ground in the financial landscape across the globe. It is also a growing business as it caters to the financial needs of the people without conflicting with their social and religious values. Despite this reality, little methodical and consistent analysis exists in the literature on efficiency and risk appetite of Islamic banks across different countries. Except for some far-reaching statements that appear in media no systematic and comparative analysis of dual banking system emerged in academic literature. Similarly, what has been the contribution of Islamic banking to the financial sector in terms of resilience and efficiency are unexplored questions. The Islamic finance dominant region includes the rapidly expanding, oil rich countries of the GCC as well as the emerging SEA nations. The world's largest Islamic banks are located in these regions and its mix of conventional and Islamic banks permits a comparison of efficiency and risk appetite by type of bank.

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The conventional banking framework assume that banks make profits by acquiring deposits from the depositors at a low interest rate, then reselling those funds to the borrowers at higher interest rate, thus making profits from the spread between the interest rate received from borrowers and the interest rate paid to depositors. While on the other hand Islamic banking performs the same intermediary function but does not receive any interest from borrowers and does not pay any interest to the depositors; the amount of profits is based on the profit sharing agreements with the depositors and also with the borrowers. Islamic banking is considered as a different banking stream as it prohibits interest and replaces with profit sharing which depends on the extent of the risk participation of the parties. The absence of interest is based on Islamic philosophy and as interpreted using Shariah principles (Haron et.al 2006).

If the operational theory behind these two banking systems is so distinct, it is expected that they will exhibit different level of efficiency which will have resultant impact of bank riskiness. Surprisingly, there is no reported study which has studied comparative risk-efficiency relationship in dual banking systems and there are only a limited number of studies that assess inter-temporal relationships between bank risk and efficiency in conventional banking system.

To tackle the above issue, this research builds on previous literature and assesses the inter-temporal relationships between bank risk and efficiency. This paper uses a large data set of 2262 banks observation from 11 emerging markets ranging from 2000 to 2010. Our main variables of interest include measure of bank risk and two bank efficiency measures (cost and profit efficiencies). This research results have particular implications for the regulation and management of banks operating in dual banking environment. The average bank in the dual banking system countries operates at a level below optimal size, especially in the case of Islamic banks which may govern only one-tenth asset size of those big conventional banks. Secondly, this study is one of the few focusing on the risk-efficiency relationship model in dual banking system, which is surprisingly inadequately explored (Hassan and Bashir, 2003; Sarker, 1999; Bashir, 1999; Samad and Hassan, 1999 do not build on comparative risk-efficiency relationship among conventional and Islamic banks). Moreover, the research assess both cost and profit efficiency and risk of the dual banking system operating in the 11 highly developed dual banking countries (Egypt, Bahrain, Bangladesh, Indonesia, Kuwait, Malaysia, Pakistan, Qatar, Saudi Arabia, Turkey, and UAE). The paper tries to carry out a suitable comparison of banking efficiency across countries by using a global best-practice econometric frontier whereby the banks in each country can be compared against the same standard. This paper choose to consider both cost and profit efficiency because conventional banking is traditionally a revenue-motivated business while Islamic banks are predominantly profit based business put further pressure for the efficiency enhancement.

The rest of this paper is organized as follows: section 2 includes a literature review while section 3 presents the methodology, variables and data. The empirical results are explained in sections 4 and section 5 concludes the paper.

## 2. Literature Review

The efficiency studies applied to the banking sector focus predominantly on conventional banking (Berger and Humphrey, 1997; Goddard et al. 2001; Berger, 2007; and Hughes and Mester, 2008). In conventional banking literature, researchers had linked efficiency to many different factors. Some studies focused on cross-country comparisons of conventional banks efficiency (e.g. Bonin et al., 2005), while other studies consider country-specific environmental conditions (e.g. Bos and Kool, 2006). Studies also focused on the efficiency of conventional banks based on their size, specialization or diversification, and type like retail or wholesale banking (e.g. Kwan, 2006) while others attempted to check the efficiency of new bank versus old bank (e.g. Fries and Taci, 2005). At the same time some studies have compared efficiency scores of foreign-owned banks with domestic-owned banks (e.g. Isik and Hassan, 2002b) while other studies focused their efficiency analysis on the ownership government versus private (e.g. Cornett et al., 2000). A number of studies tackled banks' performance and efficiency around financial crisis (e.g. Berger and Bouwman, 2009). In this context by summarizing over 100 studies which compared cross country bank efficiency Berger (2007) notices that efficiency has been measured using either: 1) the estimation of nation-specific frontiers; and 2) the estimation of common frontiers including specific variables in the estimation to account for countries differences. While the first approach guarantees the sample homogeneity, it does not enable the authors to directly compare banks from different countries. In contrast the second approach allows a direct comparison of efficiency levels and rankings from different countries (e.g. Coelli et al., 2005; Bos and Schmiedel, 2007) by implicitly assuming that banks in different countries have access to the same technology and effectively compete with each other. However, this approach requires dealing with the sample heterogeneity by controlling for systematic differences across banks that are not due to inefficiency, which can cause volatility of efficiency results (Bos et.al, 2009). To overcome this some studies focus on country specific environmental factors (e.g. Lozano-Vivas et.al, 2002).

At the same time there are some empirical studies that compare the performance of Islamic banks with their conventional counterparts. However, the focus of the majority of those studies is on comparing performance, especially profitability, with the help of financial ratios and constrained by the shorter time frame and inadequate number of Islamic banks (e.g. Samad and Hassan, 1999; Hassan and Bashir, 2003; Al-Jarrah and Molyneux, 2003; Hussein, 2004; Brown and Skully, 2005; Bader et.al, 2007 and Shamsher et.al, 2008). The scarcity of efficiency studies in Islamic banking can be explained by three main factors: first, the lack of good quality data; second, the difficulties in successfully modeling the uncharacteristic nature of Islamic banks' cost-revenue model (i.e. a problem of profit versus interest); and third, the need to accurately account for different environmental conditions in various countries.

Recently researchers have started to incorporate risk characteristics in cost or profit efficiency functions estimation, (Athanasoglou et al., 2008; Brissimis et al. 2008; Fiordelisi and Molyneux, 2010; Lepetit et al. 2008). Berger and DeYoung (1997) postulated the "bad management" hypothesis, in which banks operating with low levels

of efficiency have higher costs largely due to inadequate credit monitoring and inefficient control of operating expenses. Declines in cost and revenue efficiency will temporally precede increases in banks' risk due to credit, operational, market and reputational problems.

Another interesting concept called "cost skimping" hypothesis assumes that there is a trade-off between short-term cost efficiency and future risk-taking due to moral hazard considerations. In such cases, banks appear to be more cost efficient as they devote fewer resources to credit screening and monitoring. As a result the stock of non-performing loans remains unaffected in the short run. This leads us to another aspect whether the relationship between risk and efficiency varies for different types of bank like conventional and Islamic. Traditionally, empirical evidence has focused on efficiency comparisons between private and mutual banks in the USA. For instance O'Hara (1981) and Nicols (1967) indicate that mutual firms are likely to be more efficient than their private sector counterparts. Mester (1989, 1993) finds that mutual firms are more efficient while Cebenoyan et al. (1993) suggests there is no difference between the efficiency of mutual and joint stock Savings and Loans (S&L) banks.

Overall, the vast majority of the literature on bank risk- efficiency relationship focuses on conventional banking and, to the best of researcher knowledge; no study has specifically investigated dual banking system comparing conventional and Islamic banks. The aforementioned literature, however, provides little guidance as to whether efficiency differences between various types of banks have any influence on their risk profile. The present study advances the existing literature by examining specifically cost and profit efficiency bearing on risk taking of the dual banking system in eleven emerging markets countries and by taking into account of environmental factors in the estimation.

The next section outlines the details of the methodology and data used.

### 3. Methodology

#### 3.1 Efficiency Estimation and Environmental Factors

Our empirical analysis aims to identify the framework for comparing investment banks' efficiencies across nations. Cost and profit efficiency are measured using the Stochastic Frontier Analysis (SFA) that can be written as follows:

$$\ln TC_{i,t} = x_{i,t}\beta + (V_{i,t} + U_{i,t}) \dots\dots\dots(1)$$

where t denotes the time dimension,  $\ln TC_i$  is the logarithm of the cost of production of the i-th bank,  $x_i$  is a  $k \times 1$  vector of input prices and output quantities of the i-th bank,  $\beta$  is a vector of unknown parameters,  $V_i$  are random variables which are assumed to be i.i.d  $N(0, \sigma_v^2)$  and independent of  $U_i$ ,  $U_i$  are non-negative random variables which are

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assumed to account for cost inefficiency and to be i.i.d. as truncations at zero of the  $N(0, \sigma_U^2)$ .

We use the following translog functional form as supported by Berger and Mester (1997) and used in Altunbas et al. (2000), and Altunbas et al. (2001):

$$\begin{aligned}
 \ln TC_{k,t} (\ln TP) = & \beta_0 + \sum_{i=1}^2 \beta_i \ln Y_i + \sum_{j=1}^2 \alpha_j \ln P_j + \lambda_1 T + \frac{1}{2} \left( \sum_{i=1}^2 \sum_{j=1}^2 \delta_{ij} \ln Y_i \ln Y_j + \sum_{i=1}^2 \sum_{j=1}^2 \gamma_{ij} \ln P_i \ln P_j + \lambda_{11} T^2 \right) + \\
 & + \sum_{i=1}^2 \sum_{j=1}^2 \rho_{ij} \ln Y_i \ln P_j + \sum_{i=1}^2 \beta_{iT} T \ln Y_i + \sum_{j=1}^2 \alpha_{jT} T \ln P_j + \frac{1}{2} \tau_{EE} \ln E \ln E + \tau_E \ln E + \\
 & + \sum_{i=1}^2 \beta_{iE} \ln Y_i \ln E + \sum_{j=1}^2 \alpha_{jE} \ln P_j \ln E + \sum_{j=1}^M \theta_j \ln z_{ji} + \epsilon_{kt}
 \end{aligned}
 \tag{2}$$

where  $\ln TC_{kt}$  ( $\ln TP$ ) is the natural logarithm of total cost (total profit) of bank  $k$  in period  $t$ ,  $Y_i$  is the vector of output quantities,  $P_j$  are the input prices,  $E$  represents bank's equity capital and is included as a fixed input, specifying interaction terms with both output and input prices in line with recent studies (e.g. Beccalli, 2004; and Vander Venet, 2002). Following Coelli et al. (1998) and Bos and Kolari (2005), linear homogeneity was imposed in input prices by normalizing the dependent variables and input price variables before taking logarithms. We also account for  $M$  environmental factors,  $z_j$ , assuming different values for each  $i$ -th firm. Estimates incorporating the effect of the environmental factors can be viewed as 'gross' measures of efficiency. In this case we are assuming that all firms share the same technology, and environmental factors have an influence only on the distance between each firm and the best-practice. We include the time trend  $t$  to capture technological change.

We will apply equation (2) in two scenarios, *normal scenario* which do not include  $M$  environmental factors and *scenario 1* which will include  $M$  environmental factors. This will help us to estimate if there is any difference in efficiency level of banks if we account for environmental factors surrounding it.

We apply the same methodology presented above to estimate the alternative profit efficiency. The frontier definition is similar to the one described in equation (2). There are only two important differences: we replace total cost (TC) with total profit (TP) as dependent variable; and the inefficiency term ( $U_i$ ) is subtracted, given that we need to solve a profit maximization problem.

If we look into bank efficiency literature, the definition of inputs and outputs varies across studies and depends on researcher's assumption. The most common among all is, where inputs are identified are labor, physical capital and deposits while output constitutes total loans and other earning assets (Berger and Humphrey, 1997, Berger

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and Mester, 1997, Hughes and Mester, 2008). This study will also apply the same variables for estimating bank efficiency scores.

In order to select on which environmental factors will have direct bearing on bank efficiency, we follow the most recent empirical literature in this area. Accordingly, we account for potential differences arising from country-specific aspects of banking system on one hand and from the environmental conditions on the other. We added asset diversity (AD =  $AD = 1 - \{ ( \text{Net loans} - \text{Other earning assets}) / \text{Total earning assets} \}$ ) as a measure of diversification across different type of assets. AD takes values between 0 and 1 with higher values means greater diversification hence more profitable (Laeven and Levine, 2007).

To take into account of the diversification across different sources of income, we include a measure of income diversity (ID) (e.g. Laeven and Levine 2007; Fiordelisi and Molyneux, 2010). ID ( $= 1 - \{(\text{Net Interest Income} - \text{Other operating income}) / \text{Total operating income}\}$ ) takes values between zero and one with higher values indicating greater diversification. The asset and income diversity measures are complementary in that asset diversity is based on stock variables and income diversity is based on flow variables. The efficiency model also incorporates bank specific profitability determinants such as the return on assets (ROA) and the return on equity (ROE) as environmental model as specified by authors like Athanasoglou et al., 2008; and Lepetit et al. 2008.

We also accounted for macroeconomic conditions such as GDP and FDI inflow under which these banks operate. GDP per capita affects numerous factors related to the demand and supply of banking services (Carbo-Valverde et.al, 2007, Fiordelisi and Molyneux, 2010). Countries with a higher GDP per capita have a banking system that operates in a mature environment resulting in more competitive interest rates and profit margins. Finally, FDI is a measure of foreign ownership of productive assets. Growth of oil economy and emergence of Islamic finance in our sample emerging markets have fuelled the profitability of these sectors, primarily Islamic banks, which have had the relationship and networks to capture these flows. We expect to find, a significant impact of these environmental factors on cost (profit) efficiency.

### 3.2 Risk-Efficiency Relationship

The modeling framework adopted to estimate the relationship between risk and efficiency build on from the approaches suggested by Kwan and Eisenbeis (1997), and Altunbas et.al (2007). We specify a system of equations and estimate these using Zellners's (1962) seemingly unrelated regression (SUR) approach. This allows for simultaneity between banks' risk and efficiency while also controlling for important other environmental factors. There are two main motivations for use of SUR. The first one is to gain efficiency in estimation by combining information on different equations. The second motivation is to impose and test restrictions that involve parameters in different equations. As discussed above in literature it can be seen that risk and efficiency shows some interactions. The system of equations estimated is as follows:

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$$\text{LLR}_{ij} = \alpha + b \text{INEFF}_{ij} + c \text{NLTA}_{ij} + d \text{TA}_{ij} + e \text{LAD}_{ij} + f \text{LATAC}_j + g \text{LLPTAC}_j + \dots \quad (3)$$

$$\text{INEFF}_{ij} = \alpha + b \text{LLR}_{ij} + c \text{NLTA}_{ij} + d \text{TA}_{ij} + e \text{LAD}_{ij} + f \text{LATAC}_j + g \text{OETAC}_j + h \text{LLPTAC}_j + \dots \quad (4)$$

Variable Definition:

<b>LLR<sub>ij</sub></b>	=	Loan-loss reserves for bank i in country j
<b>INEFF<sub>ij</sub></b>	=	Cost inefficiency for bank i in country j (derived from stochastic cost frontier estimates from normal scenario used in section 3.1)
<b>NLTA<sub>ij</sub></b>	=	Net loans to total assets for bank i in country j
<b>TA<sub>ij</sub></b>	=	total assets for bank i in country j
<b>LAD<sub>ij</sub></b>	=	Liquid asset to short term deposit for bank i in country j
<b>LATAC<sub>j</sub></b>	=	Banking system liquid assets to total assets in country j
<b>OETAC<sub>j</sub></b>	=	Banking system operating expenses to total assets in country j
<b>LLPTAC<sub>j</sub></b>	=	Banking system loan-loss provisions to total loans in country j

Equation 3 and 4 examine the risk–efficiency relationship. A number of bank-specific and country specific variables are also included that are believed to also explain the variation in bank risk and inefficiency across dual banking system. Loan loss reserves as a fraction to total assets (LLR) is used as measure of banking risk. Higher levels of reserves are suggestive of greater banking risk accounting for any future bad times. Of course, this estimation as measure of riskiness can be questionable but accounting ratio like this has been widely used across literature to assess bank appetite for risk.

Individual bank efficiency (INEFF) is obtained as the distance of a bank’s observed operating cost to the minimum efficient cost frontier obtained from normal scenario as explained in section 3.1.

For the explanatory variables we used a broad range of variables that are believed to be important in explaining the performance and risk taking propensity of banks. The bank-specific variables include net loans to total assets (NLTA) as rapid loan growth may increase risk and impact adversely on bank efficiency in the long run. Banks that are more liquid may be more efficient in the sense that all other things being equal, an efficient bank can produce more output part of which includes liquid and other assets so we account for this by using liquid assets to deposits ratio (LAD). Bank size, through economies of scale, may influence the relationship between risk and efficiency so we control for the assets size of banks (TA). Big banks typically are more diversified and gain from other size advantages (Hughes et.al, 2001) so it is important to control for this factor. Generally, the effect of a growing size on efficiency has been proved to be positive to a certain extent (Athanasoglou et al., 2008; Fiordelisi and Molyneux, 2010).

Finally, a range of country-specific banking variables are included to take account of broad banking system differences across the nations. These include indicators of banking system liquidity (LATAC), efficiency (OEPAC) and risk (LLPTAC). While these

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variables are similar to the bank-specific indicators they provide another aspect to the analysis in that they control for country differences in efficiency and risk. In other words they help to show if country-specific financial differences impact on bank-specific risk and efficiency.

### 3.3 Data

This study comprises banks' balance sheet, income statement and annual reports data for 11 emerging markets over 2000-2010. The data were obtained from the Bankscope Database which includes banking information for both conventional and Islamic banks. The reasoning for 10 year data test is because it would yield a better dataset due to accuracy and also where the Islamic banking system was newly established it would have had sufficient time to mature in last decade. Table 1 illustrates the breakdown by country, by type of banks and average asset size of both Islamic banking system and conventional banking system in given country. The total number of observations is 2262; the KSA banking system has biggest asset size in both banking industries. Bahrain has the largest number of Islamic financial institutions both as a total and by year where as Indonesia has this distinction in conventional banking system. Majority of the countries here are predominant oil economy and has experienced rapid growth in the last decade.

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**Table 1. Sample description: number of banks and average asset size by country**

<b>Islamic Banking (IB)</b>													
<b>Country /Year</b>	<b>2000</b>	<b>01</b>	<b>02</b>	<b>03</b>	<b>04</b>	<b>05</b>	<b>06</b>	<b>07</b>	<b>08</b>	<b>09</b>	<b>2010</b>	<b>Total by Country</b>	<b>Avg asset of all IB in 2010 ( Milln USD)</b>
Bahrain (12)*	8	8	9	10	12	12	13	15	17	17	17	138	2422
Bangladesh (15)	2	3	3	3	3	3	3	3	3	3	3	32	709
Egypt (19)	2	2	2	2	2	2	2	2	2	2	2	22	3854
Indonesia (5.5)	2	2	2	2	3	3	3	3	4	4	4	32	1602
KSA (57)	1	1	1	1	2	2	2	2	3	3	3	21	19897
Kuwait (35)	2	2	2	2	3	3	3	3	3	3	3	29	17960
Malaysia (22.6)	2	2	2	3	3	7	10	12	16	16	16	89	5121
Pakistan (6.4)	1	1	1	2	3	3	5	6	6	6	6	40	555
Qatar (20)	2	2	2	2	2	2	3	3	3	3	3	27	9668
Turkey (4.5)	3	3	3	3	3	4	4	4	4	4	4	39	6480
UAE (18)	5	5	6	6	6	6	7	7	9	9	9	75	8458
Total By Year	30	31	33	36	42	47	55	60	70	70	70	544	
<b>Conventional Banking (CB)</b>													
<b>Country /Year</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>Total by Country</b>	<b>Avg asset of all CB in 2010 ( Milln USD)</b>
Bahrain	6	6	6	6	7	8	9	9	9	9	9	84	10410
Bangladesh	23	24	24	24	25	25	25	25	25	26	26	272	1815
Egypt	12	12	12	12	12	12	12	12	12	12	12	132	9832
Indonesia	33	33	33	34	34	34	34	35	36	36	36	378	6897
KSA	8	8	8	8	8	8	8	8	8	8	8	88	31965
Kuwait	6	6	6	6	6	6	6	6	6	6	6	66	18712
Malaysia	13	13	13	13	13	13	13	13	13	13	13	143	35924
Pakistan	12	13	13	14	14	14	16	16	16	16	16	160	4221
Qatar	4	4	4	4	4	4	5	5	5	6	6	51	17369
Turkey	18	18	19	19	20	20	21	21	21	21	21	219	21275
UAE	11	11	11	11	11	11	11	12	12	12	12	125	24729
Total By Year	146	148	149	151	154	156	160	162	166	168	169	1718	

Source: Bankscope database and Author calculation. \* Figure in parenthesis shows Islamic banking asset as percentage of total banking asset

## 4. Empirical Results

In our empirical analysis we first report the bank efficiency results for both conventional and Islamic banks under normal scenario (common frontier includes bank specific inputs and output) and scenario 1 (which accounts for impact of associated external factors on bank efficiency). Later we highlight the risk efficiency relationship for all type of banks.

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Chart 1 display the estimated mean cost efficiency levels as calculated in two alternative scenarios. The mean cost efficiency scores are on average higher than the profit ones in both scenarios for the conventional banking industry which is in line with predominant commercial bank efficiency literature (e.g. Berger and Mester, 1997). While on the other side from chart 2, we can see that Islamic banks profit efficiency scores have outperformed conventional banks profit efficiency scores in both scenarios. A possible explanation is that Islamic banks are profit based institutions and there are incentives to generate higher profit to expand customer bases in the sampled dual banking economies. It can be noted that conventional banks in dual banking system are operating at 65% cost efficiency while Islamic banks are only operating at 46%. This can be due to the fact that conventional banks on an average are bigger that Islamic banks in these countries which help them to operate at higher cost efficiency levels.

**Chart 1: Cost Efficiency estimates (means)**

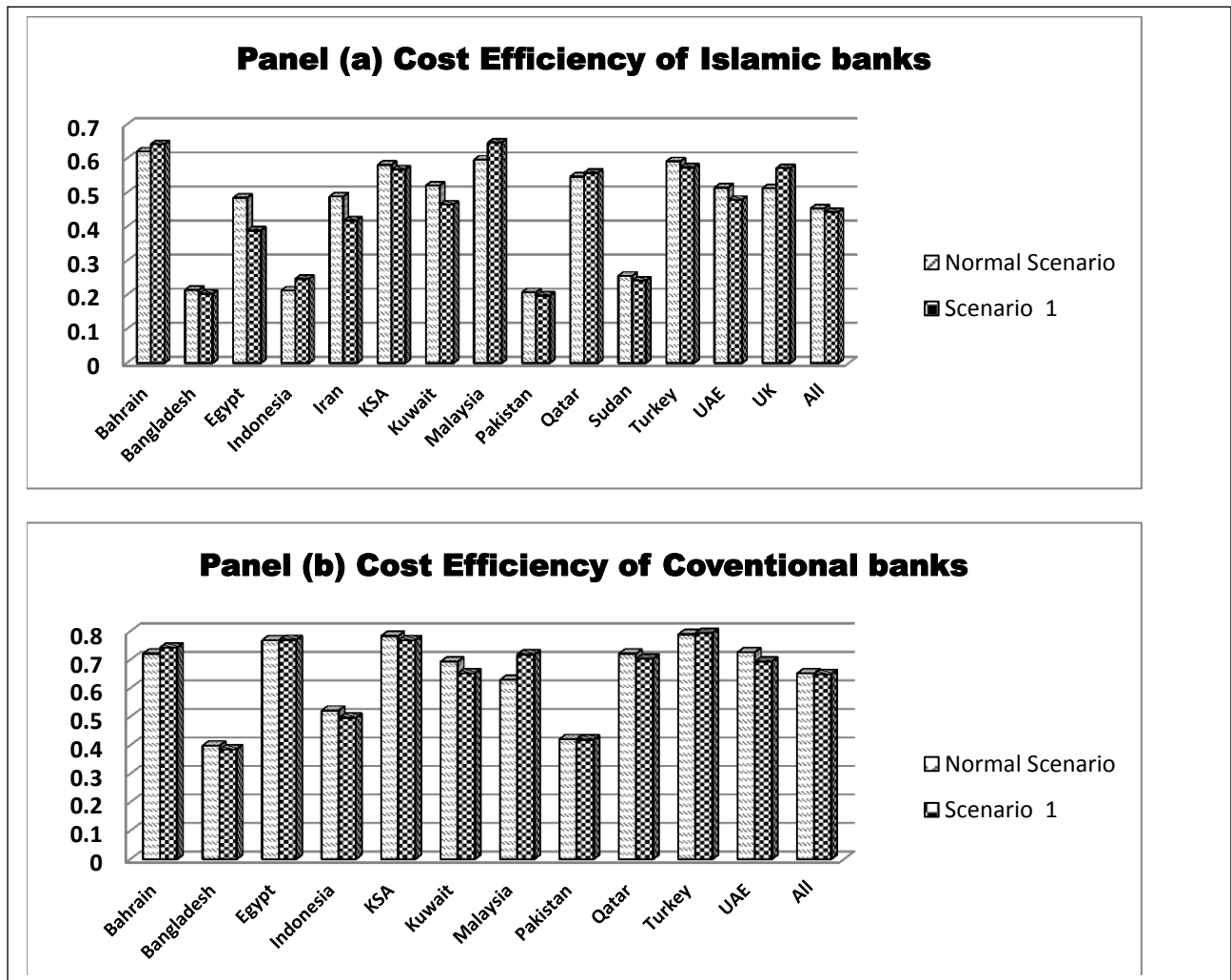
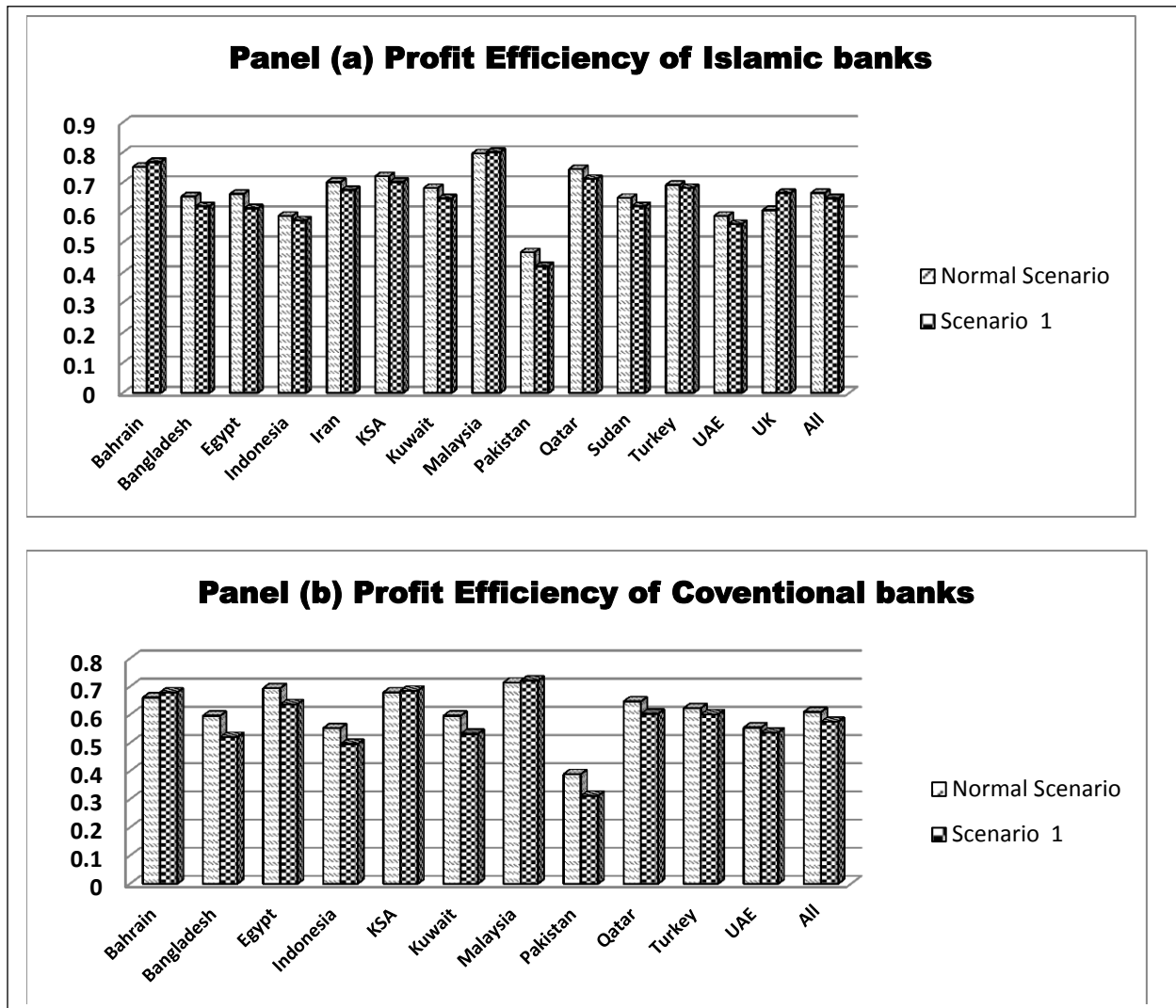


Chart 2: Profit Efficiency estimates (means)



On a country by country basis, conventional banks Turkey and Saudi Arabia are the most cost efficient operating at level close to 80% while the least cost efficient banks are in Bangladesh (40%) and Pakistan (42%). In contrast Islamic banks in Bahrain and Malaysia are the best cost efficient operating at around 62 % to 60%. One interesting observation from Chart 1 panel (a) is that if we include environmental factors (scenario 1) the cost efficiency scores changes drastically for many nations. Bahrain and Malaysian Islamic banks cost efficiency increases under the presence of country specific factors. This can be due to the fact Islamic banks in these two countries are well diversified and attract a lot of global interest in their Islamic banking operation. In case of conventional banks cost efficiency scores there is not much difference in both scenarios. Overall average cost efficiency levels for both Islamic and conventional banks in emerging markets of 46% (IB) to 65% (CB) are less than for well-established American and European banks (e.g. Berger and Young, 1997; Altunbas et.al, 2007) that operate at 80% to 90% efficiency level.

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Regarding profit efficiency, Islamic banks are more efficient (67%) than conventional counterparts (61%) under normal scenario. The higher rankings for Islamic banks are consistent with rapid growth of Islamic banks over the last decade. One more plausible reason for Islamic banks to be more profit efficient than conventional banks is that Islamic banks hold more profitable assets like Mudarabah and Musharakah (investment accounts based on profit sharing ) than loan, securities and derivatives instruments held by conventional banks.

Focusing on country estimates of profit efficiency in Chart 2 panel (a) and (b); Islamic banks in Malaysia and Bahrain have outperformed the rest of the sample. The least profit efficient country is Pakistan in both groups of banks (47% for IB and 39% for CB). The most striking of the observation is that Malaysia and Bahrain profit efficiency scores improves with addition of environmental factors while other countries faces a decline. This can be due to the reason that these two countries have well developed dual banking laws, separate Islamic banking laws and conventional banking laws while the rest of the sample countries still operate under single banking law. Our estimates of profit efficiency are somewhat larger than for developing and transition countries as reported by Yildirim and Philipatos (2007) and Olson and Zoubi (2011).

Estimates from the risk equation (equation 3) derived from the simultaneous estimation are reported in Table 2. The risk equation uses loan-loss reserves as fraction of total asset ( $LLR_{ij}$ ) as the dependent bank-risk variable. The columns report the results obtained for three estimations of the system – for all banks, conventional banks and Islamic banks in our sample. The independent variables include: cost inefficiency estimates derived for each bank from stochastic cost frontier estimation ( $INEFF_{ij}$ ), the net loans to total assets ratio ( $NLTA_{ij}$ ) for each bank, an indicator of the size of each bank measured by the total assets ( $TA_{ij}$ ) and the liquid assets to customer and short-term deposits ratio ( $LAD_{ij}$ ) for each bank. External factors to banks include: a measure of banking system liquidity given by the liquid assets to total assets ratio ( $LATAC_j$ ), and overall banking system risk measured as the loan-loss provisions to total loans ( $LLPTAC_j$ ).

Table 2 shows that for the full sample there is a positive relationship between inefficiency and bank risks. Banks with higher loan loss reserves tend to be inefficient. This is the case for conventional banks although it can be seen that there is an opposite relationship for Islamic banks. The positive relationship for conventional banks can be due to the fact that inefficient conventional banks take on more risk to improve their performance over the long run. The negative relationship for Islamic banks can be result of cost constraints impediment which restricts the ability of inefficient Islamic banks to take on more risks. Possibly, Islamic banks are more reserve constrained and this may be the reason behind this result. The table also shows that net lending ( $NLTA_{ij}$ ) is negatively related to risk suggesting that loan growth is inseparably linked to loan loss reserve levels. Bank asset size ( $TA_{ij}$ ) also seems to be important as large conventional banks appear to be more risky than their smaller Islamic counterparts and Islamic banks also seem to have a lower loan loss reserve level which is obvious since most of the

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Islamic loans are backed by real assets. This can be also interpreted that there are potential diversification benefits associated with size as noted by Altunbas et al. (2007).

<b>Table 2: Bank Risks <math>LLR_{ij}</math> as Dependent Variable</b>			
<b>Variables</b>	<b>All Banks</b>	<b>Conventional banks</b>	<b>Islamic Banks</b>
<b>INEFF<sub>ij</sub></b>	<b>0.004*</b>	<b>0.889*</b>	<b>-0.0267*</b>
<b>NLTA<sub>ij</sub></b>	<b>-0.043*</b>	<b>-0.023*</b>	<b>-0.012*</b>
<b>TA<sub>ij</sub></b>	<b>0.034**</b>	<b>0.178**</b>	<b>-0.013*</b>
<b>LAD<sub>ij</sub></b>	<b>0.087*</b>	<b>0.068**</b>	<b>-0.127*</b>
<b>LATAC<sub>j</sub></b>	<b>0.042*</b>	<b>0.014*</b>	<b>0.069*</b>
<b>LLPTAC<sub>j</sub></b>	<b>0.987*</b>	<b>1.527*</b>	<b>0.612*</b>
<b>Observations</b>	<b>2262</b>	<b>1718</b>	<b>544</b>
<b>R<sup>2</sup></b>	<b>0.3687</b>	<b>0.4962</b>	<b>0.3018</b>

Notes: \* and \*\* indicate significance at the 1% and 5% levels, respectively.

There also appears to be a mix relationship between liquidity and risk as conventional banks with higher liquidity levels have higher reserve levels while Islamic banks have lower reserve associated with higher liquidity. This suggests that banks with higher liquidity levels take on more risks which confirm to the Basel guidelines whereby banks are encourage being more liquid to cover the risks being taken. This result also confirms that Islamic banks tend to be more liquid and less risky compared to conventional banks in the dual banking system.

Finally, the country specific banking sector variables also suggest that the level of liquidity (LATAC<sub>j</sub>) and loan loss provision (LLPTAC<sub>j</sub>) in the respective country's financial system are positively related to overall banking sector risks. In other words banking systems will take on more risks if they are more liquid and banks are provisioning for loan loss at a higher level. There do not appear to be major differences in the relationships across conventional banks and Islamic banks.

Estimates from the inefficiency equation (equation 4) derived from the simultaneous estimation are reported in Table 3. The inefficiency equation uses inefficiency estimates (INEFF<sub>ij</sub>) obtained from stochastic cost frontier used in equation 2 under normal scenario as the dependent variable. The columns report the results obtained for three estimations of the system – for all banks, conventional banks and Islamic banks in our sample. The independent variables include: loan loss reserves to total asset (LLR<sub>ij</sub>) as measure of risk, the net loans to total assets ratio (NLTA<sub>ij</sub>) for each bank, an indicator of

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the size of each bank measured by the total assets (TA<sub>ij</sub>) and the liquid assets to customer and short-term deposits ratio (LAD<sub>ij</sub>) for each bank. External factors to banks include: a measure of banking system liquidity given by the liquid assets to total assets ratio (LATA<sub>Cj</sub>), overall banking system risk measured as the loan-loss provisions to total loans (LLPTAC<sub>j</sub>) and operating expenses to total banking asset (OETAC<sub>j</sub>).

Table 3 presents the results for inefficiency equation derived from the simultaneous estimates. The results for the full sample suggest that inefficient banks hold more loan loss reserves however results vary across types of banks. There appears to be positive relationship between loss reserve and efficiency for conventional banks, and an inverse relationship for Islamic banks which affirm the findings of table 1 that inefficient conventional bank takes on more risk than their Islamic counterpart. This can be a useful result to prove that Islamic banks suffer fewer damages and experienced no banking failures during the recent credit crunch of 2007-2008.

<b>Table 3: Bank Cost Inefficiency INEFF<sub>ij</sub> as Dependent Variable</b>			
<b>Variables</b>	<b>All Banks</b>	<b>Conventional banks</b>	<b>Islamic Banks</b>
LLR <sub>ij</sub>	0.037*	0.213*	-0.0067*
NLTA <sub>ij</sub>	-0.049*	-0.068*	-0.034**
TA <sub>ij</sub>	0.378*	0.015*	0.763*
LAD <sub>ij</sub>	0.026*	0.006**	-0.045*
LATA <sub>Cj</sub>	0.276*	0.163*	0.387*
LLPTAC <sub>j</sub>	-0.907*	-1.054*	-0.743**
OETAC <sub>j</sub>	1.245*	1.048*	0.0286*
<b>Observations</b>	<b>2262</b>	<b>1718</b>	<b>544</b>
<b>R2</b>	<b>0.258</b>	<b>0.3074</b>	<b>0.1763</b>

Notes: \* and \*\* indicate significance at the 1% and 5% levels, respectively.

It can be seen from Table 3 that cost inefficiency is positively related to asset size whereas bank lending appears to be inversely related to inefficiency suggesting that efficient banks are more successful in expanding their loans business. Evidence on the relationship between bank liquidity and inefficiency is mixed. Inefficient Islamic banks maintain higher liquidity level while inefficient conventional banks maintain lower level of liquidity which makes them more prone to bank runs. Viewing the country-specific

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indicators, overall it seems that banking system liquidity and banking system operating cost are positively linked to inefficiency while loan loss provision is negatively related to inefficiency. However the relationship does not vary across two types of bank. Nevertheless, the main findings from Table 1 and 2 prove that bank inefficiency and risk are positively related for conventional banks and inversely related for Islamic banks which clearly highlight the inherent difference between risk–efficiency relationships between these two distinct bank types.

It needs to be emphasized here that this research was focused on examining the risk–efficiency relationship for conventional banks and Islamic banks under dual banking system and not on changes in the relationship over the sample period. Keeping this in mind, we have not controlled for yearly dummies as well as not verified for changes in risk–efficiency relationship over the period.

## 5. Conclusion

This paper has looked at the risk–efficiency relationship of dual banking system for a large sample over the period 2000–2010. Overall our results suggest that cost efficiency scores for the conventional banking industry is higher than Islamic banking sector while, Islamic banks profit efficiency scores have outperformed conventional banks profit efficiency scores. Results also suggest that not accounting for environmental factors can significantly bias the cost and profit efficiency scores. Countries with better regulatory framework for dual banking system showed an improvement in efficiency scores while accounting for environmental factors. Inefficient conventional banks tend to have higher loan loss reserves. While inefficient Islamic banks still maintain lower risk level due to cost constraints weakness which restricts the ability of inefficient Islamic banks to take on more risks. Similarly the positive correlation between bank size and efficiency suggests that Islamic banks would be more cost and profit efficient if they were larger. Thus regulators in dual banking system should insure that Islamic banks can become and remain highly capitalized to achieve highest efficiency levels.

Bank efficiency studies in dual banking setting are important to set specific growth mechanism to promote both types of bank to achieve the highest cumulative efficiency of overall banking system. The study findings will contribute to governments' policy reviewing the performance of banks in dual banking system which can impact licensing of new conventional and Islamic banks. To the best of knowledge of researcher by far this is the most comprehensive investigation of dual banking system. This paper also substantiate the importance of alternative banking system in the form of Islamic banking which has experienced thirty two fold growth in the last three decades. Empirical results validate some of the myths and hypes surrounding Islamic banking system which can lead to more rigorous research in this emerging financial system.

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