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What determines efficiency in MENA banks?

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ABSTRACT

This paper has analyzed cost efficiency and its determinants in Middle Eastern and Northern African (MENA) countries during the 2005–2012 period. Our results have shown that cost efficiency is positively related with economic performance, but the level of concentration and market share has a negative influence on the former, thus supporting the Quiet Life Hypothesis. We have also found support for the competition-inefficiency hypothesis, which may be explained by lower loyalty between customers and banks. At the individual level, size shows the importance of economies of scale and the level of capital also produces a positive effect. The effects on market structure are more important in the crisis period than before it. Turning to country-level variables, inflation and GDP are positively related to total cost function. Therefore, banking policies should promote profitability, capitalization and growth while at the same time controlling excessive concentration and competition.

1. Introduction

Banks contribute significantly to economic activity, particularly in developing countries, where they represent the main channel for the flow of capital. Therefore, the efficiency of the banking system has become a strategic issue in order to enhance the effectiveness and the resilience of the financial system. The globalization of financial markets and institutions, which has been accompanied by government deregulation, financial innovations, the information revolution and technological change, has created a competitive banking environment and modified the financial system. Due to these developments and changes in the modern banking field, banks are trying to operate more efficiently in terms of cost and profit in order to be competitive.

During the last few decades there have been many studies conducted to investigate and analyze the efficiency of the banking sector. Most of these studies have covered developed countries (Altunbaş, Gardener, Molyneux, & Moore, 2001; Andries & Capraru, 2014; Berger & Humphrey, 1997; Casu & Molyneux, 2003; Dietsch & Lozano-Vivas, 2000; Pasiouras, 2008; Weill, 2003). More recently, there have been some studies on transition countries (e.g., Bonin, Hasan, & Wachtel, 2005; Diallo, 2018; Du & Sim, 2016; Fries & Taci, 2005; Kasman & Yildirim, 2006; Lin, Doan, & Doong, 2016; Pelletier, 2018). However, empirical research on bank efficiency in Middle Eastern and North African countries (MENA) appears relatively scarce. In this region there are many countries with a low degree of development and few regulations, technological delay, and a limited number of banks with only slight levels of efficiency. In this sense, the special interest arises from the fact that in this area there are banks operating in some countries under unstable environments and, in general, with varying market structures and levels of technological and social development as well as government deregulation (Otero, Rodríguez, Martorell, & Merigó, 2016; Otero, Razia, Vivel, & Lado, 2017). All these unstable events have an effect on the banks' and authorities' behavior when it comes to regulation and business models. Another notable aspect on which to focus is Islamic banks, which are different from their conventional rivals with regard to sources of funds, and how they are used; this allows us to make an interesting comparison in efficiency determinants among such firms. For example, Islamic banks constitute 17% of the market share in the United Arab Emirates (UAE), 53% in Saudi Arabia and 24% in Qatar (Nazim & Bellens, 2014). Consequently, studying the differences in efficiency among MENA countries can explain the competitive starting position of each nation, which may also shed light on how prepared they are to adapt to the new changing environment. It should also be mentioned that MENA countries include the Gulf region, which obtains a significant source of funds from crude oil.

The main objective of this study is to analyze the efficiency of the banking industry in MENA countries. We have estimated their cost efficiency and determinants by way of the stochastic frontier approach,

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using panel data of 201 commercial and Islamic banks, covering the period before and after the financial crisis. The purpose of this paper is twofold; firstly, we have estimated stochastic cost frontiers using the true-fixed-effect model proposed by Greene (2005a); secondly, in the following step we have used the Generalized Method of Moments (GMM) model to estimate the effect of market structure and banks' individual features on the efficiency of MENA countries, taking into consideration the effect of the financial crisis.

Our paper has added value because it explores a region that is currently undergoing substantial reforms such as proposals to deregulate banks and improve competition. The characteristics of the region, with varying rates of technological and market development, competitor numbers and levels of efficiency can help to evaluate the validity of traditional studies using a broader and more comprehensive framework than in the past. In addition, our study further contributes to the general understanding of the determinants of bank efficiency and the results have implications for policy makers in terms of potential changes in the institutional environment of the MENA banking industry.

The paper is structured as follows: in the next section, we review the related literature and develop the hypothesis; section 3 examines the data, model and variables for the estimation of efficiency; section 4 explains the determinants of efficiency, the hypothesis, the model and the results; finally, section 5 contains the conclusions and policy implications.

2. Previous research

In emerging countries and in the Middle East, efficiency has been analyzed in several studies. Many papers have focused on technical efficiency measurement. For example, Karim (2001) used a sample containing banks from Indonesia, Malaysia, the Philippines and Thailand, from 1989 to 1996. The study found that the technical efficiency scores gathered were notably different and there was also much variety among the sample countries. On this topic, Weill (2003) studied the technical efficiency of banks in two transition countries (31 Polish banks and 16 Czech banks), finding important differences depending on the banks' characteristics. Grigorian and Manole (2006) examined the technical efficiency of banks in 17 transition economies from 1995 to 1998. Their results showed that efficiency scores were dependent on the output variables used in the analysis. Other papers have also considered cost efficiency, like Ahmad (2000), Ariff and Can (2008), Said (2012), Sarsour and Daoud (2015), Turk Ariss (2008) and Wu, Li, Fan, Wang, and Wu (2018). Furthermore, Said (2012), Lin et al. (2016) and Diallo (2018) considered the effect of the financial crisis on the banking sector. In general, all the studies found that efficiency had improved during the period of study, in some cases as a consequence of the liberalization process (Bdour and Al-khoury, 2008; Chen, Kim, Nofsinger, & Rui, 2007; Lin et al., 2016), with the exception of Sarsour and Daoud (2015) who observed that the technical efficiency of banks in Palestine was in decline as a consequence of the lower allocative efficiency.

Furthermore, most studies evaluated certain efficiency determinants at the same time. Size might well be the most common factor included in the papers, with mixed results. In respect of this, Ahmad (2000) evaluated the cost and profit efficiency of 20 banks in Jordan from 1990 to 1996 using both non-parametric (DEA) and parametric (SFA) techniques. The results unveiled that the large banks were more profit-efficient than the others. Similarly, Limam (2001) considered the technical efficiency of eight banks in Kuwait from 1994 to 1999, using the SFA approach, with findings indicating that the larger the bank, the better the efficiency. Nevertheless, Chen et al. (2007) estimated the cost and technical and allocative efficiency of 43 Chinese banks from 1993 to 2000 showing that large and small banks ran better than medium-sized ones. Moreover, Darrat, Topuz, and Yousef (2002), using a sample of eight banks operating in Kuwait, found that the smaller the bank, the more competent it appeared than large ones. The same finding was presented by Sarsour and Daoud (2015) who pointed out that large banks had lower cost efficiency than their smaller counterparts, which indicated the presence of diseconomies of scale for Palestinian companies.

Another common topic has been the difference in efficiency between foreign and domestic banks, again with mixed results. Weill (2003) found that foreign banks in transition countries were more technically efficient than domestic ones. His result was in line with Bonin et al. (2005) and Cevik, Dibooglu, and Kutan (2016), who showed that foreign ownership was associated with higher banking efficiency. Along similar lines, Lin et al. (2016) studied the relationship between bank ownership and cost efficiency in twelve Asian developing economies. By using the stochastic frontier approach to estimate bank efficiency scores during the 2003–2012 period, the results indicated that foreign presence had improved bank efficiency, primarily in countries with high financial freedom. Nevertheless, the study carried out by Al-Tamimi and Hussein (2008), which examined bank performance in the United Arab Emirates (UAE) from 1997 to 2001 showed that most UAE commercial banks were poorly run and domestic banks were better organized than foreign ones. Similarly, Turk Ariss (2008) analyzed cost efficiency in Lebanese banks following a period of deregulation, using the SFA approach, discovering that domestic banks were as efficient as their foreign rivals'.

In addition, state-owned banks have attracted the interest of researchers. Ariff and Can (2008) examined cost-and-profit efficiency for Chinese commercial banks. 28 banks were included in the study from 1995 to 2004, with results showing that non-state-owned banks were more efficient than state-owned ones. In this context, the study made by Yao and Jiang (2010) between 1995 and 2008, using the One-step SFA approach, found that Chinese joint-stock commercial and city commercial financial institutions performed better than state-owned commercial ones. Nevertheless, previous findings were contradicted by Dong (2010), who analyzed the cost efficiency of Chinese banks over the liberalization period 1994–2007 by using the SFA and the DEA. His results revealed that state-owned banks were more efficient than their domestic private counterparts.

Other studies have chosen more specific topics, such as the effect of bank efficiency on growth during financial crises (Diallo, 2018) and the relationship between efficiency and risk (Said, 2013), the latter finding that credit risk and operational risk correlated negatively with efficiency. Nevertheless, little is known about the effect of market structure on the efficiency of banks. Kasman and Carvallo (2013) was the only study which evaluated the cost-and-revenue efficiency scores for Latin American and Caribbean countries (fifteen in total), providing evidence that market concentration was positively related to efficiency and that competition forces banks to be more cost efficient. On the same subject, Alhassan and Ohene-Asare (2016) found a positive effect of competition on cost efficiency in 26 Ghanaian banks from 2004 to 2011. As a consequence, the effect of market structure combined with other bank-level variables is still an unanswered question in MENA Countries. Table 1 shows a summary of the main contributions in emerging countries and in the Middle East.

3. Data and methodology for efficiency measurement

Our data has been taken from Bankscope and covers the 2005–2012 period with 201 banks from Middle Eastern and Northern African (MENA) countries. We believe that the period in question meets the ideal conditions for the analysis since it combines high-risk environments with a wide range of economic and financial circumstances among the nations studied. In addition, we have analysed the effect of the financial crisis taking into account the periods immediately before and after 2007. We have merged the data collected at firm level with country-level macroeconomic data from the World Bank; this means that we have taken the information available from the Bankscope database into consideration. In this study, we have examined cost

Table 1
Main articles used in the study.

Author(s)	Data	Period of study	Methodology	Type of efficiency analysed	Conclusions
Karim (2001)	Four Asian countries	1989–1996	SFA	Technical efficiency	There is significant difference in mean technical efficiency scores across the countries, and the highest score for technical efficiency was in Thailand, whereas the lowest one was in the Philippines.
Weill (2003)	Two transition countries: Poland and the Czech Republic	1997	SFA	Technical efficiency	Foreign banks in transition countries were more technically efficient than domestic banks.
Bonin et al. (2005)	225 banks in eleven transition economies	1996–2000	SFA	Technical efficiency	Foreign banks were more technically efficient than domestic banks.
Chen et al. (2007)	43 Chinese banks	1993–2000	DEA	Cost, technical and allocative efficiency	The study shows an improvement in the efficiency of Chinese banks after a program of deregulation in 1995, and the large state-owned banks and smaller banks were more efficient than medium sized banks.
Grigorian and Manole (2006)	17 transition economies	1995–1998	DEA	Technical efficiency	Model A's technical efficiency ranged from 23.7% for Belarus, and 79.9% for Czech-Republic, while B's technical efficiency ranged between 15.5%, for Belarus and 84.3% for Slovenia.
Ariff and Can (2008)	28 Chinese banks	1995–2004	Non-parametric approach and the second-stage Tobit regression	Cost and profit efficiency	Joint-stock banks were more efficient than state-owned banks, and the study also recommended opening up the banking industry as soon as possible, because this was associated with an increase in the efficiency of Chinese banks.
Dong (2010)	Chinese banks	1994–2007	SFA and DEA	Cost efficiency	Both state owned banks and foreign ones were more efficient than their domestic private counterparts, and larger banks tended to be relatively more efficient than smaller ones.
Ahmad (2000)	20 Jordanian banks	1990–1996	SFA and DEA	Cost and profit efficiency	Large banks were more profit-efficient than other banks. Additionally, the efficiency scores obtained using DEA were higher than those acquired from the SFA.
Turk Ariss (2008)	Lebanese banks	1990–2001	SFA	Cost efficiency	Domestic banks were found to be as efficient as foreign banks, and the average cost inefficiency of Lebanese banks was slight (at around 12%).
Said (2013)	32 Islamic banks in MENA countries	2007–2009	DEA	Technical Efficiency	Islamic banks in MENA countries as a whole were technically inefficient. However, Islamic banks in Gulf countries in the main showed higher levels of pure technical efficiency and scale efficiency scores compared with Islamic banks in North African countries and other MENA nations.
Sarsour and Daoud (2015)	Palestinian banks	2000–2009	SFA	Cost and technical efficiency	The overall cost (technical) efficiency of banks in Palestine was declining.The mean of cost and technical efficiency was found to have been deteriorating for several years.
Alhassan and Ohene-Asare (2016)	26 Ghanaian banks	2004–2011	DEA	Cost efficiency	Competition exerts a positive influence on cost efficiency.
Wu et al. (2018)	16 commercial Chinese banks	2007–2014	VIKOR aggregate model	Productive efficiency	Banking efficiency improved during the study period and the efficiency gap narrowed during this time.

efficiency rather than technical efficiency. According to Pasiouras (2008), cost efficiency is a wider concept than technical efficiency, since the former refers to both the technical and the allocative aspects. Isik and Hassan (2002) defined the term as a measure of how far the bank's cost was from the one with the best practices if both were to produce the same output under identical environmental conditions. This was measured as the ratio between the minimum cost for which it was possible to attain a given volume of production and the observed costs for the firm. As with many other studies, the intermediation approach is applied in order to measure efficiency, which assumes that the main function performed by a bank is to intermediate funds between depositors and borrowers at the lowest possible cost (Gilbert & Wilson, 1998; Isik & Hassan, 2002). According to the intermediation approach, banks produce two outputs (loans, and other off-balance sheet activities), and employ three inputs (capital, deposits and labor), all variables measured in millions of US dollars.

3.1. Variables

Regarding the price of capital assets (PK), it is noted that many studies measured the price of capital in different ways like McKillop, Glass, and Morikawa (1996), who calculated it as a ratio of (real yen) non-personnel expenses to the (real yen) value of movable and immovable capital. The price of capital (PC) is calculated as "other operating expenses divided by total assets", following Sarsour and Daoud (2015). This is used due to the unavailability of data on yearly depreciation. Price of labor (PL) is calculated as "total salaries and staff expenses divided by total assets". Price of deposits (PD) is measured as "interest expenses divided by total customer deposits".

Concerning control variables (Table 2), we added country-level variables that might affect the level of total cost in a country. We have included GDP growth and GDP per capita, like Fries and Taci (2005), because these indicators serve as a proxy measure for the overall level of development, covering the quality of state institutions and the level of skills. Costs may decrease with overall development because of corresponding improvements in the quality of institutions. This indicator is expected to be negatively associated with total costs. Thirdly, the rate of inflation affects interest rates so that the higher these variables, the lower the bank's efficiency is in activities such as risk management and credit screening. In the paper on profit efficiency in the banking industry of four new European Union member states, Koutsomanoli-Filippaki, Mamatzakis, and Staikouras (2009) showed that banks in high-inflation countries usually have drops in profits.

3.2. Methodology for efficiency

We have used the Stochastic Frontier Analysis (SFA), as developed by Aigner, Lovell, and Schmidt (1977), to estimate the cost efficiency frontier. The main advantage of the SFA over the DEA is that it allows us to distinguish between inefficiency and other stochastic shocks in the estimation of efficiency levels. In addition, by using this model, it is easier to add control variables in the equation than in non-parametric techniques. Hence, this approach allows us to compare efficiency among countries, and that of conventional and Islamic banks. The stochastic frontier for cost is estimated using Greene (2005a) models, which permits the inefficiency term to follow a distributional form. This study has considered the estimation of Greene's "true" fixed-effects (TFE) model (2005a) in trying to solve the incidental parameters problem. Greene's models can be estimated using maximum likelihood estimation methods, which are referred to as "true frontier models" in that they are a straightforward extension of the original frontier framework (in line with Aigner et al., 1977) for panel data. Thus, as formulated, the inefficiency term remains in the model and the fixed effect is only intended to capture firm-specific heterogeneity. Finally, the preference for the SFA (parametric approach) over the DEA (non-parametric approach) is justified on the grounds that even though the DEA imposes less structure on the efficiency frontier than the SFA, it has the drawback of not allowing for random errors, data problems or other measurement errors. Mamatzakis, Staikouras, and Koutsomanoli-Filippaki (2008) argued that applying the DEA in transition economies is a significant disadvantage because uncertainty and measurement problems loom large. Nevertheless, the SFA does allow for measurement error generating firm-specific efficiency estimates, which are important for bank managers in order that they can improve their operational efficiency. The Stochastic Frontier Analysis (SFA) was developed by Aigner et al. (1977) to estimate cost efficiency. This model, as is well known, specifies the optimal combination of inputs that lead to maximum output, or to paraphrase that, it "determines" the maximum potential output with minimum costs. The main features of this model permit us to deal with multiple outputs or quasi-fixed inputs. A general form of the minimum cost function (also known as the cost frontier) can be written as:

$$TCi \geq TC* = f(Q_i, W_i, \beta), \quad i = 1, \cdots, I, \tag{1}$$

where TC_i is the observed total cost of the individual bank i, Q_i is a vector of the outputs of bank i, W_i is an input price vector of bank i, $f(Q_i, W_i, \beta)$ is the cost frontier common to all banks representing the minimum cost of producing outputs Q_i when the banks face input prices W_i, and β is a vector of the technology parameters to be estimated. Cost efficiency (CE) is measured in relation to the efficient cost frontier, which is defined as the ratio of the minimum cost to the cost actually incurred. Thus, if the cost incurred in producing a given output level equals TC but the technically efficient combination of factors of production which minimize costs for this output level is TC^* then the cost efficiency of the firm will be $CE = TC^*/TC$. This in turn implies that it would be possible to produce the same output bundle under the same conditions with a saving of (1-CE). Failure to attain the cost frontier may be due to either technical or allocative inefficiency (or both). Because the cost frontier is deterministic, such a formulation ignores measurement errors and other sources of statistical noise and all deviations from the frontier are attributed to inefficiency.

In order to estimate the cost efficiency of banks, a transcendental

Table 2
Summary of variables and hypothesis predictions.

Variable	Prediction	Definition	Source
	TC		
Total cost (C)	Dependent variable	Total cost includes the interest expenses (PD), personnel expenses (PL), and other operating expenses (PC)	Bankscope, Authors' calculation
Output quantities	+/−	Gross loans of bank and off-balance sheet items (OBS)	Bankscope
Input prices	+/−	Price of capital, price of labour and price of deposits	Bankscope, Authors' calculation
Control variables			
GDP per capita	+	Annual GDP per capita	(IMF) database
GDP growth	+	Annual GDP growth rate	(IMF) database
Inflation rate	+	Annual inflation rate	(IMF) database
Years [Year]		Year dummies	

logarithmic (Trans-log) stochastic frontier functional form has been employed in this study. The general form of the cost frontier model is:

$$C_{it} = \beta x_{it} + (v_{it} + u_{it}) \cdots\cdots i = 1, \cdots, i, \; t = 1, \cdots T \tag{2}$$

where *Cit* is total cost in logarithm form of bank *i* in period *t*; *xit* is a matrix of outputs, price of inputs, and input quantity independent variables in logarithm form and β is a vector of unknown parameters. The random errors *vit* are assumed to be uncorrelated across time and panel, and normally distributed with mean zero and variance σ_V. The component *uit*is assumed to have a strictly non-negative distribution (often referred to as the inefficiency term) and it is provided by a truncated-normal distribution with mean $\mu+$ and variance $\sigma\mu^2 > 0$ (Berger & DeYoung, 1997). The sum $(vit + uit)$ reflects technical and economic inefficiencies, as well as pure random shocks in the production process that is probably due to careless handling and defective or damaged output. It also reflects unfavorable external events such as bad luck, climate, and machine performance (Aigner et al., 1977).

The technical inefficiency term (u_{ht}) is defined as follows:

$$(u_{ht}) = \exp(-\eta(t - T))u_h \tag{3}$$

where technical inefficiency (*uht*) either decreases, increases or remains constant over time depending on the values of η.

The stochastic frontier model parameters are estimated with the Maximum Likelihood (ML) method. The stochastic cost function, which is defined by Kraft and Tırtıroğlu (1998) as the transcendental logarithmic functional form of stochastic cost frontier specification is as follows:

$$\begin{aligned} LnCit &= \alpha 0 + \sum_{i=1}^{2} \alpha i LnQit + \sum_{m=1}^{3} bmLnPmt + \frac{1}{2}\sum_{n=1}^{3}\sum_{m=1}^{3} \alpha nmLnPmtLnPn \\ &\quad t + \frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{2} \beta ijLnQitLnQjt + \sum_{i=1}^{2}\sum_{m=1}^{3} \delta imLnQitLnPmt \\ &\quad + \sum_{i=1}^{4} \varphi iLnZi + vit + uit \end{aligned} \tag{4}$$

where subscript *i* denotes the cross-sectional dimension (banks); *t* stands for the time dimension; *LnCit*is the natural logarithm of total costs for a panel of *n* banks and time *t*; *LnQit* is the natural logarithm of bank outputs (total loans and total off-balance sheet); *LnPm* is the natural logarithm of the *m*th input price (i.e. labor, capital, and loanable fund); *αi*, *bm*, *αnm*, *βij*, *δim* and *φi* are coefficients to be estimated; finally, *Zi* stands for a set of control variables, namely equity, GDP growth, GDP per capita and inflation.

3.3. Results for efficiency measurement

Our results indicate a good fit and the signs of estimated coefficients are in line with those proposed below (Table 3). We can clearly observe that the price of deposits, loans, cross-output term, cross-price term and equity are significant and have a negative impact on total cost. Price of labor, off-balance sheet activities, GDP per capita, GDP growth and inflation are significant too, although they have a positive impact on total cost. Our results for inflation are in line with those of Kasman and Yildirim (2006), who highlighted that inflation increases cost and reduces profits as banks tend to compete via expanding branch networks. Furthermore, inflation increases bad debts, and therefore, makes banks bear additional costs to cope with them, which increases their inefficiency. The same happens with GDP per capita. Maudos, Pastor, Perez, and Quesada (2002) argued that high GDP per capita is associated with high demand for financial products from the financial system, resulting in more profit for banks but at the same time, forcing banks to have less control over their expenses, which yielded to an increase in bank inefficiency. The result is also consistent with Berger and Mester (1997), Dietsch and Lozano-Vivas (2000) and Pasiouras (2008), who suggested that in a more developed economy, banks incur higher financial and operating costs but could have higher demand for their financial products.

Table 3
The cost frontier function parameter estimates.

Variable	Model EFF
LnLOAN	−0.0426***
lnOBS	0.2661***
lnPK	0.0872***
lnPL	0.8102***
lnPD	−0.2729***
0.5 * ln(Loan)2	0.1678***
0.5 * ln(OBS)2	0.0442***
0.5 * ln(PK)2	0.0655***
0.5 * ln(PL)2	0.2161***
0.5 * ln(PD)2	0.0762***
lnLOAN * lnOBS	−0.0645***
lnPK * lnPL	0.0182***
lnPK * lnPD	−0.0527***
lnPL * lnPD	−0.0683***
lnLOAN * lnPK	0.0225***
lnLOAN * lnPL	0.0659***
lnLOAN * lnPD	−0.1009***
lnOBS * lnPK	0.0112***
lnOBS * lnPL	−0.1059***
lnOBS * lnPD	0.1222***
lnGDPpercap	0.1236***
Gdpgrowth	−0.0012***
Inflation	0.0061***
_cons	−2.5479***
Observations	1612
Loglikelihood function	351.11

Note: This table reports panel stochastic frontier estimates based on Greene (2005b). The outputs in the function are loans and off-balance sheet and the inputs are labour, deposits, and capital. Their prices are represented by the price of capital, PL, and PD. Year dummies have been included. The asterisk codes ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

The results presented in Table 4 show the average cost efficiency of banks in MENA countries. The overall average cost efficiency during the 2005–2012 period was around 77%. This implies that during the period of study, the average bank in MENA countries was able to reduce its costs by 23%. This result is close to what Olson and Zoubi (2008) obtained when analyzing cost-and-profit efficiency in MENA banks from 2000 to 2008 and found that average cost efficiency was around 73%. Additionally, the level of cost efficiency may well be due to the level of development in said location's banking systems. In fact, Said (2013) indicated some problems with resource allocation in MENA countries (see Table 5).

The Table 4 also demonstrates that average cost efficiency increased throughout those years, albeit slightly, going from 70% in 2005 to 76% in 2012. Nonetheless, when we analyze the evolution along the period, we can observe an increase in cost efficiency at the beginning of the crisis, but then there is a drop after 2010. Andries & Ursu (2016) show how the crisis had a significant and negative impact on cost efficiency for commercial banks from the EU in the 2004–2010 period. The different pattern in the case of MENA countries could be explained by the fact that the financial crisis had less of an impact on this area, cost efficiency starting to decrease later owing to the *Arab Spring*. The lack of global integration for some financial systems could have alleviated the adverse impact of the crisis on the efficiency of the financial sector. However, after 2010, the effects of the Arab Spring led to lower growth rates and to the reduction of efficiency in the financial markets (Acemoglu et al., 2017).

When scrutinizing efficiency scores among the countries researched, the results indicate a noticeable variation in average efficiency, which encompass many differences such as the number of banks, input

Table 4
Efficiency scores by country, year, and bank type (2005–2012).

Country	2005	obs	2006	obs	2007	obs	2008	obs	2009	obs	2010	obs	2011	obs	2012	obs	Mean of Eff
Algeria	0.56	8	0.61	7	0.68	7	0.72	10	0.95	7	0.84	2	0.95	3	0.88	4	0.74
Bahrain	0.66	15	0.74	15	0.71	13	0.75	19	0.71	19	0.73	21	0.80	22	0.78	19	0.73
Egypt					0.79	1	0.99	4	0.81	15	0.84	28	0.86	27	0.92	26	0.87
Iraq	0.33	2	0.99	1	0.80	2	0.68	3	0.60	3	0.78	3	0.75	5	0.83	2	0.71
Iran	0.65	6	0.66	8	0.60	7	0.88	8	0.77	9	0.85	9	0.71	3	0.73	3	0.74
Israel	0.78	10	0.80	10	0.89	10	0.93	9	0.92	8	0.86	6	0.90	8	0.89	8	0.86
Jordan	0.66	15	0.73	17	0.81	15	0.85	15	0.94	16	0.88	16	0.86	17	0.84	16	0.82
Kuwait	0.69	17	0.76	19	0.71	16	0.62	15	0.62	16	0.69	17	0.64	15	0.64	13	0.67
Lebanon	0.76	21	0.84	22	0.87	20	0.84	22	0.79	20	0.79	20	0.76	21	0.66	20	0.79
Libya	0.28	2	0.32	2	0.83	2	0.99	1			0.99	1	0.82	1	0.56	1	0.62
Morocco	0.85	6	0.68	8	0.58	9	0.78	8	0.62	8	0.75	8	0.69	8	0.69	6	0.69
Oman	0.82	6	0.76	6	0.83	10	0.80	10	0.89	10	0.80	9	0.78	10	0.75	9	0.80
Qatar	0.83	7	0.69	9	0.72	9	0.71	10	0.80	9	0.87	10	0.73	9	0.54	10	0.73
Saudi Arabia	0.71	12	0.86	12	0.79	13	0.82	13	0.79	14	0.77	14	0.73	14	0.61	13	0.76
Sudan	0.75	7	0.70	8	0.69	8	0.83	7	0.81	6	0.82	8	0.74	7	0.71	5	0.76
Syria	0.67	1	0.99	2	0.90	5	0.90	5	0.95	4	0.86	4					0.90
Tunisia	0.69	17	0.76	17	0.79	15	0.88	18	0.87	21	0.87	20	0.87	19	0.83	19	0.82
United Arab Emirates	0.75	21	0.73	23	0.71	25	0.65	23	0.73	23	0.76	24	0.77	23	0.80	22	0.74
Yemen	0.26	2	0.38	3	0.46	4	0.69	7	0.72	6	0.75	5	0.97	4	0.85	3	0.67
Bank type																	
Conventional banks	0.71	147	0.74	156	0.76	158	0.77	175	0.79	178	0.81	186	0.81	185	0.79	170	0.78
Islamic banks	0.66	25	0.74	32	0.71	33	0.82	32	0.80	36	0.74	39	0.71	31	0.65	29	0.73
Overall mean	0.70	172	0.74	188	0.75	191	0.78	207	0.79	214	0.80	225	0.79	216	0.76	199	0.77

expenses, and other country level variables like GDP per capita. It has been noted that the minimum values of average cost efficiency in Kuwait and Morocco were 67% and 69% respectively, which implies that the countries did not control their costs enough. At the same time, it should be clear to see that Egypt, Israel, Jordan, Tunisia and Oman ranked highest for efficiency against the other countries, obtaining scores of 87%, 86%, 82%, 82% and 80%, respectively. Also noteworthy are the Gulf countries, which had, on average, less fluctuation in efficiency scores throughout these years compared with the rest of the countries in the sample study; this implies that that area was much more capable of controlling their costs between the abovementioned period than the other nations.

Moving on to the efficiency of conventional banks compared with Islamic ones, as regards the cost aspect, the former were, on average, better than the latter. The mean cost efficiency score was 78% for conventional banks while it was 73% (the same as in the Olson & Zoubi, 2008 study) for Islamic entities. Our findings are in line with Rosly and Bakarn (2003), who noted that conventional banks were more efficient than their Islamic equivalents. Kamaruddin, Safab, and Mohd (2008) revealed that Islamic banks in Malaysia during the 1998–2004 period were two times more inefficient than the best-practice banks. This inefficiency can be explained by the lack of economies of scale associated with the lesser size of Islamic banks when compared with conventional ones. In addition, according to Olson and Zoubi (2008), the inefficiency of Islamic banks may have been due to their customers being predisposed to Islamic products regardless of cost. According to Sarsour and Daoud (2015), the firms provided their banking services in accordance with Sharia law, or Islamic law, and adopted the principle of Musharakah (partnership in profit and loss), which imposed a greater risk on their accounts because of higher levels of uncertainty.

4. Determinants of banking efficiency

Following the estimation of efficiency, the main objective of this section is to investigate the determinants of banking efficiency in MENA countries. We are mainly interested in the effect of market structure (competition, concentration and market share) and other relevant individual variables, like size, level of equity, growth and type of bank, on efficiency, considering the overall period and the effect of the recent financial crisis. To achieve this goal, this article has focused on the following hypotheses:

According to the Efficiency Hypothesis (EH), only the most well-run companies survive, so a highly-concentrated market structure is caused by a process of efficiency improvement (Demsetz, 1973) and is positively related with performance. The EH was proposed by Demsetz (1973) and again by Brozen and Bittlingmayer (1982). Berger (1995) divided the efficient-structure theories into two hypotheses: X-efficiency and scale efficiency. The first argued that higher profits for banks were associated with better management and practices to control costs, therefore bringing them closer to Best Practice. Ye, Xu, and Fang

Table 5
Summary of variables and predictions.

Variable	Prediction	Definition	Source
	Efficiency		
Eff	Dependent variable	Cost efficiency of bank	Bankscope, Authors' calculation
ROAA	+	Return on average assets	Bankscope
HHI	−	Herfindhal Index	Bankscope, Authors' calculation
H	−	H statistic competition index	Bankscope, Authors' calculation
MS	−	Market share in percent	Bankscope, Authors' calculation
Log (Equity)	+	Log of equity capital ratio	Bankscope
Log (Assets)	+	Log of total assets	Bankscope
Growth	+	Rate of growth gross loans	Bankscope, Authors' calculation
Dummy Islamic	+/−	Islamic banks = 1, and Conventional banks = 0	Bankscope, Authors' calculation
Years [Year]		Year dummies	

(2012) argued that banks which were efficient would end up performing better. The second hypothesis stated that some firms were able to operate on a more efficient scale than others with equally good management and technology, i.e., they functioned at a lower cost because of local circumstances and therefore gained higher profits. What is more, the most profitable banks have more resources at hand to invest in efficiency improvement. Consequently, under this theory, a positive relationship between profitability and efficiency must be found. Based on the ES theory, we proposed the following hypotheses:

H1. Bank efficiency is positively related to bank profitability.

The Quiet Life Hypothesis (QLH), developed by Hicks (1935), suggested that banks, instead of extracting rents in a concentrated market, made an inefficient allocation that negatively affected performance; the lax stance of the monopolist allowed banks not to be worried about cost efficiency. Thus, under this hypothesis, a negative relationship between efficiency and market structure variables is established; higher degrees of efficiency can be found in markets with low concentration and in firms with a small market share (MS). This evidence was supported by Berger and Hannan (1998), who found that banks in more concentrated markets were less cost efficient than those with more competitors. According to the authors, several reasons explained this relationship, like the higher prices they were able to charge owing to the market being less competitive, the resources invested to maintain market power or the interest in other strategic goals. Nevertheless, the results are mixed. For instance, Koetter and Vins (2008) found a negative relationship between cost efficiency and the Lerner index, supporting the QLH while Homma, Tsutsui, and Uchida (2014) found that market concentration eroded banks' cost efficiency. Additionally, Almounsor and Mensi (2016) obtained results showing that market power determined bank efficiency in the Saudi banking sector, thus supporting the QLH. However, Williams (2012) tested the 'quiet life' for a sample of 419 Latin American commercial banks between 1985 and 2010, rejecting the hypothesis and finding that bank restructuring promoted competition and yielded gains in efficiency. More recently, Färe, Grosskopf, Maudos, and Tortosa-Ausina (2015) came across the discovery that for the banking industry the QLH only operated for some financial institutions because the results varied depending on the level of market power and the type of bank.

H2. Market concentration has a negative impact on cost efficiency.

H3. Market share has a negative impact on cost efficiency.

In terms of the relationship between competition and efficiency, there are two main arguments: the competition-inefficiency hypothesis and the competition-efficiency hypothesis. The former hypothesis was supported by the empirical studies of Evanoff and Ors (2002), and Kumbhakar, Lozano-Vivas, Lovell, and Hasan (2001). These studies indicated that the more banks there were competing, the worse their efficiency would be, for several reasons: firstly, as mentioned by Boot and Schmeits (2006), in a competitive environment, the relationship between customers and banks was more unstable and short-lived; secondly, in a competitive environment, clients tended to switch to another financial institution, due to amplified asymmetric information. On the other hand, in the other hypothesis, the positive impact of competition on efficiency was supported by Chen et al. (2007), and Dick and Lehnert (2010). Because competition encourages banks to specialize in certain types of loans and niches of borrowers (Zarutskie, 2013), it also induces bank managers to adapt their lending technologies. Recently, Otero et al. (2017) have found a positive relationship between competition and concentration in MENA countries in line with Claessens and Laeven (2004) and Liu, Molyneux, and Wilson (2013).

H4. Market competition has a negative impact on cost efficiency.

Regarding equity, well-capitalized banks are more efficient than their poorer counterparts in terms of cost efficiency. This finding can be explained by higher levels of equity reducing the probability of financial distress, which reduces costs by lowering the risk premium (Berger & Di Patti, 2006). In addition, some studies like Isik and Hassan (2002) found that high capital requirements increased the efficiency of banks. In contrast, Staikouras, Mamatzakis, and Koutsomanoli-Filippaki (2008) and VanHoose (2007) reported a negative relationship between capital adequacy and profit efficiency. They explained this result as being due to the fact that banks, in light of stricter capital standards, were highly likely to decide to switch loans with other less risky assets (e.g., government securities), leading to a possible drop in profit for banks.

H5. Bank Equity has a positive impact on cost efficiency.

In terms of the size of banks, Perera, Skully, and Wickramanayake (2007), argued that large banks were more cost efficient than small ones, because the former had the ability to increase their revenue with fewer costs. However, some studies found no efficiency advantage for large banks (Berger & Mester, 1997) or even a negative relationship between efficiency and size (Allen & Rai, 1996; Christopoulos, Lolos, & Tsionas, 2002). Nonetheless, there is more literature that has identified some empirical evidence for the existence of economies of scale in banking. For example, Hughes, Mester, and Moon (2001) found economies of scale that increased with size, once the risk-taking and capital structure were under control in the bank's production function. Feng and Serlitis (2010) also highlighted the existence of economies of scale in U.S. banks. Moreover, the study of Drake and Hall (2003) provided empirical evidence for the existence of a strong relationship between bank size and technical efficiency as well as scale efficiency in Japan. In addition, they noticed that bank growth tended to affect bank size. A positive relationship was later found between growth and efficiency (Shehzad, Haan, & Scholtens, 2013).

H6. Bank size has a positive impact on cost efficiency.

H7. Bank growth is positively related with cost efficiency.

We have also incorporated Islamic banks as a dummy variable to monitor the result of the type of bank in terms of profitability. Similarly, Dridi and Hasan (2010) argued that factors related to Islamic banks' business models helped contain the adverse impact on profitability, while weaknesses in risk management practices in some Islamic banks led to a larger decline in profitability compared with conventional banks. Samad (2004) examined the performance of Islamic and conventional banks in Bahrain after the first Gulf War in 1991. The comparison of financial measures, which included several financial ratios, indicated that there was no major difference in profitability and liquidity between Islamic or conventional banks. Empirically, there is no consensus in the literature about the dissimilarities in the performance of the two types of financial institution (Kader et al., 2007; Ramlan & Adnan, 2016) and nor do we consider there to be any difference either.

H8. Islamic banks are no less cost efficient than conventional ones.

5. Model

The GMM model was used to estimate the regression between cost efficiency and other determinants. The Difference and System GMM estimators developed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) were designed for situations with "small T, large N" panels such as ours. They dealt well with independent variables that were not strictly exogenous, i.e. they correlated with past and current realizations of the error, with fixed effects, heteroscedasticity and autocorrelation within individuals (Roodman, 2009). For Difference GMM, all regressors were usually transformed by differencing (also referred to as Arellano–Bond estimation). System GMM is an extension of difference GMM (also referred to as the

Arellano–Bover/Blundell–Bond estimator) which augmented Arellano–Bond by building a system of two equations, the original one and the transformed one, making an additional assumption that the first differences of instrument variables were uncorrelated with the fixed effects. System GMM was invented to tackle the weak instrument problem and allowed for the introduction of more instruments and the improvement of the models' efficiency.

Our model is as follows:

$$EFF_{it} = \alpha_{it} + \beta_1 EFF(t-1) + \beta_2 ROAA_{it} + \beta_3 HHI_{it} + \beta_4 H_{it} + \beta_5 MS_{it} + \beta_6 Equity_{it} + \beta_7 logAssets_{it} + \beta_8 Growth_{it} + \beta_8 Islamic + \sum_{t=2006}^{2012} Year_t \sum Country_t + \varepsilon_{it} \quad (5)$$

where

EFF_{it}- Efficiency of bank i in period t.

$ROAA_{it}$– Return of Assets of bank i in period t.

HHI– Herfindhal index as a concentration measure (proxy of Competition).

H_{it}The H-statistic competition measure.

MS_{it} The market share of bank i in period t.

$Equity_{it}$ The equity of bank i in period t.

$logAssets_{it}$ The natural log of assets of bank i in period t, as a measure of bank size.

$Growth_{it}$ The gross loan growth rate.

Islamic - Dummy for Islamic, if the bank is Islamic = 1, otherwise = 0.

Country - Dummy for country, if the bank operates in this country, otherwise = 0.

6. Results and discussion

As can be seen in Table 6, most coefficients are significant and in line with our expectations. The effect of ROAA is statistically significant and confirms the general notion that profitability is positively related to cost efficiency. Hence, banks with higher profit tend to be more efficient. Similar results were reported in several studies (Isik & Hassan, 2002 for Turkish banks; Pasiouras, 2008 for Greek commercial banks; Perera et al., 2007 for 111 commercial banks in Southern Asia). Our result means that banks with better management and practices to control costs achieved greater profitability, highlighting the importance of cost efficiency for how well the establishments perform in MENA countries. Besides this, the banks which are more profitable have the resources to invest in technology, processes and human resources to increase their cost efficiency. This has also been found in earlier studies such as those by Chortareas, Garza-García and Girardone (2011), Goldberg and Rai (1996), Isik and Hassan (2002), Pasiouras (2008) and Perera et al. (2007), who reported that profitability was inversely related to cost inefficiency.

Table 6
Dynamic panel-data estimation, two-step system GMM.

Variable	Overall	Pre-crisis	Post-crisis
eff (t-1)	0.4696***	0.4085***	0.4250***
ROA_	0.0033*	0.0022	0.0057**
MS	−1.0495***	−1.0801*	−1.1961**
H_statistic	−0.0244*	−0.0158	−0.0271*
HerfindnNEW	−0.3949*	−0.2781	0.0188
EquitytoAssets	0.3571**	0.5236**	0.3745*
lnAS	0.0518***	0.0664**	0.0604**
GrowthGrossLoans	−0.0006	−0.0014***	−0.0005
Islamic	−0.0382	0.1691	−0.1063
Bah	−0.0696	−0.1076	−0.0453
Iran	−0.0125	−0.2118	0.0838
Jord	0.0522	0.0793	0.0329
Kuw	−0.1543***	−0.2303**	−0.1663*
Leb	−0.0273	0.0731	−0.0989
Oman	0.1023*	0.2055	0.0319
Qat	−0.1112*	−0.1596	−0.115
Saudi	−0.1674***	−0.1058	−0.2358**
Sudan	0.1189*	0.1423	0.1069
Emirates	−0.1500***	−0.2157**	−0.1310**
Cons	0.1394	0.0257	0.0659
N	1189	650	874
Hansen	233.5174	121.6489	196.1427
ar2	0.972	1.418	−0.1029

Note: The table reports panel data estimates for system GMM, where the dependent variable is ROAA and GMM style and estimates are robust. Model 3 includes dummies by country, and, as in model 2, it eliminates the size in the model because it is highly correlated with equity and market share. Year dummies are included. Hansen is a test for overidentifying restrictions, asymptotically distributed. Legend: *p < .1; **p < .05; ***p < .01

Another point worth mentioning is that a negative relationship has been found between concentration and cost efficiency. This result supports the Quiet Life Hypothesis, which suggests that the lax stance of the monopolist leads to lack of concern about cost efficiency. The findings are in line with those obtained in other markets and studies like Homma et al. (2014) and Almounsor and Mensi (2016). In terms of the relationship between competition and efficiency the sign is negative and is in line with the expectations of the competition-inefficiency hypothesis. This can be explained by the less stable relationship between customers and banks, and the higher propensity for them to switch to another financial institution (Boot & Shemeits, 2006). Market share is also very significant in all the models and negatively related with cost efficiency; in a concentrated market, firms do not minimize costs because of insufficient managerial effort, lack of profit-maximizing behavior, wasteful expenditures to obtain and maintain a monopoly status, and/or survival of inefficient managers (Berger & Hannan, 1998).

As expected, the equity ratio (Hypothesis 5) has a positive and statistically significant impact on cost efficiency. Hence, the result suggests that well-capitalized banks are more efficient than their less well-off counterparts in terms of cost efficiency (Berger & Di Patti, 2006). This finding can be explained by higher levels of equity that reduce the probability of financial distress, which leads to a reduction in costs (Berger & Di Patti, 2006). This is in accordance with Isik & Hassan (2002), who found that high capital requirements increased the efficiency of banks. In contrast, Staikouras et al. (2008) and VanHoose (2007) reported a negative relationship between capital adequacy and profit efficiency. This, they say, may be as banks, when considering stricter capital standards, sometimes decide to replace loans with other less risky assets (e.g., government securities) which reduce the bank's profits.

The coefficient of *logAssets* is statistically significant and positively related with cost efficiency scores as we proposed in Hypothesis 6. The result means that bank size also has a positive impact on cost efficiency, implying that larger banks are more efficient than smaller ones. Our findings are in line with many studies (e.g., Chu & Lim, 1998 for Singapore banks; Papadopoulos, 2004 for the European banking industry; Pasiouras, 2008 in Greece) which support the positive effects of economies of scale on cost efficiency. The same result has been reported in earlier papers developed in some MENA countries, like Jordan (Ahmad, 2000) and Kuwait (Liman, 2001).

When we consider crisis and post-crisis periods, we observe that, in general, the signs are maintained but competition and concentration are not significant pre-crisis. We can observe that performance is positive only in the crisis period. Therefore, our results show that in boom times, banks pay less attention to controlling costs regardless of the market structure and it is in crisis times when competition and performance is important, which explains the reason for cost efficiency.

As can be seen in Table 7, most of the coefficients are significant and in line with our expectations. In general, concentration, market share and competition have a negative effect on cost efficiency and performance, size and capitalization have a positive effect. Finally, growth and the Islamic variable are insignificant.

Table 7
Summary results of Testing Hypothesis.

Hypothesis		Results
H1	Sign	+
	Significant	Yes
H2	Sign	−
	Significant	Yes
H3	Sign	−
	Significant	Yes
H4	Sign	−
	Significant	Yes
H5	Sign	+
	Significant	Yes
H6	Sign	+
	Significant	Yes
H7	Sign	+
	Significant	NO
H8	Sign	−
	Significant	NO

7. Conclusions and policy implications

This study has investigated the cost efficiency of the MENA banking industry for the 2005–2012 period, using a stochastic frontier model with country-specific variables. The results of the analysis showed that the average cost-efficiency score was 77% and that there was an improvement in the efficiency scores during the period covered. The variation in terms of cost efficiency is a sizeable 19 per cent among the countries. Geographically, Israel (86%) is the most cost-efficient while Kuwaiti banks (67%) are the least. The results also showed that banks in Jordan (82%), Tunisia (82%) and Oman (80%) on average had higher scores compared with other countries. In view of these results, it appears that there is still room for improvement when it comes to bank efficiency in this region.

Relating to the determinants of efficiency, our paper shows the importance of market structure as a main determinant of cost efficiency for the banks operating in the MENA region. In particular, the level of concentration and market share had a negative influence on technical efficiency, supporting the Quiet Life Hypothesis. We also found support for the competition-inefficiency hypothesis, which may be owing to the less stable relationship between customers and banks and the greater likelihood of their searching for better conditions elsewhere. At the individual level, the size of the bank shows the importance of economies of scale and the level of capital also produces a positive effect. Finally, no difference has been found in terms of efficiency between conventional and Islamic banks.

The effects on market structure are more important in the post-crisis period than pre-crisis. In fact, the effect of performance on efficiency is only positive in the crisis period, showing that banks in an expansion phase have other sources available, are not reliant on efficiency to be profitable and are less worried about costs. The same happens with competition, and it is in crisis times that rivalry has a negative impact on cost efficiency. Crisis can force banks to be more aggressive in order to try to capture deposits and this behavior increases the instability of the relationship between the banks and the customers (Boot & Schmeits, 2006). Crisis can also negatively affect the solvency of certain banks, encouraging customers to switch to another financial institution, due to amplified asymmetric information. Therefore, our results show the importance of considering the economic situation in the analysis of cost efficiency.

In this sense, banking policies should promote bank performance, because as we have pointed out, it is positively associated with cost efficiency. Furthermore, monetary authorities and policy makers should adopt policies that can increase the size of MENA banks but at the same time control the level of concentration and competition; this is because according to our analysis, high levels of both market characteristics lead to there being a negative effect on efficiency. Additionally, authorities must boost efficiency in a market expansion phase because this is when banks are less committed to cost efficiency. Finally, capital requirements as well as contributing to the solvency of banks have shown a positive impact on efficiency, supporting rules and regulations like Basel III.

There are limitations to this study. Firstly, our sample is restricted to MENA countries, so it is difficult to generalize the findings because the analysis is context-dependent. Nevertheless, the size of the sample and the number of countries considered makes our paper interesting for an internationally noteworthy region and other areas with similar characteristics. Nevertheless, we were unable to have access to data from some countries and banks meaning that not all MENA countries have been represented in this study. Further research could aim to include other emerging countries, efficiency measures and new factors like risk management and governance.

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