The Impact of Bank Regulations and Institutions on Efficiency in Selected MENA Banks

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Abstract

This paper suggests analyzing the relationship between the regulatory and institutional indicators and the technical efficiency of commercial banks in 5 MENA countries during the period of 2003-2011. Firstly, we calculate the scores of efficiency with non parametric approach (DEA: Data Envelopment Analysis). Secondly, we use the Tobit regression to study the impact of the specific characteristics of banks, the indicators of governance, regulation and economic freedom indexes. The empirical results indicate evidence that a strong restriction can result in higher bank inefficiency. However, banks operating in conditions of economic freedom and governance are more likely to benefit from higher operating efficiency levels.

Keywords: bank efficiency, DEA, economic freedom, bank regulation, governance

1. Introduction

During the last two decades, the globalization of financial markets has gained importance due to liberalization programs undertaken by different countries. This, in turn, increased economic ties between these markets and therefore thorough integration of financial institutions (Ragunathan, 1999). Accordingly, these financial institutions today face a dynamic and competitive environment on a global scale. In this environment, financial institutions are forced to examine their performance because their survival in these dynamic economies of the 21st century will depend on their productive efficiencies. Some previous studies (Berger and Humphrey, 1991; Berger, Hancock and Humphrey, 1993, and Berger, Hunter and Timme, 1993) have shown that, especially in the banking sector, inefficiencies are more important than issues of size and capacity production. Therefore, companies have tried to adapt and adjust to improve their productive efficiencies to cope with the change of social and economic environment (Harker and Zenios, 2000).

All these circumstances have led many countries to liberalize their financial sectors through deregulation in order to improve efficiency. However, the results are mixed regarding the short-term effects of deregulation and productivity gains due to liberalization programs have not reached government targets across economic growth. (This may vary across countries and also depends on industry conditions prior to deregulation).

This paper contributes to the literature by studying the impact of different aspects of economic freedom and governance on bank efficiency in the countries of the MENA region from 2003 to 2011. We use the nonparametric methodology: Data Envelopment Analysis (DEA) to calculate efficiency scores. Unlike existing studies measuring the efficiency of banks, this analysis is not based on accounting ratios, but rather a methodology that enables the construction of a border of "best practice" by wrapping the data points observed in the input-output space.

In addition, while the literature generally considers various forms of regulatory constraints, we use financial considerations rather indices of economic freedom. In particular, we use the index of economic freedom based extract "the Heritage Foundation (2011)". We also used as control variables institutional indicators of the World Bank (WB) database on governance issues.

Firstly, Technical efficiency score is the variable used to measure the efficiency of the banks. Secondly, we consider the relationship between alternative measures of economic freedom and institutional variables on the one hand, and the banking efficiency on the other hand using the Tobit model censored variables. This method is considered the most suitable to give better estimates than the MCO approaches in the analysis of the second

stage of the DEA efficiency analysis.

Our results indicate that there is a strong link between the various forms of economic freedom and the efficiency of the banks. Specifically, financial institutions that seem to be more open and more democratic are associated with small inefficiencies, whereas strong regulatory policy and more restrictions on banking activities decreased the level of efficiency of the banks. The rest of the paper is organized as follows. Section 2 describes the financial and banking sector in selected MENA countries. Sections 3 and 4 present the empirical methodology and data analysis. Section 5 discusses the empirical results and section 6 concludes.

2. Banking Sector in MENA Countries

Countries in the MENA region show similar indicators in terms of cost and performance. Table 1 shows statistics on the banking sector.

Table 1. Banking sector indicators (2010)

Countries	BANK OVERHEAD COSTS / TOTAL ASSETS	NET INTEREST MARGIN	CONCENTRATION	BANK ROA	BANK ROE	BANK COST-INCOME RATIO	BANK CAPITAL TO ASSETS RATIO	BANK Z-SCORE	DOMESTIC CREDIT PROVIDED BY BANKING SECTOR / GDP	DOMESTIC CREDIT TO PRIVATE SECTOR / GDP
Egypt	0,04	0,03	0,53	0,06	0,06	0,43	0,06	2,41	0,75	0,36
Jordan	0,02	0,03	0,86	0,01	0,08	0,42	0,11	13,65	0,99	0,72
Morocco	0,01	0,03	1,00	0,01	0,22	0,36	0,08	22,00	1,01	0,65
Tunisia	0,02	0,04	0,59	0,34	0,83	0,33	n.a	6,75	0,68	0,62
Turkey	0,04	0,04	0,39	0,02	0,52	0,30	0,13	21,35	0,63	0,37
MENA (Mean)	**0,02**	**0,03**	**0,67**	**0,08**	**0,34**	**0,36**	**0,09**	**13,23**	**0,81**	**0,54**
High income countries (Mean)	**0,03**	**0,03**	**0,79**	**0,09**	**0,21**	**0,64**	**0,06**	**11,75**	**2,09**	**1,69**

Source: World Bank

As shown in Table 1, overhead costs as a share of total assets are in the order of 3%. Similarly, the net interest margin on average 4%, thus indicating that the cost of financial intermediation is similar for most countries in the MENA region but also that approximates the high-income countries. For the cost-income, averages also close, with an overall average of 37% against 64%, but for high-income countries.

About performance indicators, return on assets (ROA) and return on equity (ROE) are significantly higher for Tunisia in the countries of the MENA region. The concentration ratio (the share of 3 largest banks by capital against all the assets of the banking sector) indicates a relatively high concentration in the MENA region (67%). The high concentration is often considered an indicator of lack of competitiveness, although recent empirical studies are inconclusive (Claessen and Laeven, 2004; Casu and Girardone, 2006).

Bank capital to assets is the ratio of bank capital and reserves to total assets. Capital and reserves include funds contributed by owners, retained earnings, general and special reserves, provisions, and valuation adjustments. Capital includes tier 1 capital (paid-up shares and common stock), which is a common feature in all countries banking systems, and total regulatory capital, which includes several specified types of subordinated debt instruments that need not be repaid if the funds are required to maintain minimum capital levels (these comprise tier 2 and tier 3 capital). Total assets include all nonfinancial and financial assets. (World Bank)

Z-scores (calculated as the ratio of return on assets plus capital-to-asset ratio to the standard deviation of return on assets) are used as an indicator of the stability of a bank: the higher the value of z-scores the more stable the bank is considered. An analysis of z-scores over time (Beck and Demirguc-Kunt, 2009) indicates that their value has been decreasing in high-income countries and upper middle income countries, while there is no clear trend in

the low-income countries and lower middle income countries. In the case of countries in the MENA region values are relatively large indicating a stable banking system.

Domestic credit provided by the banking sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other banking institutions are savings and mortgage loan institutions and building and loan associations. (World Bank)

Domestic credit to private sector refers to financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include credit to public enterprises. (World Bank)

Literature and empirical studies shows that countries with higher rates grow faster (Beck and Demirgüç- Kunt, 2009). These two indicators show low values in 2010 for most countries in the MENA region compared to the average high-income countries.

3. Methodology

3.1 Measuring Efficiency

In the literature, the measurement of the efficiency remains the objective of researchers since the first approximations until the current measurement techniques available for this type of efficiency.

So the researchers attempting to measure efficiency raises two questions: a conceptual one and a practical one. At the conceptual level what is meant by decision making unit (DMU) efficiency? And more specifically why there is inefficiency?

The measurement of technical efficiency requires knowledge of the maximum amount of output that can be produced from a set of inputs. Alternatively, we must have the specification of a production function. The value of this function in the input shows the maximum output possible.

"Data Envelopment Analysis (DEA)" represents a method based on mathematical programming and calculates the efficiency score technique by solving a linear programming problem, instead of performing algebraic calculations proposed by Farrell (1957).

For the model orientation, studies have demonstrated the suitability of the orientation inputs, when the study will be conducted to measure the efficiency of production (Paradi et al., 2011). Similarly, it is beneficial to study the presence of scale inefficiencies and determine the rate of return, that is to say, considering both constant returns to scale (CRS) and variable returns to scale (VRS).

In this study, we adopt the policy of minimizing inputs based on the assumption that during the study period, banks are looking to strategically reduce costs. Also, the intermediation approach is adopted in this analysis (Berger and Humphrey, 1997) which considers that the bank is an institution that uses labor, capital and deposits to generate credits (variables used are detailed in the following section).

Efficiency scores vary between 0 and 1 with 1 representing a total efficiency. Moreover, to be able to compare the scores between banks, we assume that the countries studied access to the same bank production technology, which is a principal limit because the production technology can be different across countries with different levels of financial development. To remedy this drawback, recent empirical studies try to incorporate country-specific environmental variables in the estimation of bank efficiency either directly (one step approach) or by regressing the efficiency scores obtained on the all environmental variables (two-stage approach); for more detail see Coelli et al., (2005).

3.2 The Second Stage DEA Efficiency Analysis

In a second analysis, we will attempt to measure the impact of specific variables and bank regulatory on the efficiency measured before. Banker and Natarajan (2008) indicate that the DEA procedure with two steps OLS or maximum likelihood or Tobit estimation in the second step provide results more significant than parametric methods in a single step. This approach allows us to enhance the existing literature by testing the significance of these variables as well as their combined effect on efficiency.

So we study if these levels of efficiency can be explained by the different groups of country-specific factors or by bank-specific characteristics. We first determine the variables and then we will include them as explanatory variables in the following equation:

$$TE_{i,t} = \beta_0 + \beta_k M_{i,t} + \varepsilon_{i,t} \tag{1}$$

Where $TE_{i,t}$ represent the level of technical efficiency score of bank and $M_{i,t}$ includes the variables that may have a potential impact on levels of economic efficiency banks. More precisely, we consider four groups of variables. The first group includes factors that are specific to various banks, the second concerns the institutional and governance variables, the third takes into account the variables of economic and financial freedom, and the fourth includes variables relating to the regulation and supervision banks.

Thus, the estimated regressions to analyze the influence of factors specific to banks, governance factors, economic freedom and regulatory measures on bank efficiency are:

$$TE_{i,t}=\beta_0+\beta_1 Bank_{i,t}+\beta_2 Governance_{i,t}+\beta_3 Liberty_{i,t}+\beta_4 Regulation_{i,t}+\varepsilon_{i,t} \qquad (2)$$

These factors are detailed in the following section.

Since we are studying the data across countries, only the specific characteristics of banks may not be sufficient to explain the difference in efficiency levels observed across the sample. In fact, there may be important factors in specific countries which are omitted, but are significantly correlated with levels of efficiency and the specific characteristics of banks used. To isolate the impact of bank specific factors banks to environmental factors, we maintain bank-specific variables in each regression. To avoid multicollinearity possible between the different groups of variables, we also include each group of factors one by one. After these steps, we conduct a robustness analysis to discuss the correlations that might exist between variables in the sample.

4. Data and Variables

4.1 Data

Our sample covers five countries in the MENA region for which we could collect data, namely Egypt (25 banks), Jordan (11 banks), Morocco (11 banks), Tunisia (15 banks) and Turkey (26 banks).

The data come from four main sources:

(1) The database Bankscope, a global database published by Bureau Van Dijik. Data are collected for a sample of 87 banks with data on annual reports (balance sheet and income statement) for bank institutions, with nearly 200 variables and 36 financial ratios already calculated. The panel of banks operate in 5 countries in the MENA region through a period from 2003 to 2011.

(2) The institutional data come from the base of researchers ICRG (International Country Risk Guide) (2011), which provides a comprehensive analysis of risk rates of developed and emerging countries, based on their financial, economic and political environment. This analysis began in 1984 and was published and sold by Political Risk Services (PRS). Variables derived from expert surveys conducted on the economic and political conditions in 140 countries.

(3) The index of economic freedom are collected from the database published by " Heritage Foundation " (2011) which ranks nations on 10 broad criteria based on the statistics of the World Bank, the IMF and the Economist intelligence Unit. These criteria assess the economic success of 185 countries around the world, and the overall score (Index of economic freedom) is an arithmetic average of the 10 indicators.

(4) The data regulation and supervision provide from the base of Barth et al. (2007) revised in 2008 which covers no less than 100 countries. This base is constructed from responses provided by regulators and supervisory official three studies worldwide: Barth et al. (2004, 2006 and 2008).

4.2 Variables

4.2.1 Variables of Input and Output

We use the intermediation approach (Sealey and Lindley, 1977) to define the input and output variables. This approach considers financial institutions as intermediaries between supply and demand of funds.

Consequently, deposits are considered as inputs, and interest on deposits is a component of total costs, as well as labor and capital. The two output variables used refer to the traditional activity of granting loans by banks that is to say, the total of credits and other activities not related to credit (Other earning assets).

Banking production costs: Total Cost (TC) capture the financial and operating costs. The "financial costs" are mainly interest charges. "Operating costs" are capital and labor expenditures, i.e. staff costs, general operating costs. The price of labor is measured by the ratio of the personnel costs - as a result of the summation of the salaries and other expenses - to the annual average of the Bank. The price of capital includes assets, depreciation expenses, rental costs, and other expenses. The price of financial capital is measured by the average cost of borrowed resources. This cost is measured by the ratio of interest expense to debt capital.

Inputs = Total costs = Interest expenses + Non-interest expenses (personnel expenses + other non-interest expenses)

Outputs = Total loans + Other earning assets

Table 2. Summary statistics of input and output variables

		Obs	Mean	St.dev	Min	Max
Egypt	**Outputs:**					
	Total loans	166	1993.21	3006.03	17.23	14479.28
	Other earning assets	166	3157.08	5646.50	31.06	33062.69
	Inputs:					
	Interest expenses	166	273.93	514.88	3.16	2855.62
	Non-interest expenses	166	88.61	130.09	1.93	1058.05
Jordan	**Outputs:**					
	Total loans	81	3791.92	6100.03	97.17	22510.9
	Other earning assets	81	3516.53	5567.32	37.23	22879.7
	Inputs:					
	Interest expenses	81	178.13	296.78	3.10	1254.1
	Non-interest expenses	81	149.85	216.42	6.34	787
Morocco	**Outputs:**					
	Total loans	63	7571.60	6377.13	2.3	28532.1
	Other earning assets	65	3660.80	3021.33	16.9	9729.35
	Inputs:					
	Interest expenses	64	230.27	198.49	0	707.85
	Non-interest expenses	64	252.36	226.85	0.1	890.82
Tunisia	**Outputs:**					
	Total loans	111	1333.16	1081.01	3.7	3708.71
	Other earning assets	111	413.12	407.48	0.97	2096.95
	Inputs:					
	Interest expenses	111	48.77	39.55	0.4	137.85
	Non-interest expenses	111	47.67	41.06	2.2	154.42
Turkey	**Outputs:**					
	Total loans	174	10132.18	13681.62	0.02	60319.37
	Other earning assets	174	8360.45	12540.19	17.47	53875.6
	Inputs:					
	Interest expenses	174	1103.34	1523.26	0.19	7180.69
	Non-interest expenses	174	566.31	667.39	7.90	2730.77
Mean	**Outputs:**					
	Total loans	310	3596.87	5218.37	2.3	28532.1
	Other earning assets	312	3355.34	5178.24	16.9	33062.69
	Inputs:					
	Interest expenses	311	239.99	416.50	0	2855.62
	Non-interest expenses	311	138.26	188.67	0.1	1058.05

Values are in Millions USD

Source: Bankscope and own calculations

4.2.2 Environmental Variables

We consider regression of the equation (2).Where $Bank_{i,t}$ represents the vector of variables related to the characteristics of the bank i in year t.

$$Bank_{i,t}=(EQTA_{i,t},NETLOANS_{i,t},LIQ_{i,t},LNTA_{i,t},ROAE_{i,t})$$

∗ *Equity / Tot Assets: EQTA*

This ratio controls the capital strength and measures the degree of risk taken by the bank executives. A high level of equity reduces the risk of insolvency and therefore the cost of borrowed funds (Berger and Mester, 1997; Flannery, 1998; Dietsch and Lozano-Vivas, 2000; Flannery et al., 2004). Banks with large capitalization are less

likely to become insolvent. We expect a positive relationship between efficiency and capitalization. However, the financial capital can also affect costs because of its use as a resource for loan financing (Berger and Mester, 1997). Since the increase in capital through the issuance of shares generally leads to higher costs by increasing deposits, a negative correlation between EQTA and efficiency can be expected. Therefore, the sign of the coefficient of EQTA prediction may be ambiguous due to the conflicting results of the work.

Net Loans / Tot Assets: NETLOANS

This ratio measures the credit risk. Banks whose net values of loans relative to total assets face more credit risk which encourages banks to better manage to cope with these risks and improve their efficiencies. On the other hand, these banks are able to exploit economies of scale due to the size of their loan portfolio. Therefore, a positive relationship between NETLOANS and efficiency is expected. However, since banks in the MENA region, expertise in risk management is limited, this can lead to high costs in terms of non-performing loans which has a negative impact on efficiency.

∗*Liquid Assets / Deposits & Short-term Funding: LIQ*

The liquidity ratio is the risk of not having sufficient liquidity to meet unexpected withdrawals significant or major credit requests. The lack of liquidity may also force banks to borrow money at excessive costs. On the other hand, excess liquidity may reflect poor management of the banks and thus may result in a low efficiency. Therefore, the sign of the coefficient of this variable is ambiguous.

∗ *Size: Logaritm of Total Assets: LNTA*

LNTA variable is included in the regression to measure the influence of the size of the bank on its efficiency. The size of the bank can positively influence efficiency levels since large banks are able to hold less capital than small banks and may be able to have larger portfolios and diversification of loans that allow them to take advantage of the size (Hughes et al., 2001; Yildirim and Philippatos 2007 Altunbas et al., 2007).

∗ *Return On Average Equity: ROAE*

To take account of the profitability of banks, we identify the variable returns on equity which reflects the efficiency with which the Bank uses the funds provided by the shareholders. This ratio is often used in the banking literature as a measure of performance (for example Mester, 1996; Pastor et al., 1997; and Casu and Molyneux, 2003). This ratio expresses more great are the higher profits are scores of efficiency of each Bank (positive relationship). This can be explained by the fact that the most successful banks are preferred by custodians which allows to create a favourable environment for banks to exercise their market power and thus lower their operational costs.

$Governance_{i,t}$ represents the vector of institutional variables or variables of governance of the Bank i in the year t. It is constructed from six dimensions of governance that vary between 0 and 1 where 1 represents a maximum governance.

$$Governance_{i,t}=(VA_{i,t},PV_{i,t},GE_{i,t},RQ_{i,t},RL_{i,t},CC_{i,t})$$

* $VA_{i,t}$: *Voice and Accountability*

This variable indicates the extent to which a country's citizens can participate in selecting their government, but also enjoy the freedom of expression, association and freedom of the press.

* $PV_{i,t}$: *Political stability and absence of Violence*

This index estimates the probability that the government will be destabilized by unconstitutional or violent acts, including political violence and terrorism.

* $GE_{i,t}$: *Government Effectiveness*

This variable refers to the quality of public services, the civil service and the degree of his independence with political pressures, the quality of the formulation and implementation of policies and the credibility of the government's commitment to respect these policies.

* $RQ_{i,t}$: *Regulatory Quality*

This index reflects the ability of the government to formulate and implement policies and regulations to promote the development of the private sector.

*$RL_{i,t}$: *Rule of Law*

This index indicates how agents rely on the rules of the society and respect them, and reflects in particular the quality of execution of contracts, property rights, the police, the courts, as well as the probability of crime and

violence.

$CC_{i,t}$: Control of Corruption

This variable expresses the extent to which public power is exercised for private gain and interests, including both petty and grand forms of corruption.

It has been shown that in emerging markets, governance index have a positive effect on financial development (Detragiache et al. (2005); Ayyagari et al. (2005). Consequently, it is expected that a stable political environment, an effective control of corruption and a developed legal system improve the efficiency of banking institutions (positive sign).

$Liberty_{i,t}$ represents the vector of variables of economic freedom for the bank i in year t. This freedom is measured from the ten components of each value from a scale of 0 to 100, where 100 represents the maximum freedom.

$$Liberty_{i,t}=(FF_{i,t},GS_{i,t},PR_{i,t},FC_{i,t},EF_{i,t})$$

* FF: Financial Freedom

This variable takes values between 0 and 100, with higher values indicating greater independence on the financial and banking markets over government control. It is measured from the determination of the extent of government regulation of financial services, the extent of state intervention in banks and other financial services, the difficulty of opening and operating financial services companies (domestic and foreign), and government influence over the allocation of credit. A score of 100 indicates a negligible influence of the government, while a score of 0 a repressive approach.

* GS: Government Spending

This variable reflects the level of public spending as a percentage of GDP. The total government expenditures include both consumption and transfer payments. The rating scale for this variable is non-linear and is measured using the following equation: $GS_i = 100 - a \text{ expenditures}_i^2$, où GS_i represents the score of public expenditures in the country i, expenditures_i represent the ratio of total amount of public expenses to GDP (between 0 and 100), and a is a coefficient of variation for control change scores (set at 0.03) . The minimum value is 0 and higher values indicate excessive government spending.

* PR: Property Rights

This variable measures the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the state. It assesses the degree to which a country's laws protect private property rights and the degree to which the government enforces these laws, and the probability that private property will be expropriated; analyze the independence of the judiciary, the existence of corruption within the judiciary, the ability of individuals and businesses to enforce contracts. This variable takes values between 0 and 100, with higher values indicating greater legal protection of the property.

* FC: Freedom from Corruption

This variable is used to measure the integrity of the system and distortion by which individuals are able to gain at the expense of the whole. The score of this variable is derived from the index "Transparency International's Corruption Perceptions Index (CPI)." The score is based on a 100-point scale where 0 indicates a highly corrupt government and 100 very little corruption. Higher the level of corruption is, the higher the overall level of economic freedom is low and the lower the score the country.

In addition, an overall indicator is also considered in our analysis:

* EF: Index of Economic Freedom which represents the average of 10 indicators published by the Heritage Foundation, namely (1) (Business Freedom), (2) (Trade Freedom), (3) (Fiscal Freedom), (4) (Government spending), (5) (Monetary Freedom), (6) (Investment Freedom), (7) (Financial Freedom), (8) (Property Rights), (9) (Freedom from Corruption), (10) (Labor Freedom).

$Regulation_{i,t}$ represents the vector of variables of regulation and supervision of the bank i in year t. This indicator does not change from one bank to another within the same country. These variables are obtained from the database of Barth et al., 2004 (version I) as updated in 2006 (version II) and updated again in 2008 (version III).

$$Regulation_{i,t} = (AR_{i,t}, CS_{i,t}, SP_{i,t}, SI_{i,t})$$

* $AR_{i,t}$: Activities Restrictions

This index is the sum of 4 indices that reflect the restriction of activities:

- Index of regulation in the financial market which can measure the degree of freedom for banks to intervene in the financial markets. Higher this index is stronger restrictions on this activity are. It takes the value of 1 = no restriction, 2 = permitted activity, 3 = restricted activity, 4 = activity prohibited

- Index of regulation on the insurance market which measures the possibility of intervention in the insurance market. It also takes the value of 1 to 4 with a high index indicates a strong restriction.

- Index of regulation on the real estate market which measures restrictions on the banking sector in his intervention on the real estate market. It also takes the value of 1 to 4 with a high index indicates a strong restriction.

- Index of legislation on the acquisition by banks non-financial firms. This index is used to determine the possibilities of banks to own firms.

Therefore, the overall restriction is a value that varies between 4 (min) and 16 (max). A high value indicates that the country is experiencing a very strong restriction of the activities on the banking sector that is to say, it is highly regulated.

* $CS_{i,t}$: *Overall Capital Stringency*

This index indicates whether the minimum capital requirements incorporate some elements of risk and deducts certain market value losses if this requirement is met. More precisely, it is based on the sum of the following questions (with yes = 1, no = 0)

- Does the minimum ratio "Equity / Assets" is risk-weighted in accordance with the guidelines Bales?

- Does the minimum ratio vary with credit risk?

- Does the minimum ratio vary as a function of market risk?

- Before minimum capital requirement is determined, which items are deducted from the book value of equity? (A) unrealized losses credit? (B) unrealized losses in the portfolios of financial assets? (C) unrealized losses of exchange?

Therefore, the overall index takes a value from 0 to 6 with a high value indicates a high level of regulatory capital requirements. In addition to the regulatory indicators, Barth et al. (2006) developed indices of supervisory summarized in the power of supervision on the one hand and the independence of supervision on the other hand, because they consider that increasing the supervisory authority cannot be positively associated with the efficiency of banks in countries where the supervisory authorities aren't independent. While a large independent supervision is itself positively correlated with improved efficiency.

* $SP_{i,t}$: *Official Supervisory Power*

This index measures the degree of power exercised supervisory authority over banks. We chose three questions that measure this authority:

- Are there one or more institutions that control the banking sector? 1 = more, 0 = one.

- The supervisory authority must declare any offense she found with respect to prudential regulations?

- In this case, there mandatory sanction measures to take?

The answer to these 2 questions takes the value of 1 if yes and 0 otherwise.

The sum of the indexes 3 takes a value of 0 to 3 with a high value indicates a strong supervision.

*$SI_{i,t}$: Supervisory Independence

This index measures the degree of independence of the supervisory authority in relation to the government. It is built based on three questions:

- To whom are the supervisory bodies responsible? (a) Prime Minister (b) Finance Minister or other cabinet level official, (c) a legislative body such as parliament or congress, (d) other. This variable is equal to 1 if the answer is (c) and 0 otherwise.

- Are the supervisors legally liable for their actions (i.e., if a supervisor takes actions against a bank, can the supervisor be sued)? This variable takes the value of 1 if the answer is no and 0 otherwise.

- Does the direction of the supervising agency have a fixed term and if so how many years? This index takes the value of 1 if the mandate is ≥ 4 years and 0 otherwise.

The aggregate index takes the value from 0 to 3 with a high number indicates a greater independence of supervisory agencies.

Regarding the prediction of the signs of coefficients of regulatory variables, literature is not unanimous because there are two points of view. The first called the public interest view considers that government acts in the public interest and regulates banks in order to promote their efficiencies and improve market failures by boosting competition between banks and encouraging governance mangers. Against the second called private interest view considers that regulation is often used to promote the interests of some particular rather than the general public. It leads to constrain banks to meet political or other regulations and therefore it not play an active role in improving efficiency.

Therefore the effect of regulation and supervision on efficiency is ambiguous in light of these two opposing views. Empirical studies such our study could help to enrich the literature.

Table 3 presents descriptive statistics of sample variables described above.

Table 3. Summary statistics of environmental variables

		Obs	Mean	St.dev	Min	Max
Banks	EQTA	597	11.71	7.87	-51.77	82.22
	NETLOANS	595	49.51	18.56	0.068	95.45
	LIQ	596	40.93	37.14	2.98	658.62
	LNTA	597	8.03	1.61	2.83	11.61
	ROAE	596	9.95	30.75	-304.36	263.95
Governance	VA	597	0.55	0.13	0.25	0.79
	PV	597	0.74	0.11	0.55	0.90
	GE	597	0.5	0	0.5	0.5
	RQ	597	0.63	0.11	0.45	0.81
	RL	597	0.71	0.10	0.5	0.83
	CC	597	0.39	0.07	0.25	0.5
Economic Freedom	FF	597	44.9	12.03	30	70
	GS	597	71.27	8.62	45	83.6
	PR	597	46.91	6.10	30	55
	FC	597	39.10	7.93	28	57
	EF	597	58.94	3.96	50.6	68.9
Regulation	AR	597	9.73	1.29	8	12
	CS	597	2.73	1.16	1	4
	SP	597	1.97	0.32	1	3
	SI	597	1.53	0.89	0	3

Source: Bankscope, ICRG, Heritage Foundation, Barth et al. (2006) and own calculations.

5. Empirical Results

This section presents the results of the application of DEA to evaluate the efficiency of the banks in the countries from the MENA region as well as the results of the second stage of analysis, which is to determine the impact of different environmental variables on the calculated efficiency scores.

5.1 Efficiency Measures Results

The scores of efficiency for each Bank and each country are obtained using the DEAP 2.1 (Coelli, 1996). We used Input orientation and Variable Returns Scale (VRS).

Table 4 reports descriptive statistics of the efficiency scores for each country in our sample: Egypt, Jordan, Morocco, Turkey and the Tunisia and for each year of study (2003-2011).

Table 4. Technical Efficiency (TE)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	Mean
Egypt	0.922	0.895	0.823	0.714	0.870	0.874	0.971	0.886	0.960	**0.879**
	(0.19)	(0.18)	(0.29)	(0.29)	(0.19)	(0.19)	(0.09)	(0.18)	(0.21)	**(0.07)**
Jordan	1.000	0.961	0.877	0.928	0.960	0.906	0.912	0.920	0.908	**0.930**
	(0.00)	(0.08)	(0.20)	(0.27)	(0.08)	(0.20)	(0.11)	(0.13)	(0.15)	**(0.03)**
Morocco	1.000	0.932	1.000	0.964	0.895	0.811	0.848	0.885	0.894	**0.914**
	(0.00)	(0.11)	(0.00)	(0.07)	(0.17)	(0.30)	(0.22)	(0.18)	(0.20)	**(0.06)**
Tunisia	0.885	0.753	0.875	0.890	0.753	0.816	0.798	0.726	1.000	**0.833**
	(0.18)	(0.34)	(0.20)	(0.21)	(0.34)	(0.25)	(0.24)	(0.26)	(0.00)	**(0.08)**
Turkey	1.000	0.841	0.761	0.884	0.776	0.864	0.870	0.902	0.817	**0.857**
	(0.00)	(0.28)	(0.28)	(0.19)	(0.27)	(0.23)	(0.22)	(0.17)	(0.22)	**(0.07)**

St.dev in brackets

Dependent variable	Mean	St.dev	Min	Max
TE	0.882	0.075	0.714	1

The results show relatively high scores (above 70%) for the five studied countries with a maximum efficiency of 100% and a minimum of 71.4%. As highlighted in Table 4, the magnitude of the standard deviation of different measures of efficiency in each country is low, which shows that in each country there is no significant variation between the efficiency of different banks within a country for each year studied.

We note that the mean efficiency score of Jordanian banks is the highest (93%) followed by Moroccan banks (91.4%). These efficiency levels are within the range of the scores achieved by banks in developed countries according to the literature (between 55% and 95%). However, it is important to note that these calculated efficiencies are relative to each frontier of the country. These boundaries correspond to the set of technologies and the available infrastructure and other features of the production environment. Therefore, high efficiency levels found are related to the technology of production of a given country. It is for this reason that recent literature focuses instead on the efficiency relative to a frontier to all countries without restrictions on the technology called 'metafrontier'.

5.2 Second Stage Results

Alternative regression methods are employed in the literature for examining the sources of bank efficiency such as Least Squares, censored regressions, Monte Carlo simulations (Simar and Wilson, 2007), and so on.

Tables 5, 6 and 7 report the main results of the regression of equation (2), the dependent variable is the efficiency scores of banks. We use the censored regression model (Tobit regression) which is among the limited dependent variable models (technical efficiency scores *TE* take values between zero and unity).

We can analyze these data using OLS regression. A limitation of this approach is that when the variable is censored, OLS provides inconsistent estimates of the parameters, meaning that the coefficients from the analysis will not necessarily approach the "true" population parameters as the sample size increases. See Long (1997, chapter 7) for a more detailed discussion of problems of using OLS regression with censored data.

To preserve the degree of freedom and avoid problems of multicollinearity between variables, it was decided to introduce the indicators one by one with specific parameters banks.

With regard to the specific characteristics of banks, we note that the impact of the ratio Equity / Total Assets (EQTA) is significantly positive for the six specifications indicating that banks with high capital have a higher efficiency. This is consistent with the literature (Berger and Mester, 1997; Reda and Isik, 2006). The coefficients of the ratio of Nets Loans / Total assets (NETLOANS) are positive and significant for all estimates, showing that banks that have a high credit risk control better their costs because of the pressure to improve their efficiency. On the other hand, the liquidity variable is also positively linked with efficiency which shows that more liquid banks face the risk of non-performing loans. However, the size of the bank (logarithm of total assets) seems to be not significantly associated with bank efficiency at 10%, which indicates a small bank is not necessarily less efficient than a large bank. Regarding the performance indicator (ROE), we show that the relationship is positively significant which is consistent with existing results in the literature (Miller and Noulas 1996; Casu and Molyneux, 2003; Stavarek, 2004).

The impact of institutional variables is shown in columns 1-6 of Table 5. Due to the fact that the institutional country variables are highly correlated we do not run a regression of all these variables together, to avoid

problems of multicollinearity.

Table 5. Bank efficiency and governance indicators

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0,821	1,045	1,304	1,096	1,337	0,801
Bank characteristics						
EQTA	0,003*	0,004*	0,003*	0,003*	0,004*	0,003*
NETLOANS	0,004**	0,004**	0,004**	0,005**	0,005***	0,004**
LIQ	0,001*	0,001*	0,001*	0,001*	0,001*	0,001*
LNTA	0,012	0,005	0,012	0,011	0,003	0,009
ROAE	0,001**	0,001**	0,001**	0,001**	0,001*	0,001**
Governance indicators						
VA	0,048*					
PV		0,175*				
GE			0.632*			
RQ				0,413*		
RL					0,661**	
CC						0,199*
Observations	593	593	593	593	593	593

* significant at level of 10% (p<0,1), ** significant at level 5% (p<0,05), *** significant at level 1% (p<0,01).

Unsurprisingly, the results indicate a positive correlation between these variables including freedom of expression, political stability, control of corruption, regulation promote greater efficiency of banking institutions. This is shows that an environment with less governance and high corruption impede the ability of banks to operate efficiently. The obtained results broadly confirm that better quality of the institutional development in the country's financial climate lead to more efficient financial institutions.

Turning to the second vector of country specific variables, the impact of economic freedom indexes is analyzed in table 6.

Table 6. Bank efficiency and economic freedom indicators

	(1)	(2)	(3)	(4)	(5)
Constant	0,725	1,149	1,587	0,996	0,655
Bank characteristics					
EQTA	0,005*	0,004*	0,001*	0,003*	0,003*
NETLOANS	0,004**	0,005**	0,004**	0,005**	0,004**
LIQ	0,001*	0,001*	0,001*	0,001*	0,001*
LNTA	0,001	0,018	-0,002	0,011	0,01
ROAE	0,001**	0,001**	0,001**	0,001**	0,001**
Economic freedom indicators					
FF	0,005**				
GS		0,005*			
PR			0,013**		
FC				0,004*	
EF					0,003*
Observations	593	593	593	593	593

* significant at level of 10% (p<0,1), ** significant at level 5% (p<0,05), *** significant at level 1% (p<0,01).

Table 6. reports strong statistical evidence that corroborates the thesis that shows that the restrictions in the economic opening decrease significantly the levels of technical efficiency. Indeed, economic freedom variables including financial freedom have positive and significant coefficients at the level of 5%. Thus, these results are consistent with the importance of the protection and respect for property rights, the effectiveness of regulation measures and the existence of free markets and their impact on the performance and efficiency for institutions operating in this environment and the economic growth in the large sense.

Finally, the impact of regulation indicators and the supervisory authority of the country built by Barth et al. (2008) is indicated in table 7.

Table 7. Bank efficiency and regulation indicators

	(1)	(2)	(3)	(4)
Constant	1,16	0,892	0,876	0,941
Bank characteristics				
EQTA	0,004*	0,003*	0,003*	0,003*
NETLOANS	0,004**	0,005**	0,004**	0,004**
LIQ	0,001*	0,001*	0,001*	0,001*
LNTA	0,008	0,012	-0,013	0,006
ROAE	0,001**	0,001**	0,001**	0,001**
Regulation indicators				
AR	-0,028*			
CS		-0,03*		
SP			-0,014	
SI				0,021*
Observations	593	593	593	593

* significant at level of 10% (p<0,1), **significant at level 5% (p<0,05), ***significant at level 1% (p<0,01).

The results in column 1 report a negative coefficient of restriction activities variable that shows a strong restriction, which is related to bank regulation policy, does not promote greater efficiency of banks. This result is in accordance with previous findings in the banking literature (see among others, Barth et al., 2004, 2006; Demirguc-Kunt et al, 2004). On the other hand, capital requirements are negatively associated to efficiency, which is not necessarily consistent with the literature which states that this requirement reduces the credit risk (Barth et al., 2013). However, we find that the supervisory power variable is not significant at the 10% level in explaining efficiency, but the coefficient on the independence of the supervision is positive and significant. These results suggest that the supervisory power does not necessarily lead to greater efficiency but the independence condition of supervisory body should be checked at the same time. (Barth et al., 2013).

As a robustness check, OLS is used instead of the Tobit model to estimate equation (2) in order to see if the results substantially differ since we change the regression method.

The results obtained by the OLS specification are reported in table 8 and confirm the finding of the Tobit regession. Indeed, as indicated in table 8, the sign of the coefficients in all specifications remains the same, suggesting a significant influence of different sets of institutional and regulation variables on bank efficiency.

Table 8. Second-stage regression results for bank efficiency—OLS estimation

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0,676	0,675	0,678	0,695	0,937	0,655
Bank characteristics						
EQTA	0,001*	0,001*	0,001*	0,001*	0,001*	0,001*
NETLOANS	0,002**	0,002**	0,002**	0,002**	0,002**	0,002**
LIQ	0,000*	0,000*	0,000*	0,000*	0,000*	0,000*
LNTA	0,012	0,012	0,012	0,012	0,012	0,012
ROAE	0,000**	0,000**	0,000**	0,000**	0,000**	0,000**
Governance indicators						
VA	0,003*					
PV		0,002*				
GE			0,205*			
RQ				0,032*		
RL					0,408***	
CC						0,096*

	(1)	(2)	(3)	(4)	(5)	
Constant	0,603	0,849	0,822	0,696	0,432	
Bank characteristics						
EQTA	0,002*	0,002*	0,001*	0,001*	0,002*	
NETLOANS	0,002**	0,002**	0,002**	0,002**	0,002**	
LIQ	0,000*	0,000*	0,000*	0,000*	0,000*	
LNTA	0,009	0,014	0,011	0,012	0,011	
ROAE	0,000**	0,000**	0,000**	0,000**	0,000**	
Economic freedom indicators						
FF	0,003**					
GS		0,003*				
PR			0,003**			
FC				0,000*		
EF					0,004*	

	(1)	(2)	(3)	(4)		
Constant	0,706	0,698	0,744	0,671		
Bank characteristics						
EQTA	0,002*	0,002*	0,002*	0,002*		
NETLOANS	0,002**	0,002**	0,002**	0,002**		
LIQ	0,000*	0,000*	0,000*	0,000*		
LNTA	0,012	0,012	0,012	0,012		
ROAE	0,000**	0,000**	0,000**	0,000**		
Regulation indicators						
AR	-0,002*					
CS		-0,019**				
SP			-0,036			
SI				0,002*		
Observations	593	593	593	593	593	593

6. Conclusion

This article contributes to the existing literature by examining empirically the role of economic freedom on the improvement of the operational efficiency of the banks. We focus on a sample of banks operating in 5 countries of the MENA region in the period of 2003-2011. We evaluate the technical efficiency of banks in Egypt, Jordan, Morocco, Tunisia and Turkey by using the non-parametric method (DEA). Results indicate that despite the existing similarities in economic and financial development and the reforms undertaken by these countries, we note differences in the observed levels of technical efficiency.

The second stage of analysis can give a clear idea of how the level of economic and financial freedom of a country (The Heritage Foundation) with indexes of governance (Kaufmann et al., 2006) may affect the bank operations. To support the impact of these variables on bank efficiency, we use indicators of regulation and

supervision established by the regulatory authorities of the country (Barth et al., 2006). This analysis is based on the Tobit regression technique by introducing the variables one by one to avoid problems of multicollinearity.

The results provide evidence in favor of economic freedom, which implies that excessive regulatory restrictions on banking and government interventions can increase the level of inefficiency. In other words, our results suggest that banks operating in more open and free countries tend to have relatively high levels of efficiency.

However, our results are not always consistent with the existing literature that supports the idea that with financial crises observed in the world, governments will seek to strengthen the regulation and to improve the legal system in which operate financial institutions. In this sense, restrict the activities of banks and require more capital will enable banks to manage risk and cope with potential crises and this regulation is not necessarily against the performance and efficiency of banks. Yet there is no doubt that the recent financial crisis and its effect that persists until today, the research remains incomplete and discussions are still without a satisfactory answer as to the role of governments in predicting crises.

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