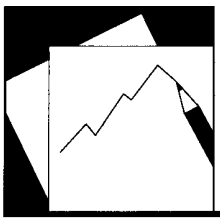

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What Drives the Performance of Selected MENA Banks? A Meta-Frontier Analysis

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What Drives the Performance of Selected MENA Banks? A Meta-Frontier Analysis

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Abstract

This study examines the effect of financial-sector reform on bank performance in selected Middle Eastern and North African (MENA) countries in the period 1994 −2008. We evaluate bank efficiency in Egypt, Jordan, Morocco, Lebanon and Tunisia by means of Data Envelopment Analysis (DEA) and we employ a meta-frontier approach to calculate efficiency scores in a cross-country setting. We then employ a second-stage regression to investigate the impact of institutional, financial, and bank specific variables on bank efficiency. Overall, the analysis shows that, despite similarities in the process of financial reforms undertaken in the five MENA countries, the observed efficiency levels of banks vary substantially across markets, with Morocco consistently outperforming the rest of the region. Differences in technology seem to be crucial in explaining efficiency differences. To foster banking sector performance, policies should be aimed at giving banks incentives to improve their risk management and portfolio management techniques. Improvements in the legal system and in the regulatory and supervisory bodies would also help to reduce inefficiency.

JEL Classification Numbers: *G21, G28, L11*

Keywords: DEA, meta-frontier, performance, MENA

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I. INTRODUCTION

A large number of developed and developing countries have deregulated their banking systems over the past two decades. In particular, developing countries, mostly following International Monetary Fund (IMF) and/or World Bank inspired programs, have sought to improve the performance and efficiency of their financial sectors to enhance their overall economic performance. The existence of a link between a well functioning financial system and economic growth is widely accepted, both in the theoretical and empirical literature (Levine, 1997; 2005; Demirguc-Kunt, 2010). Given that the financial system in developing countries is mostly bank-based, a strong and stable banking system has been advocated as being the cornerstone in many liberalization programs.

In this context, governments of some Middle Eastern and North African (MENA) countries have instituted reforms to establish a market-based financial sector, reduce state ownership and allow greater foreign participation. Despite the reforms, the financial sector in these countries remains dominated by banks and government ownership is still prevalent.[1] While other developing countries, particularly in Eastern Europe and South Asia, have been fairly successful in their reform agendas, liberalization in the MENA countries has been less comprehensive and far reaching and the economic development of the region is lagging behind (MENA- OECD Investment Program). Further privatization of banks, modernization of the legal and regulatory environment and fuller integration into the global financial sector are seen as long term solutions to foster growth in the region.

This study attempts to shed some light on these issues by examining the effect of institutional development, financial structure and bank-specific characteristics on the performance and efficiency of the banking sector in Egypt, Jordan, Lebanon, Morocco, and Tunisia. These MENA countries share similarities in terms of economic structure - the order of implementation of structural adjustment programs, the liberalization of state-owned companies, the attraction of direct foreign investments and resource-scarcity in relation to population. Despite the substantial transformation of the countries' banking and financial sectors in recent years and the fact that the regulatory requirements imposed by national regulators are now in line with international standards, there is still a paucity of empirical studies investigating the impact of financial and institutional reforms on MENA banks performance and efficiency. This paper contributes both to the international debate on the impact of deregulation on the banking system of developing countries and whether the reform process is translating into more efficient and profitable banking systems. It also contributes to the understanding of the dynamics of economic development of the MENA region.

The rest of the paper is organized as follows. Section 2 discusses the main characteristics of the banking and financial sectors in the MENA region. Section 3

[1] The IMF (2004) Global Financial Stability Report estimates that bank assets accounted for 85% of financial assets in the MENA countries, compared to 48% in emerging Asian countries, 41% in Emerging Europe and 35% in Latin America.

describes the methodology, the data, and the variables used. The empirical results are illustrated in Section 4, and Section 5 concludes.

II. BANKING SECTORS IN THE MENA REGION

Banking sectors in the MENA region have many similarities, but are also quite different from each other. Within the region there are also large differences among countries, in terms of size, per capita GDP and financial development. Egypt, Jordan, Morocco and Tunisia are classified by the World Bank as lower middle income countries, Lebanon as a middle income country. Table 1 illustrates selected financial sector development indicators. Financial development has been shown to have a pivotal role in fostering economic growth and protecting the economy from external shocks (Beck et al, 2006); however empirical evidence also indicates that, without the necessary institutional development, deeper financial systems may lead to increased risk, as size and depth may reflect policy distortions rather than development (Demirguc-Kunt and Detragiache, 2006).

Table 1: Financial development indicators (2008)

	Liquid Liabilities / GDP	Bank Deposits / GDP	Financial System Deposits / GDP	Bank Credit / Bank Deposits	Stock Market Capitalization / GDP	Stock Market Total Value Traded / GDP	Stock Market Turnover Ratio
Egypt	0.89	0.76	0.77	0.51	1.02	0.39	0.29
Jordan	1.27	1.08	1.08	0.85	2.09	0.83	0.24
Lebanon	n.a	n.a	n.a	0.32	0.55	n.a	n.a
Morocco	1.06	0.85	0.86	0.89	1.24	n.a	0.45
Tunisia	0.61	0.51	0.52	1.11	0.17	0.02	0.13
MENA	0.73	0.61	0.63	0.53	0.81	0.29	0.27
Lower Middle Income	0.53	0.46	0.46	0.93	0.59	0.22	0.24
High Income OECD	1.11	1.03	1.04	1.40	1.19	1.79	1.55

Source: World Bank Financial Structure Database

Liquid liabilities to GDP is a traditional indicator of financial depth (King and Levine, 1993); it measures the extent of the financial intermediation sector and is typically strongly correlated with the level and rate of change in GDP per capita. Financial system deposits to GDP (which includes Banking Deposits to GDP) is a stock indicator of resources available to the financial system for its lending activities; this ratio also positively varies with the level of income. As is shown in Table 1, there is

wide cross-country variation, with Tunisia displaying values below the MENA region average and Jordan displaying values higher than those of OECD countries.
The ratio of Bank Credit to Bank Deposits indicates the extent to which banks intermediate savings into private sector credits. It increases with the level of economic and financial sector development (Honohan and Beck, 2007). While a high credit-to-deposit ratio indicates high intermediation efficiency, a ratio higher than one suggests that private sector lending is funded with non deposit sources and this can results in funding instability (Beck and Demirguc-Kunt, 2009). In the countries in our sample, this is true only for Tunisia, while the other MENA countries indicate low levels of intermediation efficiency. Finally, Table 1 reports some indicators of capital market development: stock market capitalization to GDP, stock market value traded to GDP and stock market turnover ratio. All three indicators will increase with the level of income, with high income countries having larger and more liquid stock exchanges. Beck and Demirguc-Kunt (2009) highlight that stock market development over the past decades has been mainly driven by the price effect of existing stocks while Levine and Zevros (1998) and Beck and Levine (2004) indicate that it is the liquidity of a stock market rather than its size that matters for economic growth. Cross country differences are apparent, with Jordan outperforming the other countries in the region in terms of stock market development. However, differences between the MENA countries and high income OECD countries are substantial.

When it comes to specific banking sector differences, the MENA countries display similar indicators with respect to cost and performance. Table 2 illustrates relevant banking sector statistics. Overhead costs as a share of total assets are in the region of 2%, in line with OECD countries. Similarly, the net interest margin is on average 4%, thus indicating that the cost of financial intermediation is similar to OECD countries and lower than that observed in other lower middle income countries. When it comes to the cost to income ratio, the averages for the MENA countries compare favorably, with an overall average of 47 percent

Table 2: Banking Sector Indicators (2008)

	Overheads/ Total Assets	Net Interest Margin	Concentration	Return on Assets	Return on Equity	Cost-Income Ratio	Z-Score
Egypt	*0.03*	*0.03*	*0.55*	*0.03*	*0.09*	*0.48*	*3.40*
Jordan	*0.02*	*0.04*	*0.86*	*0.02*	*0.10*	*0.43*	*14.70*
Lebanon	*0.01*	*0.02*	*0.76*	*0.01*	*0.08*	*0.58*	*14.81*
Morocco	*0.01*	*0.03*	*0.91*	*0.01*	*0.20*	*0.42*	*22.00*
Tunisia	*0.02*	*0.04*	*0.54*	*0.07*	*-0.26*	*0.40*	*7.65*
MENA	*0.02*	*0.04*	*0.75*	*0.03*	*0.13*	*0.47*	*13.41*
Lower Middle Income	*0.04*	*0.06*	*0.70*	*-0.02*	*0.16*	*0.64*	*12.36*
High Income OECD	*0.03*	*0.02*	*0.73*	*0.02*	*0.15*	*0.69*	*9.14*

Source: World Bank Financial Structure Database

Moving on to indicators of performance, the Return on Assets (ROA) averages at 3% for the MENA region. Substantial cross country variations are found for the Return on Equity (ROE), with strong performance of banks in Morocco and negative ROE in Tunisia in 2008. However, as these measures are computed as un-weighted averages across all banks in a given year, the results tend to show substantial variation over time. The concentration ratio (here the share of the 3 largest banks' assets to the total banking sector assets) indicates relatively high concentration in Morocco (91%) and Jordan (86%). High concentration is often considered an indicator of lack of competitiveness, although recent empirical evidence is inconclusive (Claessen and Laeven, 2004; Casu and Girardone, 2006).

Finally, the z-scores (computed as the ratio of return on assets plus capital-to-asset ratio to the standard deviation of the return on assets) are used as an indicator of bank stability: the higher value of the z-score 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 and upper-middle income countries, while there is no clear trend in low and lower middle income countries. In the case of MENA countries, Tunisia and Egypt display below average z-score in 2008, while the values for Jordan, Lebanon and Morocco are substantially higher than those in OECD countries thereby indicating a more stable banking system.

Following the 2007 crisis, there is an increased awareness of the importance of the development of financial institutions and markets. Engaged in the privatization, modernization and the opening of the banking system to foreign banks, the authorities in the MENA region are also concerned with avoiding the risks often resulting from

liberalization programs. It has been shown that when banking systems grow too quickly, crises are likely to follow (Demirguc-Kunt and Detragiache, 2006). This study contributes to the understanding of the dynamics of economic development of the MENA region by assessing the impact of financial and institutional reforms on bank performance and efficiency.

III. METHODOLOGY

There is a vast literature on the evaluation of bank performance and efficiency, using both parametric and non-parametric approaches.[2] In this study, we follow the non-parametric Data Envelopment Analysis (DEA) to estimate bank specific efficiency levels. DEA is a mathematical linear programming technique developed by Charnes, Cooper, and Rhodes in 1978 (CCR) which identifies the efficient frontier from the linear combination of those units/observations that (in a production space) use comparatively fewer inputs to produce comparatively more outputs. The DEA frontier corresponds to the set of efficient observations for which no other production unit or linear combination of units employs as little or less of every input without changing the output quantities produced (input orientation) or produces as much or more of every output without changing the input quantities (output orientation). Efficiency scores range between 0 and 1, with 1 being fully efficient.[3] We adopt an input-minimization orientation, based on the assumption that during periods of regulatory changes and increased competition market participants strategically focus on cutting costs.

Most early cross-country studies assume that banks in different countries can access the same banking-production technology. In other words, in order to be able to compare efficiency results across borders, they assume a common production frontier for all countries. The interpretation of the resulting efficiency scores relies significantly on the validity of this assumption. In some cases this is a major drawback, as the production technology can be substantially different among countries, particularly if countries are at different levels of financial development. Recent empirical studies have attempted to overcome this problem by integrating country-specific environmental variables in the efficiency estimation. There are various ways to incorporate environmental variables in the estimation of bank efficiency, the most commonly used are the one-step and the two-step approaches.[4]

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[2] Early bank efficiency studies investigate mainly the US and EU countries (see Berger and Humphrey, 1997, and Goddard and others, 2001). For a review of recent literature, see Berger (2007); Goddard and others (2007), Cook and Seiford (2009); Hughes and Mester (2010).

[3] Further methodological details can be found in Appendix 1.

[4] In the one-step approach, environmental variables are included directly in the estimation of efficiency whereas in the two-step approach efficiency scores obtained in the first stage of analysis are then regressed on a number of country-specific environmental variables. Both approaches are employed in the literature. The one-step approach seems to be the preferred choice if using a parametric approach to the efficiency evaluation, following the maximum likelihood procedure of Battese and Coelli (2005). A one-step approach is used, among others, by Zhao and others (2010) to evaluate the impact of financial reforms on Indian banking and by Kablan (2010) to evaluate the efficiency and financial development of the banking sector in Sub-Saharan Africa.

The two step approach, on the other hand seems to be the favored approach if efficiency is estimated by means of Data Envelopment Analysis (DEA). In a typical two-stage study, the relative efficiency of each institution is first evaluated and then regressed (as the dependent variable in an ordinary least

(continued…)

Departing from the standard two stage approach, Battese and others (2004) and O'Donnell and others (2008) recently proposed a so-called "meta-frontier" as a method to estimate country or regional-specific frontiers and obtain comparable efficiency scores, as the DEA meta-frontier results from the envelopment of country specific DEA frontiers. In this paper, we follow the meta-frontier approach to estimate cross-country efficiency scores. [5]

However, while the meta-frontier approach develops a formal theoretical framework for making meaningful efficiency comparisons across groups of firms in different countries, it provides us with little information on the determinants of the differences in efficiency among countries. In a second stage analysis, we therefore attempt to measure the impact of local (country-specific) market and regulatory variables. [6] This approach allows us to improve on the current literature by testing the significance of each of these variables as well as their combined impact on efficiencies derived from the meta-frontier analysis.

The regressions estimated to analyze the influence of bank specific, country specific and institutional factors on bank performance and efficiency are

$$EFF_{i,t} = \beta_1 \text{ Bank\_Char}_{i,t} + \beta_2 \text{ Contry\_Char}_{i,t} + \beta_3 \text{ Institutional}_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$ROA_{i,t} = \beta_1 \text{ Bank\_Char}_{i,t} + \beta_2 \text{ Contry\_Char}_{i,t} + \beta_3 \text{ Institutional}_{i,t} + \varepsilon_{i,t} \quad (2)$$

In equation (1) the dependent variable EFF is the efficiency score computed by the meta-frontier approach. In equation (2) the dependent variable is a bank's ROA. Bank_Char is a vector of bank characteristic variables; Country_Char is a vector of country characteristic factors and Institutional is a vector of institutional variables. These variables are explained in details in Section 4.3. β is a vector of coefficient estimates and ε is the disturbance term. Following the literature, we use both a Tobit and an OLS specification.

IV. DATA AND VARIABLES

A. Data

Our data set is primarily drawn from BankScope, a global database published by Bureau Van Dijk. Data are collected for a sample of 735 observations, relative to annual information from unconsolidated bank statements of a balanced panel of 49 banks operating in Egypt (19 banks), Jordan (8 banks), Morocco (5 banks), Tunisia (11 banks) and Lebanon (6) over the period 1994 to 2008. These countries have followed IMF or World Bank programs and are at a comparable stage of economic and financial development. The choice of countries is also influenced by the

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squares or a Tobit regression) on various explanatory variables to identify the factors whose impact on efficiency is statistically significant. For more details on the one-stage and two-stage approaches, see Coelli and others (2005).

[5] Methodological details are reported in Appendix 1.

[6] Banker and Natarajan (2008) indicate that a two-step DEA-based procedure with OLS, maximum likelihood, or Tobit estimation in the second stage performs considerably better than one-stage parametric methods.

availability of data on institutional factors and financial structure. We limit our analysis to publicly traded commercial banks. We focus on this banking category as the services they offer are reasonably homogeneous and comparable across countries. In addition, publicly traded banks follow the international accounting standards (IAS/IFRS), hence providing comparable and more reliable data.

The institutional data are taken from the International Country Risk Guide (ICRG) Researchers Dataset, which provides a comprehensive analysis of risk ratings of developed and emerging countries, based on their financial, economic, and political environment. The financial structure data was drawn from the updated Beck and others database (2008 update), which is published by the World Bank.

B. Input and Output Definition

In this study we follow a variation of the intermediation approach (Sealey and Lindley, 1977) to define our input and output variables. This approach views financial institutions as mediators between the supply and the demand of funds. As a consequence, deposits are considered as inputs, and interest on deposits is a component of total costs, together with labor and capital. Specifically, the input variable used in this study is total costs = interest expenses + overheads (personnel expenses and other non-interest expenses).[7] The two output variables capture both the traditional lending activity of banks (total loans) and the growing non-lending activities (other earning assets). Table 3 reports the descriptive statistics of the input/output variables. While there are no substantial differences in term of costs, Moroccan banks are on average much bigger in term of both outputs.

Table 3. Summary Statistics of Input and Output Variables

		Mean	*Median*	*St.dev.*	*Min*	*Max*
Egypt	*Total loans*	1143.8	403.7	1595.2	17.4	7628.7
	Other earning assets	1324.9	539.0	1829.2	31.4	13506.2
	Total costs	200.8	73.3	301.6	6.8	1857.6
Jordan	*Total loans*	1234.2	353.8	2358.2	68.9	15284.0
	Other earning assets	1316.7	397.6	2649.8	22.4	15859.7
	Total costs	151.0	50.1	248.4	8.6	1366.0
Lebanon	*Total loans*	873.6	516.7	1021.3	9.5	6129.1
	Other earning assets	2394.6	1403.4	2636.1	16.5	11659.6
	Total costs	247.7	169.0	237.9	5.7	1087.4
Morocco	*Total loans*	2600.0	1751.6	3033.3	590.5	18951.4

[7] We aggregate the cost expenditure into a single input to minimize the well-known dimensionality problem associated with DEA. In small samples, if we have a large number of variables relative to the number of observations, units can be wrongly identified as efficient because too many constraints have been specified. Observations tend to become incomparable and hence figure 3 on the frontier owing to the inability of DEA to identify peers. One way around this, commonly used in the literature, is to aggregate the input variables in a single monetary value.

	Other earning assets	2041.7	856.9	2688.1	205.9	14483.2
	Total costs	203.7	144.9	208.1	58.0	1118.9
Tunisia	*Total loans*	1306.0	1150.8	863.7	18.3	3672.6
	Other earning assets	330.6	234.5	295.2	21.9	1756.4
	Total costs	97.8	85.6	61.9	1.7	246.1
Mean	*Total loans*	1310.4	760.6	1819.8	9.4	18951.4
	Other earning assets	1304.4	460.4	2106.6	16.5	15859.7
	Total costs	175.6	90.6	244.3	1.7	1857.6

Note: Values are in Millions USD.

C. Environmental Variables

In this section we introduce our contextual variables and our proxies for the institutional and regulatory environment in the four MENA countries under study. We utilize proxies for institutional development, financial structure, and bank specific characteristics. Specifically, proxies for institutional development are: Bureaucracy Quality (BC), Corruption (C), Democratic Accountability (DA), Government Stability (GS), Investment Profile (I), Law and Order (LO), Socioeconomic Conditions (SC). and Financial Sector Reform (FSR). Proxies for financial structure are: stock market capitalization (MCAP); credit to the private sector (CREDITPR), and concentration (CONC). Finally, the bank specific variables of interest are: the ratio of equity over total assets (EQTA); the ratio of net loans over total assets (NETLOANS), and the liquidity ratio (LIQ). The remainder of this section provides a rationale for the inclusion of these variables in our second stage analysis.

Institutional Development

According to the literature, official government power hampers bank development in countries with a closed political system (Barth and others, 2003). Specifically, according to the "private interest view", in such countries politicians and regulators do not maximize social welfare; they maximize their own. Thus, if bank regulators have substantial influence over bank decisions, this power may be abused to force banks to divert the flow of credit to investments that satisfy private interests. Hence, heavy regulation of bank activities and direct influence over banks are unlikely to promote sound banking as most countries do not have political and legal systems that induce politicians and government officials to act in the best interests of society.

To test this hypothesis we include various institutional indexes to reflect the political stability of the countries in our sample and allocate risk points to a pre-set group of factors, termed political risk components. The minimum number of points that can be assigned to each component is zero, while the maximum number of points depends on the fixed weight that component is given in the overall political risk assessment. The lower the risk point total, the higher the risk, and vice versa.

To ensure consistency, both between countries and over time, points are assigned by the International Country Risk Guide (ICRG) on the basis of a series of pre-set questions for each risk component. For example, the institutional strength and quality

of the bureaucracy (BC) is considered a shock absorber that tends to minimize revisions of policy when governments change. Therefore, high points are given to countries where the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services. In low-risk countries, the bureaucracy tends to be somewhat autonomous from political pressure and to have an established mechanism for recruitment and training.

The corruption (C) within the political system distorts the economic and financial environment, reduces the efficiency of government and business by enabling people to assume positions of power through patronage rather than ability, and introduces an inherent instability into the political process. In low income countries, political instability and corruption have been shown to have a detrimental effect on financial development (Detragiache, and others, 2005; Ayyagari, and others, 2005). The most common form of corruption met directly by business is financial corruption in the form of demands for special payments and bribes connected with import and export licenses, exchange controls, tax assessments, police protection, or loans. Such corruption can make it difficult to conduct business effectively, and in some cases might force the withdrawal or withholding of an investment. For instance, Barth and others (2004) argued that powerful supervision may lead to corruption or distortions and/or hinder banking operations. Our study takes such index into account in order to control the risk to foreign business. It ranks nations on a scale from 0 to 6. A score of 0 represents maximum corruption level, while 6 indicates minimum corruption level.

Democratic Accountability (DA) is a measure of how responsive the government is to its people, on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society, but possibly violently in a non-democratic one. The points in this component are given on the basis of the type of governance enjoyed by the country in question.

Government Stability (GS) is an index of the government's ability to carry out its declared program(s), and its ability to stay in office. The risk rating assigned is the sum of government unity, legislative strength, and popular support. A score of 4 points equates to very low risk and a score of 0 points to very high risk.

Investment Profile (I) proxies the factors affecting the risk to investment that are not covered by other political, economic, and financial risk components. The risk rating assigned is the sum of three subcomponents: contract viability/expropriation, profits repatriation, and payment delays. Each element has a maximum score of four points and a minimum score of 0 points. A score of 4 points equates to very low risk and a score of 0 points to very high risk.

Law and Order (LO) are assessed separately, with each sub-component comprising zero to three points. The Law element is a measure of the strength and impartiality of the legal system, while the Order element is an assessment of popular observance of the law. Thus, a country can enjoy a high rating in terms of its judicial system, but a low rating if it suffers from a very high crime rate or if the law is routinely ignored without effective sanction. The empirical evidence confirms the relevance of an effective legal system to promote financial development (Beck, Demirguc-Kunt and Levine, 2005; Djankov and others, 2007)

Socioeconomic Conditions (SC) assesses the socioeconomic pressures at work in the society that could constrain government action or fuel social dissatisfaction. The risk rating assigned is the sum of three subcomponents: unemployment, consumer confidence, and poverty. Each element can take a maximum score of four points (very low risk) and a minimum score of 0 points (very high risk).

Financial Sector Reform (FSR) is an index provided by Tressel and Detragiache (2008) that measures banking reforms in five areas (credit control and reserve requirements, interest rate controls, entry barriers, state ownership and banking supervision). A higher score corresponds to more advanced reforms. Additional details on the index are in Abiad, Detragiache and Tressel (2008).

Financial Structure

Following the recent literature which links financial development to economics efficiency and productivity growth (see, among others, Kasman and Yildirim, 2006) we specify the following variables to proxy the countries' financial structure: stock market capitalization (MCAP); credit to the private sector (CREDITPR), and concentration (CONC).

The level of stock market development can be proxied by the index stock liquidity, measured by the ratio of market capitalization of the stock exchange over GDP (MCAP). Empirical evidence indicates that, as countries develop, the financial structure changes and financial systems become more market based. Diamond (1991) argues that there is a "life cycle" effect in the use of borrowing through intermediaries. New borrowers borrow from banks initially but may later issue debt directly, without using an intermediary. Accordingly, as stock markets develop the type of clients that borrow from banks will change (probably with a larger share of smaller and newer firms). Nevertheless, Demirguc-Kunt and Levine (1996) document a positive relationship between various stock market indicators and measures of development and efficient functioning of banks. Countries with well developed stock markets tend to have more efficient financial intermediaries. Hence, we expect a positive impact of MCAP on bank efficiency if the banking sector and capital market are complementary and a negative impact in case of competition between them.

We use also the ratio credit to the private sector (CREDITPR) defined as claims on the private sector by banks and other financial institutions divided by GDP. It is a standard indicator in the literature and empirical evidence indicates that countries with higher rates of CREDIPR grow faster (Beck and Demirgüç-Kunt, 2009). We expect a positive relationship with bank efficiency and profitability.

Concentration (CONC) in the banking industry can have a wide range of long-lasting implications for financial sector efficiency, bank stability, and competition. The empirical evidence about the effects of concentration in the banking sector is mixed. On one hand, concentration increases market power and hence might prevent competition and efficiency. On the other hand, if economies of scale drive bank mergers and acquisitions, then increased concentration may lead to efficiency improvements (Demirguc-Kunt and Levine, 2000; Casu and Girardone, 2009). We proxy concentration as the percentage of assets held by the three largest commercial banks relative to the total assets of all commercial banks (CR3).

Banks Characteristics

Finally, to control for differences in bank specific characteristics; we use the following proxies: the ratio of equity over total assets (EQTA), the ratio of net loans over total assets (NETLOANS), and the liquidity ratio (LIQ).

The ratio of equity over total assets (EQTA) controls for capital strength. High levels of equity mitigate the risk of insolvency and, ultimately, the cost of borrowed funds. Bank with larger capitalization are less likely to become insolvent. We expect a positive relationship between efficiency and capitalization.

NETLOANS is defined as the ratio of net loans to total assets. Banks with larger loan portfolios to total assets might have expanded rapidly; might not be well diversified and therefore be more exposed to credit risk compared to counterparts. Given that MENA banks risk management expertise is limited, this may bring about higher costs (or lost revenues) in term of nonperforming loans. This would have a negative effect on efficiency (i.e. bad management). Nevertheless, these banks may appear more profitable, if the higher credit risk is reflected in higher interest margins.

On the other hand, given the size of their lending book, these banks may be better at assessing risks and able to exploit economies of scale, which in turn would have a positive impact on efficiency (i.e. good management).

Finally, LIQ is defined as the ratio of liquid assets to deposits and short-term funding. This ratio represents the risk of not having sufficient cash to satisfy unexpectedly high withdrawals or new loan requests. Lack of liquidity may also force banks to borrow funds at excessive cost. Regarding the sign of the coefficients of this explanatory variable, we do not have a priori expectations.

V. EMPIRICAL RESULTS

This section presents the results of the application of Data Envelopment Analysis (DEA) to evaluate the efficiency of banks in selected MENA countries and the results of the two-stage procedure to investigate the impact of environmental variables on bank efficiency.

A. DEA Efficiency Results

DEA estimates of the country frontiers and the meta-frontier were obtained using DEAP 2.1 (Coelli, 1996). All results were obtained using the Variable Returns Scale (VRS) input-orientated DEA. Table 4 reports descriptive statistics of efficiency scores for Egypt, Jordan, Morocco, Tunisia and Lebanon, as well as estimates for all countries combined (meta-frontier). Technical efficiencies and meta-technology ratios were estimated for each of the five MENA countries in each of fifteen years analysis, relative to a balanced panel data set rather than relative to yearly frontiers, which makes analysis of the evolution of efficiency over time meaningful.

Table 4. DEA Estimates MENA-5 Countries

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Egypt	DEA-M	0.655	0.578	0.694	0.670	0.683	0.647	0.534	0.535	0.557	0.494	0.444	0.460	0.477	0.539	0.496
		(0.039)	*(0.045)*	*(0.034)*	*(0.034)*	*(0.034)*	*(0.045)*	*(0.047)*	*(0.040)*	*(0.044)*	*(0.036)*	*(0.036)*	*(0.037)*	*(0.037)*	*(0.035)*	*(0.037)*
	DEA-C	0.871	0.861	0.915	0.934	0.883	0.855	0.864	0.850	0.844	0.839	0.820	0.866	0.830	0.807	0.753
		(0.033)	*(0.036)*	*(0.025)*	*(0.016)*	*(0.027)*	*(0.031)*	*(0.032)*	*(0.029)*	*(0.033)*	*(0.035)*	*(0.035)*	*(0.030)*	*(0.044)*	*(0.047)*	*(0.052)*
	DEA-MTR	0.755	0.665	0.761	0.714	0.771	0.748	0.606	0.618	0.649	0.584	0.539	0.532	0.577	0.685	0.678
		(0.034)	*(0.038)*	*(0.029)*	*(0.029)*	*(0.026)*	*(0.033)*	*(0.037)*	*(0.029)*	*(0.032)*	*(0.027)*	*(0.030)*	*(0.034)*	*(0.032)*	*(0.034)*	*(0.032)*
Jordan	DEA-M	0.665	0.591	0.612	0.530	0.584	0.525	0.488	0.539	0.532	0.556	0.565	0.672	0.622	0.624	0.656
		(0.060)	*(0.096)*	*(0.072)*	*(0.072)*	*(0.062)*	*(0.069)*	*(0.073)*	*(0.071)*	*(0.077)*	*(0.080)*	*(0.080)*	*(0.075)*	*(0.063)*	*(0.065)*	*(0.057)*
	DEA-C	0.911	0.838	0.945	0.935	0.951	0.914	0.889	0.879	0.836	0.861	0.864	0.917	0.970	0.939	0.931
		(0.056)	*(0.081)*	*(0.036)*	*(0.035)*	*(0.027)*	*(0.033)*	*(0.051)*	*(0.051)*	*(0.065)*	*(0.066)*	*(0.069)*	*(0.043)*	*(0.020)*	*(0.037)*	*(0.036)*
	DEA-MTR	0.734	0.696	0.646	0.563	0.611	0.569	0.549	0.607	0.630	0.644	0.652	0.727	0.639	0.662	0.706
		(0.050)	*(0.072)*	*(0.066)*	*(0.066)*	*(0.056)*	*(0.062)*	*(0.069)*	*(0.059)*	*(0.062)*	*(0.066)*	*(0.066)*	*(0.063)*	*(0.059)*	*(0.057)*	*(0.053)*
Lebanon	DEA-M	0.474	0.479	0.424	0.518	0.538	0.425	0.477	0.377	0.438	0.340	0.304	0.365	0.379	0.573	0.667
		(0.061)	*(0.110)*	*(0.051)*	*(0.044)*	*(0.077)*	*(0.023)*	*(0.095)*	*(0.025)*	*(0.063)*	*(0.042)*	*(0.034)*	*(0.024)*	*(0.032)*	*(0.105)*	*(0.087)*
	DEA-C	1.000	0.906	0.924	0.951	0.950	0.997	0.966	0.931	0.898	0.955	0.933	0.956	0.983	0.972	0.997
		(0.000)	*(0.090)*	*(0.076)*	*(0.049)*	*(0.050)*	*(0.003)*	*(0.029)*	*(0.062)*	*(0.083)*	*(0.028)*	*(0.044)*	*(0.032)*	*(0.017)*	*(0.022)*	*(0.004)*
	DEA-MTR	0.474	0.525	0.460	0.545	0.571	0.426	0.508	0.406	0.484	0.352	0.323	0.382	0.385	0.589	0.670
		(0.061)	*(0.097)*	*(0.039)*	*(0.036)*	*(0.077)*	*(0.023)*	*(0.118)*	*(0.008)*	*(0.045)*	*(0.037)*	*(0.028)*	*(0.023)*	*(0.030)*	*(0.104)*	*(0.088)*
Morocco	DEA-M	0.792	0.827	0.901	0.844	0.935	0.886	0.782	0.781	0.827	0.876	0.837	0.891	0.960	0.872	0.880
		(0.068)	*(0.050)*	*(0.042)*	*(0.049)*	*(0.029)*	*(0.054)*	*(0.109)*	*(0.057)*	*(0.047)*	*(0.045)*	*(0.067)*	*(0.045)*	*(0.021)*	*(0.081)*	*(0.078)*
	DEA-C	0.945	0.972	0.997	0.974	0.986	1.000	0.973	0.995	0.981	0.954	0.917	0.940	0.967	0.928	0.923
		(0.036)	*(0.017)*	*(0.003)*	*(0.026)*	*(0.014)*	*(0.000)*	*(0.027)*	*(0.005)*	*(0.019)*	*(0.031)*	*(0.055)*	*(0.039)*	*(0.021)*	*(0.067)*	*(0.063)*
	DEA-MTR	0.834	0.850	0.903	0.866	0.947	0.886	0.803	0.785	0.843	0.919	0.917	0.949	0.992	0.934	0.947
		(0.048)	*(0.041)*	*(0.040)*	*(0.042)*	*(0.023)*	*(0.054)*	*(0.107)*	*(0.057)*	*(0.044)*	*(0.040)*	*(0.058)*	*(0.036)*	*(0.005)*	*(0.030)*	*(0.027)*
Tunisia	DEA-M	0.844	0.845	0.892	0.919	0.915	0.924	0.891	0.879	0.875	0.889	0.817	0.835	0.781	0.658	0.655
		(0.033)	*(0.038)*	*(0.033)*	*(0.027)*	*(0.026)*	*(0.028)*	*(0.041)*	*(0.035)*	*(0.038)*	*(0.032)*	*(0.037)*	*(0.042)*	*(0.045)*	*(0.042)*	*(0.042)*
	DEA-C	0.892	0.870	0.909	0.935	0.940	0.948	0.968	0.948	0.904	0.941	0.930	0.943	0.914	0.900	0.916
		(0.034)	*(0.037)*	*(0.032)*	*(0.026)*	*(0.023)*	*(0.021)*	*(0.013)*	*(0.023)*	*(0.032)*	*(0.027)*	*(0.032)*	*(0.027)*	*(0.037)*	*(0.044)*	*(0.040)*
	DEA-MTR	0.950	0.971	0.982	0.983	0.973	0.973	0.921	0.930	0.967	0.948	0.882	0.888	0.859	0.736	0.717
		(0.026)	*(0.014)*	*(0.011)*	*(0.011)*	*(0.012)*	*(0.015)*	*(0.042)*	*(0.034)*	*(0.020)*	*(0.020)*	*(0.033)*	*(0.038)*	*(0.040)*	*(0.037)*	*(0.033)*
MENA-5	**DEA-M**	**0.691**	**0.653**	**0.713**	**0.702**	**0.727**	**0.686**	**0.625**	**0.618**	**0.637**	**0.613**	**0.571**	**0.611**	**0.606**	**0.618**	**0.618**
		(0.027)	***(0.034)***	***(0.029)***	***(0.029)***	***(0.028)***	***(0.033)***	***(0.036)***	***(0.032)***	***(0.033)***	***(0.035)***	***(0.035)***	***(0.034)***	***(0.033)***	***(0.028)***	***(0.028)***

Notes: DEA-M = efficiencies estimated with respect to the meta-frontier; DEA-C = efficiencies estimated with respect to the country frontier;
DEA-MTR = meta-technology ratio. St.dev. in brackets.

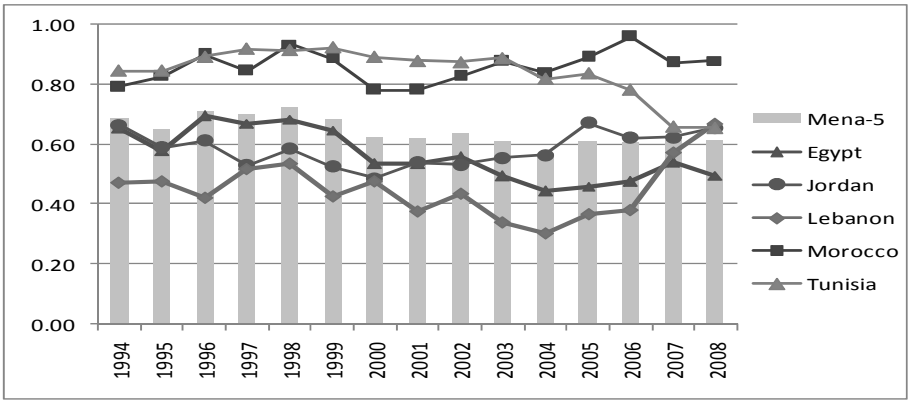
The average annual efficiency scores of banks of each country relative to the country's frontier (DEA-C) reveal stability or a slight general improvement for Moroccan, Tunisian, Lebanese and Jordanian banks and a slight decline in overall efficiency levels for Egyptian banks. The mean efficiency score of Moroccan and Tunisian banks is 96.3 percent and 92.3 percent, respectively; the average for Egypt 85.2 percent, for Jordan 90.5 percent and 95.4 percent for Lebanon. These efficiency levels are within the range of the scores recorded in the literature on developed countries (efficiency levels range between 0.55 percent and 0.95 percent). However it is important to notice that these efficiencies are calculated relative to each country's frontier; the boundaries of these frontiers are restricted technology sets, where the restrictions derive from the available economic infrastructure and other characteristics of the production environment. As a consequence, the high efficiency levels displayed are relative only to the other institutions in a given country and the available production technology in that given country.

We now move to the measurement of efficiency relative to a common meta-frontier, defined as the boundary of an unrestricted technology set. It is interesting to note that in all countries, the country-specific frontiers were at least partially tangent to the meta-frontier. This is the case when at least one observation from each country lies both on the country and on the meta-frontier and it is therefore positioned in the point of tangency between the country and the meta-frontier (see Figure 3 in the Appendix). This indicates that the meta-frontier closely envelops the country specific frontiers and that the value of the technological gap ratio equals the maximum value of one for at least one observation in each of the sample countries. The technological gap or meta-technology ratio (DEA-MTR), is calculated as the ratio between meta-frontier (in)efficiency (DEA-M) and the country specific (in)efficiency (DEA-C) and it indicates the relative productivity of technologies. The higher the ratio, the closer a country's production technology is to the "best practice" in the region. Vice versa, the lower the ratio, the bigger is the technology gap.

Looking at the efficiency scores derived from the estimation of the meta-frontier, Moroccan and Tunisian banks dominate the region, with average efficiency scores of 85.9 percent and 84.1 percent respectively. Jordan, Lebanon and Egypt are lagging behind with average efficiency scores of 58.3 percent, 45.2 and 56.4 percent over the period. The region's average efficiency score is 64.6 percent, which indicates that MENA countries banks could, on average, reduce costs (inputs) by 35.4 percent and still produce the same outputs. Figure 1 illustrates the trend of efficiency levels over the period 1994-2008. For all countries, it is possible to note an improvement in efficiency levels in the early stages of the analysis. However, the improvement is short lived and efficiency levels decline steadily over the late 1990s to mid-2000s for all countries. During this period, their meta-technology ratio is also decreasing, thus indicating a lagging behind from the best available technology in the region (Figure 2). Jordanian banks efficiency levels seem to improve steadily from 2000 onwards, and seem to converge to the average for the region by the end of the sample period. Efficiency levels in Tunisia, on the other hand, seem to deteriorate from the early 2000, when Tunisian banks seem to lose their comparative advantage in the region and display an increase in input wastage. Lebanese banks efficiency levels indicate an improvement since 2004 and reach the region average by the end of the sample period. To summarize, by the end of 2008 Moroccan banks still dominate the region,

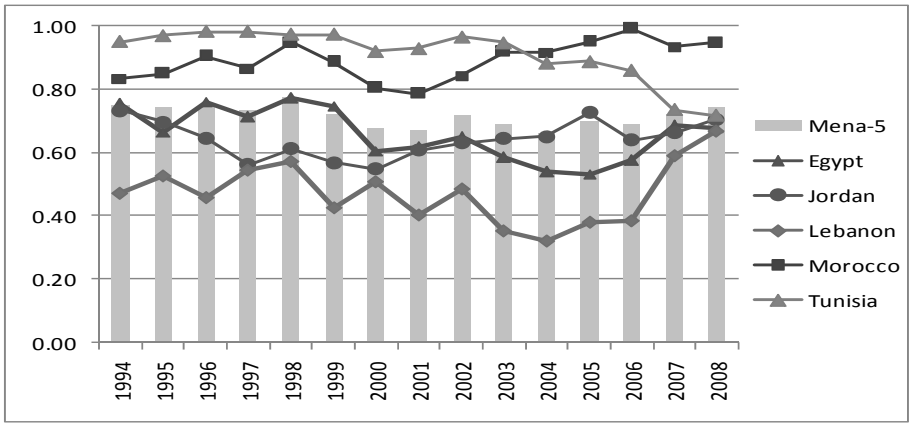
efficiency levels of Tunisia, Jordanian and Lebanese banks converge towards the region average, while Egyptian banks underperform.

Figure 1. Meta-frontier DEA Efficiency Scores



This pattern is also revealed in Figure 2, which illustrates the evolution of the meta-technology ratios for the five MENA countries. Tunisia and Morocco display the highest ratios, thereby indicating that they operate close to the meta-frontier. As highlighted earlier, Tunisian banks meta-technology ratios are decreasing from 2000-2001. Despite underperforming in terms of overall efficiency levels, Egyptians, Lebanese and Jordanian banks meta-technology ratios are gradually increasing, thus indicating a convergence towards the average, but they are still substantially lagging behind the best available technology in the region, which is represented by Moroccan banks. Lebanon's banks MTR displays the sharpest improvement from the year 2004 onwards, and converges towards the average for the region.

Figure 2. Meta-technology Ratios



Estimates of the gap between country frontiers and the meta-frontier can be used to design programs for performance improvement, which would involve changes to the production environment, such as deregulation (O'Donnell and others, 2008). In the next section, we investigate the determinants of difference in efficiency levels.

B. Robustness Tests

By its very nature, efficiency measures derived by means of Data Envelopment Analysis are relative measure of efficiency. In the definition of the optimization problem the issue of industry heterogeneity is accounted for by the weights allocated to the input and outputs of each bank compared to its own virtual benchmark. By construction, our sample is a balanced sample where all observations exist over the period of analysis. The reference frontier represents the best available technology in a specific year. Efficiency change is calculated as the change of the relative position of the observed production unit from the frontier between time t and t+1. This usually signals the technological imitation of average practices, the change in their ability to appropriate the best existing production technology over time. More in particular, a positive change in the efficiency score indicates an efficiency improvement (or catching-up), and it reflects the movement of the particular inefficient unit towards the frontier; in contrast, a negative change in the efficiency value is explained as the deterioration of efficiency (or falling behind). There is a second element, which reflects technological change namely the shift of the frontier, i.e. the expansion of the frontier indicates technological progress and a contraction of the frontier represents technological regress.

It is however a limitation of the DEA methodology to evaluate efficiency relative to the observation in the sample. To ensure that the best practice banks in the region constitute a good benchmark, we re-run all the estimations including listed banks from a Southern-Mediterranean country, Portugal, to our dataset.[1] Another potential issue may arise from the impact of different inflation rates in the MENA region. Although DEA works in terms of ratios and therefore potential distortions in terms of inflation rates on interest costs should not be impacting the results, we re-calculated all efficiency scores using inflation adjusted data.

Table 5 below reports the results of the meta-frontier estimations using inflation adjusted data in dollars (inflation adjustment carried out on the country currencies and then converted to US$), when the sample includes Portugal. The results show that Portuguese banks do not dominate the frontier (see also Figure 3), which indicate that the "best practice" MENA banks are already operating using the best available technology. A number of banks remains efficient in all model specifications: these institutions can be considered the "true best practice across the region. In summary, changing the unit of account (country currencies v US dollars), using inflation adjusted data and including a Southern Mediterranean country in the sample does not substantially change our results, with Moroccan banks still outperforming their peers.

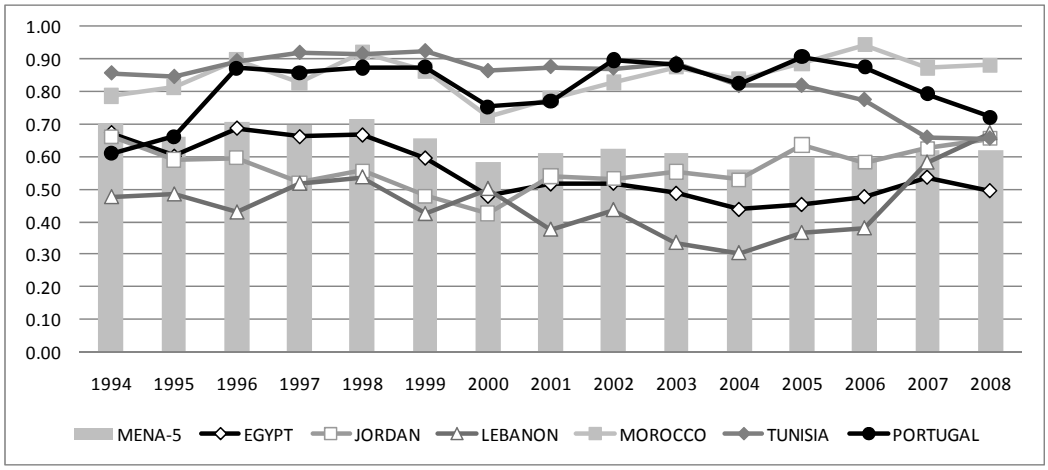
[1] Although this choice may appear arbitrary, Portugal has been used in the literature of economic development as a benchmark country. In this specific case, we could have used any other Southern Mediterranean country which is currently part of the European Union as a potential benchmark for the MENA region.

Table 5. Further DEA Estimates

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Egypt	DEA-M	0.674	0.602	0.688	0.662	0.667	0.596	0.479	0.517	0.519	0.488	0.438	0.454	0.478	0.537	0.496
		0.179	*0.196*	*0.144*	*0.131*	*0.134*	*0.152*	*0.140*	*0.116*	*0.157*	*0.155*	*0.159*	*0.161*	*0.164*	*0.148*	*0.160*
	DEA-C	0.870	0.860	0.914	0.934	0.883	0.855	0.865	0.850	0.835	0.839	0.820	0.866	0.830	0.807	0.753
		0.145	*0.157*	*0.110*	*0.072*	*0.117*	*0.136*	*0.139*	*0.126*	*0.145*	*0.154*	*0.151*	*0.131*	*0.193*	*0.205*	*0.228*
	DEA-MTR	0.779	0.695	0.754	0.706	0.754	0.695	0.560	0.612	0.616	0.578	0.533	0.526	0.578	0.683	0.678
		0.166	*0.171*	*0.124*	*0.112*	*0.094*	*0.108*	*0.154*	*0.147*	*0.112*	*0.120*	*0.135*	*0.154*	*0.141*	*0.145*	*0.139*
Jordan	DEA-M	0.661	0.590	0.596	0.520	0.556	0.479	0.425	0.539	0.532	0.554	0.530	0.635	0.582	0.626	0.655
		0.168	*0.271*	*0.174*	*0.181*	*0.095*	*0.075*	*0.091*	*0.201*	*0.217*	*0.226*	*0.164*	*0.169*	*0.098*	*0.183*	*0.161*
	DEA-C	0.911	0.838	0.945	0.935	0.951	0.914	0.889	0.879	0.836	0.862	0.864	0.917	0.970	0.939	0.931
		0.157	*0.228*	*0.103*	*0.100*	*0.078*	*0.094*	*0.144*	*0.145*	*0.183*	*0.187*	*0.194*	*0.122*	*0.056*	*0.103*	*0.102*
	DEA-MTR	0.730	0.696	0.629	0.553	0.584	0.524	0.501	0.608	0.630	0.642	0.616	0.690	0.600	0.664	0.705
		0.142	*0.203*	*0.156*	*0.163*	*0.074*	*0.049*	*0.184*	*0.165*	*0.175*	*0.188*	*0.134*	*0.139*	*0.089*	*0.162*	*0.151*
Lebanon	DEA-M	0.476	0.484	0.428	0.517	0.537	0.423	0.501	0.375	0.436	0.335	0.303	0.365	0.379	0.582	0.673
		0.148	*0.269*	*0.124*	*0.107*	*0.187*	*0.056*	*0.269*	*0.059*	*0.151*	*0.098*	*0.083*	*0.060*	*0.079*	*0.255*	*0.215*
	DEA-C	0.921	0.882	0.898	0.931	0.953	0.951	0.966	0.947	0.915	0.929	0.916	0.933	0.921	0.890	0.919
		0.124	*0.139*	*0.113*	*0.110*	*0.081*	*0.057*	*0.046*	*0.085*	*0.119*	*0.111*	*0.131*	*0.111*	*0.129*	*0.171*	*0.133*
	DEA-MTR	0.519	0.532	0.474	0.558	0.562	0.445	0.518	0.401	0.495	0.368	0.341	0.396	0.417	0.710	0.776
		0.145	*0.238*	*0.110*	*0.110*	*0.178*	*0.053*	*0.274*	*0.084*	*0.246*	*0.135*	*0.131*	*0.083*	*0.088*	*0.433*	*0.382*
Morocco	DEA-M	0.786	0.814	0.897	0.827	0.921	0.864	0.724	0.779	0.827	0.876	0.837	0.887	0.943	0.873	0.880
		0.155	*0.113*	*0.097*	*0.110*	*0.054*	*0.104*	*0.263*	*0.128*	*0.106*	*0.101*	*0.150*	*0.105*	*0.068*	*0.181*	*0.173*
	DEA-C	0.945	0.972	0.997	0.974	0.986	1.000	0.969	0.995	0.981	0.954	0.917	0.940	0.967	0.928	0.923
		0.081	*0.039*	*0.008*	*0.058*	*0.030*	*0.000*	*0.069*	*0.011*	*0.043*	*0.070*	*0.123*	*0.087*	*0.046*	*0.151*	*0.140*
	DEA-MTR	0.827	0.836	0.900	0.849	0.934	0.864	0.757	0.783	0.843	0.918	0.917	0.944	0.974	0.935	0.948
		0.111	*0.095*	*0.093*	*0.097*	*0.043*	*0.104*	*0.299*	*0.128*	*0.099*	*0.089*	*0.130*	*0.076*	*0.037*	*0.066*	*0.060*
Tunisia	DEA-M	0.856	0.845	0.893	0.919	0.915	0.924	0.862	0.875	0.871	0.886	0.817	0.818	0.774	0.658	0.655
		0.108	*0.127*	*0.110*	*0.091*	*0.086*	*0.094*	*0.143*	*0.114*	*0.123*	*0.105*	*0.124*	*0.125*	*0.147*	*0.140*	*0.139*
	DEA-C	0.940	0.882	0.922	0.946	0.938	0.973	0.965	0.939	0.895	0.955	0.939	0.955	0.948	0.944	0.958
		0.102	*0.174*	*0.149*	*0.094*	*0.100*	*0.063*	*0.059*	*0.116*	*0.159*	*0.064*	*0.091*	*0.068*	*0.097*	*0.093*	*0.105*
	DEA-MTR	0.929	1.006	0.998	0.982	0.989	0.956	0.897	0.950	1.019	0.932	0.877	0.860	0.827	0.702	0.696
		0.214	*0.296*	*0.229*	*0.146*	*0.165*	*0.141*	*0.157*	*0.203*	*0.307*	*0.128*	*0.150*	*0.142*	*0.188*	*0.151*	*0.182*
Portugal	DEA-M	0.610	0.661	0.873	0.858	0.873	0.874	0.753	0.769	0.896	0.883	0.825	0.908	0.875	0.793	0.721
		0.142	*0.213*	*0.155*	*0.195*	*0.151*	*0.139*	*0.168*	*0.150*	*0.122*	*0.137*	*0.152*	*0.144*	*0.178*	*0.269*	*0.277*
MENA-5	**DEA-M**	0.704	0.662	0.709	0.695	0.714	0.657	0.584	0.610	0.623	0.609	0.562	0.598	0.597	0.619	0.619
		0.183	*0.228*	*0.198*	*0.196*	*0.186*	*0.214*	*0.235*	*0.214*	*0.224*	*0.248*	*0.238*	*0.231*	*0.220*	*0.191*	*0.197*

Notes: DEA-M = efficiencies estimated with respect to the meta-frontier; DEA-C = efficiencies estimated with respect to the country frontier; DEA-MTR = meta-technology ratio. St.dev. in brackets.

Figure 3. Meta-technology Ratios with Portugal



C. Second Stage Results

To test the impact of the institutional and financial sector variables on bank efficiency we use both a Tobit and an OLS regression model. We estimate several specifications to examine the impact of each variable on bank performance and efficiency, to preserve degrees of freedom and reduce the potential for multicollinearity. The regression results relating to the influence of different sets of institutional and control variables on bank efficiency are presented in Table 6.

Looking at bank specific variables, the capitalization variable displays the expected relationship with bank efficiency. All coefficients on EQTA are positive and statistically significant, which indicates that well capitalized banks are also more efficient. This result is in line with previous studies (Berger and Mester, 1997; Reda and Isik, 2007). Indeed, banks with sound capital positions face lower bankruptcy costs, which in turns reduce their cost of funding. This positive relationship between cost efficiency and bank capitalization may also indicate that shareholders of less capitalized banks have lower incentives to monitor bank management, as there is less capital at stake.

The coefficients on NETLOANS are positive and significant in all estimations, thus indicating that when the bank's portfolio increases (hence exposing the bank to more credit risk), banks' manager may have incentives to better control costs (Fuentes and Vergara, 2003). On the other hand, Liquidity variable (LIQ) impact positively on bank cost efficiency; this could be explained by the fact that more liquid banks are less involved in financing risky loans (that turn to be nonperforming) in the region and are therefore more efficient.

Looking at the influence of financial structure on bank efficiency, we find a negative and significant impact of the overall credit to private sector ratio to GDP in the economy. This is consistent with the evidence that the relationship between banking sector development and economic growth in the MENA region is negative (see Ben Naceur and Ghazouani, 2007). The excessive availability of funds in the region and

the lack of strong supervisory and governance structure contribute to overinvestment in projects with low profitability and this in turn decreases banking efficiency.

Interestingly, the financial sector reform (FSR) variable is negatively and significantly related to cost efficiency. This suggests that compliance with bank regulation and additional requirements of sector reforms increase costs for the banking industry, at least in the short run.

Higher concentration in the banking sector seems to result in higher cost efficiency as the coefficients on CONC are positive and significant in all specification in Table 6. This result is consistent with the view that in a concentrated market only survive the banks that are the most able to contain inefficiency.

Finally, we turn to the impact of institutional variables on bank efficiency. The results are shown in columns 2 to 8 in Table 6 and indicate a significant and positive influence for C (corruption) as well as GS (government stability), DA (democratic accountability), I (investment profile) and L&O (law and order). We interpret this as supportive evidence for the hypotheses that less corruption, a better investment environment, a more developed legal system and more stable political environment contribute to improve cost efficiency in our sample. However coefficients on SC (Socioeconomic Conditions) is significant and negative which means that in an environment when unemployment is high or consumer confidence is low banks are more able to reduce their costs.

Table 5. Second-stage regression results for bank efficiency (Meta Frontier approach) - Tobit estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CONSTANT	0.267	0.310	0.241	-0.007	0.140	-0.227	0.664	0.626
	(2.12)**	(4.82)***	(3.71)**	(-0.06)	(2.00)**	(-3.31)***	(6.31)***	(6.86)***
EQTA	0.005	0.003	0.005	0.006	0.005	0.003	0.006	0.004
	(3.38)***	(1.95)**	(3.44)***	(3.64)***	(3.06)***	(2.42)**	(3.99)***	(2.59)***
LIQ	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001
	(2.80)***	(1.99)**	(2.87)***	(2.96)***	(2.79)***	(2.53)***	(2.89)***	(2.75)***
NETLOANS	0.002	0.001	0.002	0.002	0.001	0.000	0.002	0.001
	(3.54)***	(3.31)***	(3.69)***	(3.67)***	(2.58)***	(1.49)	(3.53)***	(2.16)**
CONC	0.664	0.029	0.583	0.814	0.635	0.431	0.763	0.510
	(5.53)***	(-0.18)	(4.92)***	(6.03)***	(5.80)***	(4.40)***	(6.94)***	(4.15)***
CREDITPR	-0.458	-0.102	-0.465	-0.601	-0.635	-0.433	-0.544	-0.352
	(-4.42)***	(-0.85)	(-4.51)***	(-4.86)***	(-5.61)***	(-4.83)***	(-5.34)***	(-2.61)***
MARKETCAP	-0.038	-0.022	-0.028	-0.060	-0.016	0.022	-0.089	0.008
	(-1.29)	(-0.78)	(-0.97)	(-1.95)**	(-0.58)	(0.90)	(-2.97)***	(0.16)
BC	-0.016							
	(-0.25)							
C		0.092						
		(5.49)***						
DA			0.011					
			(1.65)*					
GS				0.024				
				(2.07)**				
I					0.027			
					(3.57)***			
L&O						0.153		
						(11.97)***		
SC							-0.078	
							(-5.05)***	
FSR								-0.022
								(-4.31)***
LR chi2	68.89***	97.96***	71.53***	73.09***	81.42***	192.58***	93.58***	76.77***
Log likelihood	112.56	127.09	113.88	114.65	118.82	174.40	124.90	101.97
Pseudo R2	-0.44	-0.62	-0.45	-0.46	-0.52	-1.23	-0.59	-0.60
Observations	433	433	433	433	433	433	433	352

As a robustness check, OLS is used instead of the Tobit model to estimate equation (1) The results obtained by the OLS specification are reported in Table 7 and confirm the finding of the Tobit estimator.

Next, we re-estimate equation (1) using the Tobit specification, by replacing the cost efficiency estimates with the technical efficiency. The results confirm previous findings: banks are more efficient when the level of corruption is low, laws are enforced and the political and investment environment are stable. Moreover, technical efficiency is linked to better capitalized and liquid banks.[1] Overall, our results are consistent with those of Kablan (2010) who concludes that better regulation, improved credit risk management, improved law enforcement and a better information system could improve bank efficiency in Sub-Saharan Africa.

We then estimate equation (2), where the dependent variable is Return on Assets (ROA) using OLS, to investigate the impact of bank specific, country specific and institutional variables on bank profitability.

The results reported in Table 8 indicate that banks with more liquid assets (LIQ) have lower profitability. This is in line with the literature and indicates that inefficient portfolio management usually leads to higher holdings of low-yield liquid assets. Banks with larger lending portfolios (NETLOANS) are also less profitable. One explanation for this result is that if these banks have to spend additional funds to select projects and to supervise borrowers, this may result in lower profitability.

Also, as financial supervision and risk management are still not well developed in the MENA region, although improving, the over-exposure to credit risk (proxied by a large lending book) may result in a high level of nonperforming loans that could reduce the profit of banks. This result is in line with the evidence showing that bank sector development hurt growth in the MENA region (Ben Naceur and Ghazouani 2007). Our final concern is that the institutional environment has quite no impact on bank profitability in our sample where government stability is the only variable that affects positively bank profits. The improvement in the cost side seems to be lost in the revenue side by a poor regulatory environment and a low capacity of banks to screen projects.

Finally, we explore whether stock market development impact on the profitability of banks. The results suggest that a bigger stock exchange reduce the profits of banks through higher competition.

[1] These results are not reported in the paper, but are available from the authors.

Table 6. Second-stage regression results for bank efficiency (Meta Frontier approach) - OLS estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CONSTANT	0.267	0.310	0.241	-0.007	0.140	-0.227	0.664	0.626
	(2.10)**	(4.77)***	(3.68)***	(-0.06)	(1.99)**	(-3.28)***	(6.25)***	(6.78)***
EQTA	0.005	0.003	0.005	0.006	0.005	0.003	0.006	0.004
	(3.35)***	(1.93)*	(3.41)***	(3.61)***	(3.03)***	(2.39)**	(3.95)***	(2.56)***
LIQ	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001
	(2.78)***	(1.98)*	(2.84)***	(2.93)***	(2.77)***	(2.50)**	(2.87)***	(2.72)***
NETLOANS	0.002	0.001	0.002	0.002	0.001	0.000	0.002	0.001
	(3.51)***	(3.28)***	(3.66)***	(3.64)***	(2.56)***	(1.48)	(3.50)***	(2.14)**
CONC	0.664	-0.029	0.583	0.814	0.635	0.431	0.763	0.510
	(5.48)***	(-0.18)	(4.87)***	(5.97)***	(5.74)***	(4.36)***	(6.87)***	(4.11)***
CREDITPR	-0.458	-0.102	-0.465	-0.601	-0.635	-0.433	-0.544	-0.352
	(-4.38)***	(-0.85)	(-4.47)	(-4.82)	(-5.56)	(-4.79)	(-5.29)	(-2.58)
MARKETCAP	-0.038	-0.022	-0.028	-0.060	-0.016	0.022	-0.089	0.008
	(-1.28)	(-0.78)	(-0.96)	(-1.93)*	(-0.57)	(0.89)	(-2.95)***	(0.16)
BC	-0.016							
	(-0.25)							
C		0.092						
		(5.44)***						
DA			0.011					
			(1.63)*					
GS				0.024				
				(2.05)**				
I					0.027			
					(3.54)***			
L&O						0.153		
						(11.86)***		
SC							-0.078	
							(-5.00)***	
FSR								-0.022
								(-4.26)***
F-statistic	10.47***	15.41***	10.91***	11.16***	12.56***	34.01***	14.65***	11.98***
Adjusted R2	0.13	0.18	0.13	0.14	0.17	0.34	0.18	0.18
Root MSE	0.18	0.18	0.18	0.18	0.15	0.16	0.18	0.18
Observations	433	433	433	433	433	433	433	352

Table 7. Second-stage regression results for bank performance (ROA estimations)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CONSTANT	26.205	23.679	23.285	36.465	18.197	21.981	17.615	30.423
	(4.74)***	(8.07)***	(8.10)***	(6.11)***	(5.91)***	(6.28)***	(3.70)***	(7.33)***
EQTA	-0.108	-0.119	-0.109	-0.130	-0.138	-0.113	-0.118	-0.210
	(-1.42)	(-1.51)	(-1.43)	(-1.71)*	(-1.85)*	(-1.47)	(-1.55)	(-2.46)***
LIQ	-0.076	-0.079	-0.078	-0.081	-0.078	-0.078	-0.077	-0.061
	(-3.52)***	(-3.61)***	(-3.61)***	(-3.77)***	(-3.69)***	(-3.59)***	(-3.57)***	(-2.49)***
NETLOANS	-0.351	-0.351	-3.353	-0.353	-0.378	-0.354	-0.349	-0.375
	(-13.20)***	(-13.20)***	(-13.29)***	(-13.38)***	(-14.08)***	(-13.04)***	(-13.17)	(-12.69)***
CONC	-1.062	-5.776	0.342	-10.840	-3.172	-2.942	-3.769***	-7.510
	(-0.20)	(-0.78)	(0.07)	(-1.83)*	(-0.66)	(-0.59)	(-0.76)	(-1.35)
CREDITPR	5.915	7.574	5.913	13.283	-3.168	5.827	6.890***	5.639
	(1.30)	(1.39)	(1.30)	(2.45)***	(-0.64)	(1.28)	(1.50)	(0.92)
MARKETCAP	-3.635	-3.390	-3.759	-2.194	-2.478	-3.292	-2.75***	-3.082
	(-2.75)***	(-2.62)***	(-2.88)***	(-1.59)	(-1.93)**	(-2.51)***	(-2.02)**	(-1.28)
BC	-1.78							
	(-0.61)							
C		0.473						
		(0.62)						
DA			-0.428					
			(-1.43)					
GS				-1.311				
				(-2.51)***				
I					1.413			
					(4.18)***			
L&O						0.440		
						(0.68)		
SC							1.058	
							(1.51)	
FSR								-0.162
								(-0.68)
F-statistic	23.72***	27.32***	27.66***	28.55***	30.88***	27.34***	27.71***	25.26***
Adjusted R2	0.30	0.30	0.31	0.31	0.33	0.30	0.30	0.32
Root MSE	8.16	8.16	8.15	8.10	8.00	8.16	8.15	8.22
Observations	428	428	428	428	428	428	428	353

VI. CONCLUSION

This study attempts to examine the effect of deregulation policies on the performance of selected Middle Eastern and North African (MENA) countries banking industries, covering the period 1994-2008. Despite the enormous potential of policy reforms, the analysis of the effect of these initiatives on bank efficiency and performance in MENA countries has been limited. We evaluate bank efficiency in Egypt, Jordan, Lebanon, Morocco, and Tunisia by means of Data Envelopment Analysis (DEA) and we employ a meta-frontier approach to calculate efficiency scores in a cross-country setting. We then employ a second-stage Tobit and OLS regression to investigate the impact of institutional, financial, and bank specific variables on bank efficiency.

The first-stage analysis indicates that Morocco and Tunisia have more efficient banking systems compared with the other selected MENA countries, although banks in Tunisia seem to be lagging behind best practice from 2004 onwards. Banks in Egypt, Lebanon and Jordan have lower meta-technology ratios, which indicate a bigger technology gap between the technology adopted and the best available technology in the in the region. This gap reduces from the mid-2000s onwards and Egypt, Jordan and Lebanon are displaying some catching up.

The analysis of the technological gap between country frontiers and the meta-frontier can be used to design programs for performance improvement and changes to the production environment. For this reason, it is of interest for policy makers to understand what drives the differences in bank performance and efficiency among countries in order to improve strategic decision-making.

The empirical results of the second-stage analysis show a robust association of some environmental measures with cost efficiency. In this context, our results reveal that bank efficiency is influenced by the quality of the legal system. Our results also indicate that large and well capitalized banks display higher efficiency scores. Furthermore, a highly concentrated banking sector seems to have a significantly positive effect on bank efficiency.

Overall, the analysis shows that, despite similarities in the process of financial reforms undertaken in the four MENA countries, the observed efficiency levels of banks varies substantially across markets. Differences in technology seem to be crucial in explaining efficiency differences. To improve banking sector efficiency, policies should be aimed at giving banks incentives to improve portfolio management and risk management techniques, as well as maintaining a sufficient level of capitalization. Improvements in the legal system and the regulatory and supervisory bodies would also help to reduce inefficiency.

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Appendix 1: Data Envelopment Analysis

DEA is a mathematical linear programming technique developed by Charnes, Cooper, and Rhodes in 1978 (CCR) which identifies the efficient frontier from the linear combination of those units/observations that (in a production space) use comparatively fewer inputs to produce comparatively more outputs[13]. The CCR model assumes constant returns to scale (CRS), which is the optimal scale in the long run. Banker, Charnes, and Cooper (1984) (or BCC model) include an additional convexity constraint (λ) to allow for variable returns to scale (VRS). In particular, if at any time t there are N firms that use a vector of inputs $X=\left(x_1,x_2,...,x_k\right)$ to produce a vector of outputs $Y=\left(y_1,y_2,...,y_m\right)$, the input-oriented BCC measure of efficiency of a particular firm is calculated as:

$$\begin{aligned}
&\min_{\theta,\lambda}\ \theta_i \\
&s.t.\quad \sum_{r=1}^{N} y^t{}_{mr}\lambda^t{}_r \geq y^t{}_{mi} \\
&\qquad \sum_{r=1}^{N} x^t{}_{kr}\lambda^t{}_r \leq \theta_i x^t{}_{ki} \\
&\qquad \lambda^t{}_r \geq 0 \\
&\sum_{r=1}^{N}\lambda = 1
\end{aligned} \tag{A1}$$

where $\theta_i \leq 1$ is the scalar efficiency score for the i-th unit. If θ_i=1 the i-th firm is efficient as it lies on the frontier, whereas if $\theta_i < 1$ the firm is inefficient and needs a $(1-\theta_i)$ reduction in the inputs levels to reach the frontier. [14]

It is important to recall that DEA efficiency scores measure the performance of firms relative to the sample. Technically, firms make choices from a set of feasible input-output combinations (technology sets). These technology sets may differ across regions/countries because of differences in available stocks of physical, human, and financial capital, economic infrastructure, and any other characteristics of the physical, social, and economic environment in which firms operate.

If we consider the available technology to be a state of knowledge in existence at a given point of time, we can define the meta-technology as the totality of the regional/country specific technologies. The meta-frontier production function is therefore a frontier function that envelops all frontiers of individual countries/groups.

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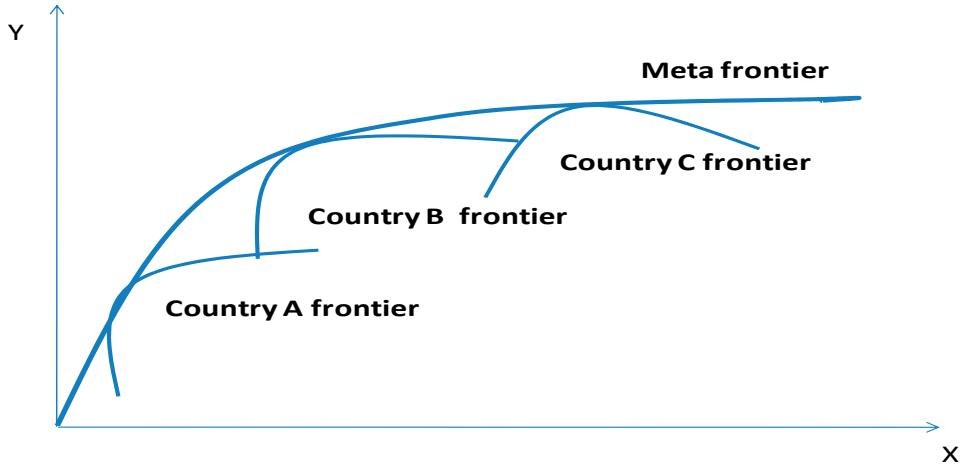
[13] DEA is a widely used methodology in the field of performance measurement and the definition of "unit" relates to any decision making unit (DMU), from the firm level to individual departments/groups within the firm which enjoy decision making/budgetary autonomy. In this context the "unit" is the banking firm.

[14] For an introduction to DEA methodology see, among others, Thanassoulis (2001); Coelli and others (2005). See Thanassoulis and others (2008) for an extensive review of this literature.

Figure A presents an illustration of a meta-frontier in the simple case of one input and one output.

Figure 3. A Meta-Frontier Model



To apply the meta-frontier approach with DEA, it is necessary to solve separate models (equation A1) for each country in order to specify the country-specific frontiers and one for the joint data set for solving the meta-frontier.[15] Efficiencies measured relative to the meta-frontier can be decomposed into two components: a component that measures the distance from an input-output point to the group frontier (the common measure of technical efficiency); and a component that measures the distance between the group frontier and the meta-frontier (representing the restrictive nature of the production environment). The meta-technology ratio (DEA-MTR), that is the relative productivity of technologies, can be obtained as the ratio between meta-frontier (in)efficiency (DEA-M) and the country specific (in)efficiency (DEA-C).

[15] For more details on the meta-frontier approach applied to DEA, see Battese and others (2004) and O'Donnell and others (2008). Other approaches to the estimation of the meta-frontier have been proposed in recent studies, see, among others Sipiläinen and others (2008).