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Institutional Quality and Capital-Systemic Risk Relationship in MENA Region Banks

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Abstract

This paper examines the relationship between capital and bank stability conditioning on the specific socio-political factors of different countries. The sample under study includes 13 banking systems operating in the MENA region for the period 2000 till 2017. It was revealed that bank's capital is associated with a reduction in the systemic risk. It was also found that capital contributes more in the stability of countries that are less transparent, experience higher information asymmetry, and face lower efficiency in monitoring their financial institution. Overall, our findings suggest that additional capital requirements for MENA countries that are facing unfavorable institutional factors can act as a substitute in augmenting systematic banking sector stability.

Keywords: Systematic risk; Bank capital; MENA region
JEL Classification:G01; G21; G28.

1. Introduction

The recent global financial crisis highlighted on the importance of adopting a more stringent regulatory capital by commercial banks. While Basel III has determined the incremental required capital and its composition, it is still unclear the link between the structure of this capital and its dependence on the socio-political factors in a country.

The significance of this study to developing countries is very high, especially in relation with MENA region, where development has been hindered partly due to the poor performances of the financial and economic sectors. In the course of 2007 to 2008, due to the global financial crisis, a greater number of the MENA banks stood through the tough times and bounced back afterward. Amongst several factors, several scholars have established a link between this resilience and factors such as sound bank capitalization, stable funding basis, and prudent lending. After the aforementioned financial crisis, most banks are now subjected to procedures like strict capital regulations and systemic stability. Consequently, empirically speaking, there is a connection between bank capital and systemic risk conditioning on the institutional environment of a specific region. Speaking of cross-country differences too, there are some significant variances in the procedures of bank supervision, regulation, and information availability (Barth et al., 2008; Beck et al., 2013). Many studies have indicated that the institutional environment can have a substantial amount of effect on commercial strength (Barth et al., 2004; Klomp & De Haan, 2012). Likewise, according to a foregoing World Bank statement (World Bank, 2014), if the performance of banking and financial institutions in MENA must be enhanced, there must be a vital restructuring through the following procedures: bridging the gap between implementation and regulation, refining the rule of law, combating government fraud and dishonesty, promoting transparency in the government, and enhancing answerability.

In this study we use a sample of commercial banks that are operating in the MENA region. The two commonly used measures for the systematic risk that were adopted are the conditional value at risk (CoVaR) and the marginal expected shortfall (MES). These measures were described in the work of Adrian and Brunnermeier (2016) and Acharya et al. (2017a, 2017b) respectively. In additional, three sets of institutional variables are to be examined in this paper. The first group of variables are supposed to measure how strong the monitoring level within a country. In countries where weak market discipline is dominant, we expect capital to have a higher weight in reducing systematic risk since corrective actions are not easily applicable. The second set of variables deal with the information transparency, and finally the third set of institutional variables track the impact of informational asymmetry. Obviously, we predict an inverse relationship between capital requirements and both informational transparency and asymmetries. This paper deals with both concerns by examining the relationship between bank stability and capital conditioning on the specific socio-political factors of each country. Specifically, we investigate if capital contributes more in the stability of countries that are less transparent and face lower efficiency in monitoring its financial institution.

The remaining sections will proceed as follows. Section 2 will present an overview of the literature on the capital-systematic relationship. Section 3 introduces the adopted methodology and demonstrates the chosen variables. Finally, Section 5 contains the empirical results of the paper.

2. Literature Review

A lot of studies stated that capital plays a major role in reducing insolvency risk by absorbing earnings shocks (e.g., Repullo, 2004; Von Thadden, 2004). Thus, regulators used to increase capital requirements on banks as an extra cushion to absorb unexpected losses following each financial crisis. Unfortunately, stringent capital requirements led to mixed results on banks risk-taking behavior (Jokipii & Milne, 2008). Regulatory hypothesis and several empirical studies supported the positive impact of additional capital on lowering risk (Shrieves & Dahl, 1992; Jacques & Nigro, 1997; Holmstrom & Tirole, 1997; Aggarwal & Jacques, 1998; Coval & Thakor, 2005; Peura & Keppo, 2006; Allen et al., 2011; Mehran & Thakor, 2011). Their findings were explained by the high cost of financial distress, regulatory and compliance cost, and the risk aversion theory. In contrary, relying on the moral hazard theory and other conducted studies, it was suggested that some banks reacted negatively to stringent capital requirements by increasing their risk bearing behavior (Kahane, 1977; Koehn & Santomero, 1980; Kim & Santomero, 1988; Furlong & Keeley, 1989; Calomiris & Kahn, 1991; Rochet, 1992; Gorton & Rosen, 1995; Freixas & Rochet, 2008). Further studies have included bank's efficiency as an extension to the risk and capital trade-off. Once again, mixed results were discovered by which some empirical studies confirmed the presence of a positive relationship between efficiency level of banks and their risk-taking behavior (Kwan & Eisenbeis, 1997; Hughes & Mester, 1998). On the contrary, moral hazard hypothesis supported the tendency of relatively inefficient banks to follow riskier practices to increase their returns (Berger & De Young, 1997; Williams, 2004; Deelchand & Padgett, 2009).

This paper is linked to the impact of capital on systematic risk especially during the financial crisis. Beck et al. (2013) found a positive effect of financial development on economic growth which by turn lower systematic risk. Furthermore, Kaufman and Scott (2003) stated that the vulnerabilities of a country to macro shocks can be offset by higher capital ratios. Besides, the result of Albertazzi and Gambacorta (2009) study shows that there is a significant negative effect of the business cycle on the stability of the banking sector because poor economic conditions may worsen loan quality, leading to reduced profits and enhance credit losses. In the same context, Caglayan and Xu (2016) highlighted that high inflation volatility has a significant effect on the provision of banks' loans and the risk faced by the bank. Several studies were conducted aiming to check the correlation between banks performance and their capital position during the financial crisis. In 2012, Beltratti and Stulz (2012) analyzed the performance of large banks with an excess of $10 billion worth of assets in 32 countries

around the GFC. Also, Berger and Bouwman (2013) studied the effect capital has on individual bank risk at normal times and times of financial crises. Moreover, Demirguc-Kunt et al. (2013) examined whether the returns of bank stock respond differently to capital ratios of different types. In 2015, it was Kim et al. who took the results from commercial bank in eight of major Asian nations and surveyed the connection between the banking market size structure and the stability of financial institutions employing commercial bank data. As stated by Olszak et al. (2017), loan loss provisions (LLP) procyclicality in banks can reduced as a result of restrictive bank capital regulations and a strong protection of investor. In 2018, Ozili and Thankom posited that systemic bank experience income smoothing compared to non-systemic banks in Europe. Likewise, Laeven et al. (2016) analyzed the role of bank capital, size, funding and activities in explaining systemic risk during the 2007–2009 financial crisis.

Our study also contributes to the literature that detect the impact of banks capitalization on systematic stability which relies on specific institutional factors. In countries with no regulatory environments which do not enhance incentives for private agent to exert cooperate control, no private monitoring and that promotes disclosure of accurate information, capital contributes more significantly to their systemic stability (Decamps et al., 2004). Correlated bank defaults can inflict large social costs that are not fully internalized and in the presence of implicit guarantees multiple equilibria can arise with a differential effect of capital on risk (Acharya et al., 2016). In a study, Qian and Strahan (2007) have illustrated how that a good legal setting is required in order to grant access to a creditor to the collateral in the event of default. According to the findings of Davydenko and Franks (2008), lower recovery rates characterize the banks of those countries known to operate creditor-unfriendly laws. Thus, depending on collateral can be very effective if the degree of asymmetric information between the borrower and lender keeps increasing (Liberti & Mian, 2010). More research findings reveal that foreign banks will tend to function more with legal structures than do their local counterparts. The study of Leuz et al. (2003) stated that the management of earning decreases legal environment stress. In their study, Haw et al. (2004) suggested that the management of earnings was constrained by extra-legal institutions which constitutes pressure from the media, laws regarding competition, and the enforcement of tax payment. In 2004, Bushman et al. stated that firms that are state owned, have high expropriation risk and cost of business capital, and in a political environment have a low transparency rate. Most institutions that are strong promote a high level of transparency and timely disclosure (Pagano & Volpin, 2005; Darrough & Stoughton, 1990). The announcement of annual earnings is very impactful if the management of the earnings of a country is less (DeFond et al., 2007).

3. Data and Empirical Methodology

3.1. Sample

The sample for this study was the data obtained from the commercial banks operating in the MENA region for the period 2000 till 2017. It covered the data on the following 13 countries: Saudi Arabia, Bahrain, Egypt, Israel, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Arab United Emirates, Tunisia, and Turkey. The financial statements for both public banks and private banks, that covers over 90% of a given countries banking assets, were obtained from the Bankscope database report. Data on the Bank Regulation and Supervision Survey (BRSS) from World Bank was obtained to get information on the regulation and supervision of the banks at the country level. The statistics of all the bank variables and country level variables, which in summary is used for the quantitative analysis, is presented in Panel A of Table 1. The result of the correlation coefficients by Pearson in the analysis of the key variables used in the analysis is presented in Panel B. The result shows that there exists a positive and significant correlation between the two systemic risk measures despite the weakness in its association.

3.2. The Empirical Model

The following starting point regression was employed to detect the correlation between capital and systemic risk:

$$Systemic\ risk_{ijt} = \beta_0 + \beta_1 \times Capital_{ijt-1} + \Omega \times bank\ controls_{ijt-1} + \alpha_j \times \lambda_t + \varepsilon_{ij} \quad (1)$$

The systemic risk of bank *i* is being adopted as the dependent variable in country *j* for a period *t* and was determined using the conditional value at risk (*CoVaR)* and the marginal expected shortfall (*MES)* measures as described in the section 3.3. The most important explanatory variable in the baseline equation is the capital to asset ratio which is described in section 3.4. Other independent variables are classified into: (1) Specific variables at the bank level which are known by control variables as liquidity, size, deposits amount, the quality of assets and management practice. These variables are highly monitored by regulatory bodies and abbreviated as CAMELS. It is worth noting that all these independent variables are lagged for a period of one year. (2) Country fixed effects yearly variables $(\alpha \times \lambda)$ were also involved in all regressions to control time-varying factors. These variables include; interest rates, inflation, and other macroeconomic variables as well as differences in economic development level, quality of bank regulations and supervisions, and differences in the accounting standard and regulatory principles. The objective behind adding theses variables is to reduce greatly the concerns regarding possible omitted variables. Further investigations were conducted to ascertain the impact of the institutional environment in the trade-off between capital and the systemic risk and presented as follows:

$$Systemic\ risk_{ijt} = \beta_0 + \beta_1 \times Capital_{ijt-1} + \beta_2 \times Capital_{ijt-1} \times country\ monitoring/information\ index_{ijt} + \Omega \times bank\ controls_{ijt-1} + \alpha_j \times \lambda_t + \varepsilon_{ij} \quad (2)$$

The public and private monitoring, transparency and information asymmetry were captured using the monitoring and information index variables described in Section 3.5 as well as the Bank controls which are the same as indicated in equation (1). Using the implied asset returns, we controlled the leverage effect and estimated the systemic risk measures in equations (1) and (2) with the aim of separating the "buffer" and "incentive" roles of bank capital (VanHoose, 2007), thus allowing us to account for the mechanism of transmission asides the leverage on which capital is related to systemic risk.

Table 1: Summary Statistics

Panel A: Statistics	**N**	**Mean**	**Std Dev**	**P25**	**P50**	**P75**
Variable						
Bank variables						
MES	3715	0.026	0.024	0.016	0.024	0.032
CoVaR	3715	0.061	0.09	0.008	0.035	0.093
total capital /rwa	3715	0.148	0.085	0.12	0.135	0.154
common / ta	3715	0.092	0.052	0.072	0.093	0.112
liquid assets / ta	3715	0.117	0.128	0.046	0.059	0.127
deposits / ta	3715	0.882	0.144	0.783	0.841	0.894
loan loss provisions / ta	3715	0.009	0.012	0.002	0.005	0.008
net loans / ta	3715	0.594	0.164	0.525	0.574	0.653
size	3715	0.013	0.028	0.004	0.012	0.021
Country variables						
supervisory power	3715	11.064	3.038	11	12	12
deposit insurance	3715	1.337	0.574	1	1	1
public registry	3715	0.09	0.454	0	0	0
disclosure	3715	2.643	0.297	3	3	3
audit	3715	1.876	0.187	2	2	2

Panel B: Correlation									
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**

(1) MES	1.000								
(2) CoVaR	0.285	1.000							
(3) Total Capital /RWA	–0.037	–0.093	1.000						
(4) Equity /TA	–0.060	–0.164	0.828	1.000					
(5) Liquid Assets / TA	0.035	0.068	0.251	0.122	1.000				
(6) Deposits / TA	–0.056	–0.023	–0.305	–0.278	–0.208	1.000			
(7) LLP / TA	0.385	0.147	–0.050	0.013	0.032	0.004	1.000		
(8) Net Loans / TA	–0.086	–0.045	–0.414	–0.144	–0.636	0.153	0.091	1.000	
(9) Size	0.130	0.087	–0.024	–0.074	0.314	–0.186	–0.005	–0.232	1.000

Notes: Definitions of the variables are in Appendix A.

3.3. Measures of Systemic Fragility

Using the systemic risk to measure the contribution of banks to the risk faced by the entire financial system of a given country, we aimed to determine the systemic stability of the banks. From a policy viewpoint, bank regulation and bank supervision carried out at the country level is more relevant in determining the measure of the systemic risk at the country level. Two measures that are used frequently in the literature were employed in this study. The first measure as proposed by Adrian and Brunnermeier (2016) is the conditional value-at-risk *(VaR)* of the financial system conditioned to an individual institution that is under distress. It covers both spillover effects and common exposure to the overall risk in the financial system. The contribution of a financial institution to the systemic risk *(CoVaR)* is the difference of the VaR of the entire financial system conditioned on the individual bank that is under distress from the VaR of the entire financial system in the standard state of the same bank. We compute a time-series of CoVaR measures for each bank using quantile regressions and some macro-economic variables relevant to the study (Adrian & Brunnermeier, 2016). We run the following quantile regressions using the equation below:

$$R_{i,t} = \alpha_i + \gamma_t M_{t-1} + \varepsilon_{i,t}$$

$$R_{m,t} = \alpha_{system|i} + \beta_{system|i} R_{i,t} + \gamma_{system|i} M_{t-1} + \varepsilon_{system|i,t} \quad (3)$$

From the equation above, $R_{i,t}$ is the equity return for bank i in week t. While for the lagged state variables that includes the alter in the 3-month T-bill rate, the changes in the term spread, weekly country stock index return, and the volatility of the daily country stock index returns over previous 4 weeks is denoted by M_{t-1}. $R_{m,t}$ in the equation is the weekly value-weighted return of all financial institutions in each country. The weekly stock returns from Compustat Global (US dollars) were used for the international financial firms, and the information on the weekly stock market was obtained from the CRSP of financial firms in the U.S. The index on the country stock from which financial institutions are incorporated was used to obtain the index of the aggregate market.

CoVaR variable is computed to denote the incremental change in the *VaR* of the financial institution due to an event that is likely equally experienced across institutions. To achieve this, we condition the *VaR* of the financial institution on the event that an individual bank's loss shift from its median level to the adverse $Var^{i}_{q\%}$ level (the q^{th} percentile of the contributed loss of an individual institution).To calculate the contribution of individual banks to systemic risk, we express it mathematically as:

$$\Delta \text{CoVaR}_q^{\text{system|i}} = \text{CoVaR}_q^{system/X^i = VaR_q^i} - \text{CoVaR}_q^{system/X^i = VaR_{50}^i} \quad (4)$$

When the quantile for each financial system in our model in a 3-year time period is 5%, we calculated the measure of *CoVaR* in order to cover the business conditions affected by time varying factors (Moore and Zhou, 2011). The *CoVaR* variable is inverted so that higher values signify greater systemic risk, reasons being that the *CoVaR* is a reduced-form measure and therefore does not contribute to the source of systemic risk of a financial institution. Besides, time-series dimension of systemic risk through which risks in low-risk environments are built up by the individual banks cannot be captured by it. In addition, it may not fully capture externalities (such as, investment decisions that

affect other market participants) or spill overs (through contractual links or indirect channels). Even so, *CoVaR* is a reliable measure of systemic risk as indicated by Zhang et al. (2015) and provides a means through which statistical tail-dependency and individual institutions contribution to other common factors can be measured.

The Marginal Expected Shortfall *(MES)* is the second method of measuring systematic risk as opined by Acharya et al. (2017a, 2017b). Marginal Expected Shortfall *(MES)* of a financial institution is the expected equity loss an investor in a financial institution would experience if there is a significant decline in the market. The *MES* measures the firm return on average during times when the general market is at the end of its loss distribution:

$$MES_t^i = E(R_{i,t}\, R_{m,t} < C) \tag{5}$$

$R_{i,t}$ above is the financial firm's daily stock return and $R_{m,t}$ is the market index daily return on aggregate. A drop in the market index below a threshold, C, over a given time horizon is indicated as the systemic event. The systemic event is thus defined by $R_{m,t}<C$.

Acharya, Engle and Richardson (2012) indicated that MES can be used to set capital limits based on the systemic risk contributions. As the book value of debt will be unchanged while equity values fall by MES, a regulator can necessitate a bank to hold equity to satisfy a prudential capital ratio of *k%* to ensure that the systemic risk indicated by the bank is zero:

$$Equity_{i,t} \geq \frac{k\ x\ Debt_{i,t}}{(1-k)\ (1+MES_{i,t})} \tag{6}$$

The *MES* is computed using an entry that corresponds to the index at its lowest 5% level above the previous one year of return data. The country stock index from which the financial firm is incorporated was used to obtain the aggregate market index, and the country daily stock indices used for this studies computation was obtained from Compustat Global. MES is also used to measure the sensitivity of a bank's stock price to extremely negative shocks. Unlike *CoVaR* which measures how much a given bank contributes to the systemic event, MES measures the exposure of banks to these systemic events. *MES* measures the expected equity loss of a financial firm when the financial system is in distress, whereas *CoVaR* measures the change in the risk value of the financial institution when the firm is in distress. The direct comparison of these two measures is not precise due to the different estimation methods used to obtain their result. Also, the systemic risk rankings obtained from these two measures can be different. Notwithstanding, *MES* and *CoVaR* can be expressed as the measure through which market risk can be transformed as proposed by Benoit et al. (2013). Both measures were employed to account for different scope of systemic risk and to provide a result that is very comprehensive in defining the relationship that exists between capital and systemic risk. We took note of the fact that *CoVaR* and *MES* are the reduced form models of tail correlation and would likely identify the situation in which the tail risk is difficult to separate. For example, when banks are exposed to a specific cause of market credit and operational risk, tail correlation may be identified to occur in these banks. All the banks will be affected if there is a negative shock and would at the same time cause multiple failures and aggregate losses. Bank can also experience risk that is within the system (endogenous risk) whereby the whole system could be a driven by asymmetric information, or the malfunction of a large counterparty which can result to a domino effect so much that a small shock in an individual bank can result to ripple effect failures. The summary statistics for *MES* and *CoVaR* are provided in Table 1.

3.4. Capital Ratios and Bank-Level Control Variables

Regulatory capital was used in the analysis. It indicated that the total capital is calculated as the summation of Tier 1 and Tier 2 capital divided by risk-adjusted assets and off-balance sheet exposures (*total capital/rwa*). For robustness, the common equity ratio was employed and computed as common

equity divided by total assets (*common/ta*). Tier 1 capital is the sum of shareholder funds and perpetual, non-cumulative preference shares. Tier 2 capital is the sum of hybrid capital, subordinated debt, loan loss reserves, and valuation reserves. The capital ratios and the bank level controls were sourced from Bankscope. For the complete model, the result of the median risk-adjusted capital asset ratio is 12.5%, which is higher than the minimum Basel II requirement of 8% (Table1, Panel A). In investigating the relationship that exists between capital and systemic stability, several bank country level variables were controlled. For each bank and each year, we calculated the following: relative bank size, bank liquidity, reliance on deposit funding, asset quality and business model. The size of a bank measured as the logarithm of total assets was captured in the SIZE variable. Anandarajan et al. (2003) and Ozili (2017a) held that large banks are characterized with having higher levels of business activities and such large banks may set aside higher provisions to be proportionate to their high business levels compared to smaller banks, therefore, a positive sign for the *SIZE* coefficient is expected. The use of natural logarithm of total asset (SIZE) to determine the bank size is in line with the study of Kilic et al. (2012), Ozili (2015), Curcio and Hasan (2015), and Ozili and Thankom (2018). Bank liquidity is the ratio of liquid assets to total assets (*liquid assets/ta*). According to Chen et al. (2015), banks are probable to store more liquid assets in order to protect it against difficulties e.g., higher volatility on returns. Reliance on deposits for funding is deposits divided by total assets (*deposits/ta*); asset quality is loan loss provisions divided by total assets (*loan loss provisions/ta*). Business model is net loans divided by assets (*net loans/ta*). Here, we summarize all financial ratios at their 1st and 99th percentile values to correct for possible data entry errors and to reduce the effect of outliers.

3.5. Institutional Environment

In order to examine the effect of the larger institutional environment on the relationship between capital and systemic risk, three sets of institutional variables were considered. The first set of these variables measure the monitoring strength of public and private financial institution activities in each country. The supervisory and monitoring power is an indicator of the power and authority of supervisory agencies to carry out preventive and corrective measures. The measure ranges from 0-14, with 14 indicating the maximum strength of the supervisory agencies. It was computed using the responses to fourteen questions outlined in Table A1 in Appendix A. The deposit insurance variable shows whether a country has explicit deposit insurance with the response option of Yes=1 or No=0. The deposit insurance variable also shows whether depositors were fully compensated the last time a bank failed, with the response option of Yes=1 or No=0. The presence and strength of deposit insurance provide an alternative for private monitoring incentives. The variable ranges from 0-2, with 2 denoting a greater ethical dangers and poor incentives for private monitoring. Data was obtained from the BRSS for the index on the supervisory power and the deposit insurance.

The information asymmetries in the lending market are captured by the second set of these institutional variables. Djankov et al. (2007) opines that since efficient private monitoring depends on information availability and communication, a dummy variable is created to indicate whether a public registry exists in each country. This information is obtained from the World Bank Doing Business Survey. Existence of a public credit registry indicates the availability of greater information and the availability of effective means of sharing the information.

Finally, the third set of these institutional variables measures quantitatively the information transparency in the banking sector. These variables indicate if accrued or unpaid interest or principal on nonperforming loans are included in the income statement of banks, if consolidated financial statements are required to be documented by banks, and if bank directors are legally responsible for an incorrect and deceptive information in these financial statements. The variable ranges from 0-3, with a higher value (3) indicating higher information and transparency level in the accounts of banks. The audit variable indicates whether audit of the financial statements of a bank from an external body is necessary and if the audit is to be performed by an auditor that is licensed and certified. The variable ranges from 0-2, with a higher value signifying that banks have more informative and transparent

accounts. Data for these three institutional variables were obtained from the BRSS. The summary statistics for the institutional variables used in the analysis are provided in Table 1.

4. Empirical Results

4.1. Relationship between Capital and Systemic Risk

To examine the relationship between systematic risk and capital, we start with the results presented in Table 2 from the regression of equation (1). A significant negative relationship between capital and systematic measured by *CoVAR* and *MES* was found. These findings are also verified when the equity ratio was employed. As such, well-capitalized banks are exposed to lower systematic risk. The expected negative sign of the control variables is consistent with results obtained by Adrian and Brunnermeier (2016) and Anginer et al. (2018). In additional, both liquid assets and deposits have shown a negative correlation with systematic risk. Banks that enjoy higher liquidity and rely more on deposits funding are less exposed to systematic risk. In contrary, bank size and loan loss provision revealed a positive relationship with systematic risk. Despite the higher diversification ability of large banks, they are associated with higher systematic risk which support the core intermediation activity of the banking sector (Too big to fail and contagious risk). Regarding asset quality, it is proxied by the loan loss provision and consequently through the engagement in more traditional banking activities (loan issuance) the net loans to asset ratio will increase leading to a lower systematic risk. It is worth noting that the results of quantifying systematic risk using MES are similar.

Table 2: Capital and systemic risk (baseline results)

Variables	(1)	(2)	(3)	(4)
	CoVaR	**CoVaR**	**MES**	**MES**
total capital / rwa	−0.058***		−0.015***	
	(0.014)		(0.005)	
common / ta		−0.063***		−0.006
		(0.016)		(0.008)
liquid assets / ta	−0.029*	−0.025*	−0.001	−0.003
	(0.017)	(0.019)	(0.004)	(0.004)
deposits / ta	−0.014	−0.013	−0.012***	−0.009***
	(0.013)	(0.015)	(0.002)	(0.002)
loan loss provisions / ta	0.028	0.037	0.329***	0.332***
	(0.128)	(0.129)	(0.049)	(0.050)
net loans / ta	−0.023**	−0.019*	−0.018***	−0.016***
	(0.008)	(0.008)	(0.002)	(0.002)
size	0.001***	0.001***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
constant	0.095***	0.091***	0.040***	0.038***
	(0.013)	(0.011)	(0.002)	(0.002)
Observations	3715	3715	3715	3715
R-squared	0.520	0.531	0.498	0.496

Notes: Definition of all variables are in Appendix A. ***, **, * indicates significance at 1%, 5%, and 10%, respectively.

Although capital acts as a cushion and provides a buffer against any economic shock and thus can mechanically reduce systematic risk, it can also affect indirectly systematic risk through other channels. Anginer et al. (2018) found that information asymmetry can be considered as a potential channel for spreading economic shocks through the banking system. Moreover, it was found that systematic risk is affected negatively through government intervention in increasing bank's regulatory capital (Duchin & Sosyura, 2014). In order to examine the effect of capital through these channels after removing the leverage impact, we used the return on asset instead of the return on equity (which includes the leverage effect) and we determined the market value of assets through adopting Merton

Black Scholes Model (1974). This structural model derives the market value of assets from market value of equity while considering the level of debt and the volatility of return. We follow the method adopted by Anginer et al. (2014, 2018) in determining the value of assets and calculating again the two systemic risk measures.

To check for test robustness, we run again the same regression that was detailed in equation (1) but using the newly calculated systemic risk measures. The overall results listed in Table 3 are like those obtained previously in Table 2. Therefore, we found that governmental intervention and information asymmetry have an indirect negative impact on the stability of individual banks. This result confirms the notion that transmission channels contribute in determining systematic risks.

Table 3: Capital and systemic risk using implied asset return

Variables	(1)	(2)	(3)	(4)
	CoVaR	**CoVaR**	**MES**	**MES**
total capital / rwa	−0.003***		−0.054***	
	(0.007)		(0.013)	
common / ta		−0.017*		−0.054***
		(0.009)		(0.017)
liquid assets / ta	−0.007	−0.009*	−0.002	−0.003
	(0.006)	(0.006)	(0.009)	(0.009)
deposits / ta	−0.005	−0.003	−0.033**	−0.029***
	(0.004)	(0.004)	(0.006)	(0.007)
loan loss provisions / ta	0.169***	0.171***	0.282***	0.284***
	(0.041)	(0.041)	(0.101)	(0.101)
net loans / ta	−0.006***	−0.005**	−0.025***	−0.020***
	(0.002)	(0.002)	(0.004)	(0.004)
size	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
constant	0.031***	0.027***	0.083***	0.075***
	(0.004)	(0.004)	(0.005)	(0.005)
Observations	3715	3715	3715	3715
R-squared	0.476	0.478	0.532	0.534

Notes: Definition of all variables are in Appendix A. Systemic risk measures are computed using returns of implied asset values from the Merton model. ***, **, * indicates significance at 1%, 5%, and 10%, respectively.

4.2. Institutional Environment, Bank Capital and Systemic Risk

To investigate whether capital can replace the presence of weak institutional environment in monitoring systematic risk, we run the regression of equation (2) which includes country specific variables beside capital. This regression examines the cross-sectional heterogeneous relationship between capital and systematic risk including country policy variables that may inhibit the regulatory bodies from monitoring efficiently commercial banks.

Referring to the results in Table 4, the first three interaction variables that measure the monitoring power in each country have shown significance. This confirms that a good institutional environment plays a vital role in the relationship between capital and systematic risk. As a proxy for public monitoring, we use the supervisory power to measure specific preventive and corrective actions that are taken by regulatory agencies. Capital is expected to have a greater impact on systematic risk in countries that experience weak supervision. This can be explained by the lack of incentive or the inability of regulatory bodies to take timely corrective action. As a proxy for private monitoring, deposit insurance was adopted to lower the impact of moral hazard. We expect a negative relationship between bank's private monitoring and moral hazard (Demirguc-Kunt & Kane, 2002; Demirguc-Kunt & Huizinga, 2004). As such, capital is expected to reduce more systematic risk for banks facing lower private monitoring.

Table 4: Impact of institutional environment of on systematic risk

Variables	*CoVaR*	R^2	*MES*	R^2
(total capital / rwa) × supervisory power	0.015*** (0.005)	0.493	0.003*** (0.001)	0.475
(total capital / rwa) × deposit insurance	−0.034* (0.031)	0.474	−0.016*** (0.003)	0.472
(total capital / rwa) × public registry	0.084*** (0.022)	0.484	0.018*** (0.005)	0.465
(total capital / rwa) × disclosure	0.032* (0.022)	0.486	0.019*** (0.004)	0.462
(total capital / rwa) × audit	0.053 (0.044)	0.481	0.034** (0.015)	0.472

Notes: Definition of all variables are in Appendix A. ***, **, * indicates significance at 1%, 5%, and 10%, respectively.

In the context of public registries and information asymmetry, it was found that capital is more crucial and exerts a higher impact on systematic risk in countries that face scarce information. Thus, capital may act as a substitute in compensating the asymmetric information issue under the capital-systematic risk relationship. Regarding financial statements transparency of commercial bank (disclosure) and the requirement of external auditing, we find that transparent and timely disclosure of information provides a transmission channel in the banking sector. Consequently, since capital provides a cushion against unfavorable events an information, then the impact of capital is expected to be more noticeable in countries that experience less available information.

To check for test robustness, we run again the same regression that was detailed in equation (2) but using the newly calculated systemic risk measures. The overall results reported in Table 5 are in line with those obtained previously in Table 4. It is worth noting that information transparency seems to have a higher impact on the capital-systematic risk relationship when using the return on asset and the market value of assets in calculating the systematic risk measures (focusing on the incentive role of banks in determining their capital level). This finding confirms that transmission channels play an important role beside capital in determining systematic risks.

Table 5: Impact of institutional environment on systematic risk (leverage adjusted)

Variables	*CoVaR*	R^2	*MES*	R^2
(total capital / rwa) × supervisory power	0.003 (0.002)	0.321	0.011*** (0.002)	0.521
(total capital / rwa) × deposit insurance	−0.031* (0.015)	0.285	−0.043*** (0.007)	0.517
(total capital / rwa) × public registry	0.012* (0.007)	0.322	0.013 (0.011)	0.522
(total capital / rwa) × disclosure	0.019** (0.008)	0.296	0.022*** (0.009)	0.516
(total capital / rwa) × audit	0.051** (0.019)	0.287	0.062** (0.035)	0.517

Notes: Definition of all variables are in Appendix A. Systemic risk measures are computed using returns of implied asset values from the Merton model. ***, **, * indicates significance at 1%, 5%, and 10%, respectively.

5. Conclusion

The recent 2007-2008 financial crisis emphasized on the importance of adopting a more stringent regulatory capital by commercial banks to prevent any potential systematic banking crises. While Basel III stated the incremental required capital and its composition, no clear relationship was verified between the structure of this capital and its dependence on the socio-political factors in the MENA region. The significance of this study to developing countries is very high since evolution has been

delayed due to the poor performances of the financial and economic sectors. Since bank capital may have varied effects on systemic stability conditioning on specific policy environments, we investigate this issue empirically using bank-level data for banks operating in the MENA region for the period 2000 till 2017. It was found that capital contributes more in the stability of countries that are less transparent, experience higher information asymmetry, and face lower efficiency in monitoring their financial institution.

Our results have imperative policy inferences regarding the continuous argument on reinforcement of additional capital requirements. Since specific institutional environment has been found to exert a noticeable impact on how capital affects systematic risk, each country should be assessed separately while setting capital requirements. Besides, because of the high cost that is accompanied by applying effective and timely supervision in the MENA region, it is suggested to impose additional capital requirements for countries facing unfavorable institutional factors as a substitute in augmenting systematic banking sector stability.

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Appendix

Table A1: Variables definitions

Variables	Definitions
Systemic risk variables	
CoVaR	Change in the VaR of the system when the institution is at the 1% percentile minus the VaR of the system when the institution is at the 50% percentile.
MES	The difference between the asset value of a firm and the face value of its debt scaled by the standard deviation of the firm's asset value, calculated from the Merton (1974) model.
Capital variables	
total capital / rwa	Tier 1 capital (sum of shareholder funds perpetual and non-cumulative preference shares) plus Tier 2 capital (subordinated debt, loan loss reserves, and valuation reserves) divided by risk-adjusted assets and off-balance sheet exposures.
common / ta	Common equity divided by total assets
Bank level variables	
size	Log value of total assets in millions of US dollars divided by the average assets of all other banks in each country
liquid assets / ta	Liquid assets divided by total assets
deposits / ta	Total deposits divided by total assets.
loan loss provisions / ta	Loan loss provisions divided by total assets.
net loans / ta	Net loans divided by total assets.
Country level variables	
deposit insurance	It indicates whether a country has explicit deposit insurance (Yes = 1/No = 0) and whether depositors were fully compensated the last time a bank failed (Yes = 1/No = 0). The variable ranges from 0 to 2.
supervisory power	A variable that ranges from zero to fourteen, with fourteen indicating the highest power of the supervisory authorities. For each of the following fourteen questions, a value of 1 is added to the index if the answer is yes: Q1. Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank? Q2. Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse? Q3. Can supervisors take legal action against external auditors for negligence? Q4. Can the supervisory authority force a bank to change its internal organizational structure? Q5. Are off-balance sheet items disclosed to supervisors? Q6. Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses? Q7. Can the supervisory agency suspend the directors' decision to distribute: a) dividends? b) bonuses? c) management fees? Q8. Can the supervisory agency legally declare-such that this declaration supersedes the rights of bank shareholders-that a bank is insolvent? Q9. Does the banking Law give authority to the supervisory agency to intervene that is, suspend some or all ownership rights-a problem bank? Q10. Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency do the following: a) supersede shareholder rights? b) remove and replace management? c) remove and replace directors? Data comes from the World Bank regulation and supervision surveys described in Barth et al. (2013).
public registry	An indicator variable that is equal to 1 if a public registry operates in the country and 0 otherwise. Data comes from Djankov et al. (2007) and World Bank Doing Business Survey.
disclosure	A variable that indicates whether the income statement includes accrued or unpaid interest or principal on nonperforming loans, whether banks are required to produce consolidated financial statements, and whether bank directors are legally liable if information disclosed is erroneous or misleading. The variable ranges from 0 to 3, with a higher value indicating more informative bank account. Data comes from the World Bank regulation and supervision surveys described in Barth et al. (2013)
audit	A variable that indicates whether an external audit is required of the financial statements of a bank and, if so, by a licensed or certified auditor. The variable ranges from 0 to 2, with a higher value indicating more informative bank account.

Source: Anginer, D., Demirguc-Kunt, A. and Mare, D. (2018)