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Abstract

The literature has extensively focused on the sensitivity of the capital adequacy ratio to the changes in bank-specific and economic variables in developing and developed economies. The current study continues in the same momentum by examining the effects of bank-specific and economic factors on the capital adequacy ratio for a panel of 30 banks over six Arab countries from 2014 to 2020. These banks are selected according to systemic importance, based on the size of their assets. For this purpose, we conduct a meticulous analysis based on estimation and testing techniques in the framework of dynamic panel data models.

The estimate results indicate that the capital adequacy ratio responds significantly and positively to the fluctuations in the size of banks, the non-performing loans ratio, the return on assets, and the real GDP growth rate, with the effect of the return on assets being the most important. There is also evidence of no significant effect of the growth of provisions on the capital adequacy ratio for the set of banks over the selected Arab economies. Based on these outcomes, the study provides pertinent policy implications for the Arab banking authorities to enhance capital adequacy in order to improve the banks' ability to face various risks and to absorb potential losses.

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Introduction

The capital adequacy ratio is an important tool that enhances banks' ability to withstand financial and economic shocks and to absorb losses, thus reflecting positively on the soundness and strength of the banks' financial position. In this context, several banks were not able to face the risks induced by the 2008 global financial crisis, due to insufficient capital in terms of quality and quantity. As a result, excessive debt led banks to a gradual erosion of their capitals and consequently doubling their credit losses.

In 2010, the Basel Committee on Banking Supervision amended fundamentally the Basel II standards by issuing new guidelines regarding capital and liquidity (Basel III), with a view of strengthening the capacity of banks and enhancing the quality of their capitals to absorb shocks. In this context, one of the most important amendments is to improve the quality and quantity of capital through retaining a high-quality capital, allowing to face risks and absorb losses. The standards consist in redefining capital by focusing on the part of the highest quality, called Common Equity Tier 1 Capital (CET1). According to Basel III standards, the regulatory capital of banks should not be less than 8% of the risk-weighted assets:

- Tier 1 Capital: It includes the highly quality part of the capital, the core capital Tier1 (minimum 6%), comprising the Common

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Equity Tier 1 "CET1" (minimum 4.5%) and additional Tier 1 (maximum 1.5%).

- Tier 2 Capital: It is of lower quality than the CET1 and is called Tier 2 (with a minimum of 2%).

According to this standard, additional capital buffers are applied to the minimum applicable capital adequacy ratio in order to improve the banks' ability to face various risks, including risks of economic and financial cycles and risks of the financial system (for example, Countercyclical Capital Buffer (CCyB) and D-SIBs buffer).

The current study continues in the same momentum of empirical works on the sensitivity of the capital adequacy ratio to the changes in the bank-specific and economic variables based on panel data procedures. Indeed, we apply the system Generalized Method of Moments (GMM) method in the framework of dynamic panel data models for a set of 30 banks over six Arab economies[1] from 2014 to 2020. We consider a more generalized specification by including four bank-specific factors and one macroeconomic variable into the model, thus shedding more light on several determinants that may exert an impact on the capital adequacy ratio, and providing pertinent policy implications for the Arab banking authorities.

[1] Five banks from each Arab country are selected by taking into account the varying asset sizes (small, medium and large), according to systemic importance.

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The estimate outcomes for most of the determinants comply with expectations for the set of Arab banks under consideration over the study period. Indeed, there is evidence of significant and positive impacts of the one-period lagged capital adequacy ratio, the size of banks, the non-performing loans ratio, the return on assets, and the real GDP growth rate. The results also show evidence of no significant influence of the growth of provisions on the capital adequacy ratio. Pertinent implications are provided for policymakers to help them enhance the capital adequacy ratio of the banking sector in the Arab region, depending on the specificity of each economy.

The remainder of the study is organized as follows. Section 1 briefly reviews previous studies in the related literature. Section 2 provides some insights on the Arab banking sector. Section 3 describes the variables under consideration and presents a preliminary analysis of data. Section 4 introduces the model and estimation issues. Section 5 discusses the empirical results. Concluding comments and policy implications are set forth at the end of the study.

1. Literature review

The literature has extensively examined the effects of many bank-specific and economic determinants, such as size of banks, return on assets, credit quality, economic growth, among others, on the capital adequacy ratio. In this context, Bouri and Ben Hamida (2006) investigated the impact of Basel II standards and capital adequacy

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ratio on the Tunisian banking sector using factors, such as banks' assets, non-performing loans, provisions to total deposits, equity to total loans, and banks' risks measurements. The results reveal positive linkages between capital adequacy rules and the financial risks that threaten banks' decisions.

Asarkaya and Ozcan (2007) found that the credit risk, the economic growth, the return on assets exert a positive impact on the capital adequacy ratio, and that deposits to assets ratio affects negatively the capital adequacy ratio in Turkey. Abdul Karim et al. (2014) showed evidence of positive links of loans and deposits growth with the capital adequacy ratio in Islamic and conventional banks. Al-Tamimi and Fakhri (2013) found that the return on assets has a positive impact on the capital adequacy ratio, and that credit risk does not have the power to influence the capital adequacy ratio in the Jordanian banking sector.

Polat and Al-Khalaf (2014) revealed that for the Saudi banking system, the leverage ratio, and the return on assets are relevant drivers of the capital adequacy ratio, and that the loans to assets and loans to deposits ratios have a negative impact on the capital adequacy ratio. It is also found that the non-performing loans do not affect the capital adequacy ratio. Ansary and Hafez (2015) showed that the liquidity levels, the assets, and the operational efficiency are the most significant determinants of the capital adequacy ratio for a sample of 36 Egyptian banks. They also found that before the 2008

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global financial crisis, the credit risk, the assets, and the profitability are the most significant variables in explaining the capital adequacy ratio. After the global financial crisis, the estimate findings showed that the credit risk, the assets, the liquidity, and the operational efficiency are the most important drivers of the capital adequacy ratio.

Badalashvili (2016) found positive links of the assets structure, the return on assets, and the inflation with the capital adequacy ratio for the biggest four banks in Greece. By cons, the credit risk (non-performing loans), the net interest margin, and the unemployment have a negative impact on the capital adequacy ratio. Ben Moussa (2018) found that the net interest margin, the return on assets, the liquidity, the inflation, the private ownership, and the foreign ownership affect significantly the capital adequacy ratio for a sample of 18 Tunisian banks.

Vu and Dang (2020) showed that the return on assets has a positive impact on the capital adequacy ratio of the Vietnamese banking sector. However, the leverage, the loan loss reserves, and the return on equity have the power to negatively affect the capital adequacy ratio. It is also found that the size of banks, the loan, the deposit, the liquidity, the net interest margin, and the non-performing loans do not exert any significant influence on the capital adequacy ratio.

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2. Insights on the Arab banking sector

Under Basel III regulations, the regulatory capital of banks must be at least 10.5% of risk-weighted assets. In the Arab region, the average capital adequacy ratio of the banking sector maintained its good levels during the 2015-2020 period and at rates higher than those applied internationally according to Basel III requirements. This indicates that the Arab banking sector experiences high solvency that enhances its ability to absorb potential losses, as the average percentage in 2020 and 2019 was about 17.8% and 17.7%, respectively, compared to 16.9% in 2018, while during the years 2017, 2016, 2015, 2014, 2013, it amounted to 17.2%, 17.6%, 17.3%, 16.0%, and 16.1%, respectively (see Figure 1).

For the countries under study, Kuwaiti banks achieved the highest level of capital adequacy ratio, as the average ratio during the study period was about 18.2%., while the lowest average capital adequacy ratio is experienced by Moroccan banks and is 14.2% during the same period, thus exceeding the internationally applied rate according to Basel III requirements (see Figure 2).

It can be concluded that despite the COVID-19 pandemic, the challenges and shocks witnessed by the world in general and the Arab region in particular, and the financial and political shocks during the 2013-2020 period, the Arab banking system is generally stable and able to withstand shocks, as it continues to play its important role in

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the economy by attracting and directing liquidity to investments. In light of the risks and circumstances surrounding the Arab region, the supervisory authorities still continue strengthening their supervision over the banking sector, constantly verifying the validity of its work and performance, and developing its infrastructure and legislations in order to reach the requirements of banking security and financial stability in accordance with the best International standards and practices.

It is worth mentioning that the Arab banking sector is resilient and able to absorb financial shocks in general, despite the challenges and risks due to the COVID-19 pandemic. Indeed, the capital adequacy ratio shows that the sector has strong and stable financial centers that enable it to withstand the shock of COVID-19 and other challenges, as the Arab banking sector is characterized by a solvency higher than that targeted internationally according to Basel III standards, implying that the Arab banking sector experiences a high solvency that enhances its ability to absorb any potential losses.

3. Data and preliminary analysis

According to prior empirical studies in the related literature, various banking and economic variables might affect the capital adequacy ratio, and that the impacts vary across countries. Several studies show that banking factors are the most significant drivers of the capital adequacy ratio, while other studies reveal that the macroeconomic

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variables, especially economic growth, may play a role in explaining the capital adequacy ratio in some economies. It is worth noting that some previous studies in the related literature examine the determinants of capital adequacy ratio in the Arab banking sector, but the analysis is limited to individual countries and not conducted at aggregated level. For that reason, the current study explores the empirical evidence of the relationship between the capital adequacy ratio and various banking and economic determinants for a panel of 30 banks over six Arab economies (Bahrain, Kuwait, Morocco, Oman, Palestine, and Sudan) based on annual data from 2014 to 2020.

3.1. Variables

In our model, the dependent variable, which is the capital adequacy ratio (CAR), is regressed on bank-specific and economic factors.[2] As regards the banking indicators, the size of banks (SIZ), proxied by the logarithm of the assets, is expected to positively affect the capital adequacy ratio (see Badalashvili, 2016). This is due to the fact that large-sized banks usually maintain higher levels of capital adequacy compared to small-sized banks. Moreover, the Domestic Systemically Important Banks (D-SIBs) require, in accordance with

[2] Note that according to Basel III requirements, the bank-specific variables have a major role in determining the levels of capital adequacy in the banking sector.

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Basel III requirements, to maintain an additional capital buffer in order to increase their ability to absorb shocks.

We consider the non-performing loans ratio (NPL), which is expected to have positive links with the capital adequacy ratio (see Asarkaya and Ozcan, 2007), due to the fact that credit risks are usually associated with higher requirements for capital adequacy. The growth of provisions (PRO) is also considered as a determinant of the capital adequacy ratio. This factor is expected to positively affect the capital adequacy ratio, as credit risk increases generate increases in the provisions made to enhance the soundness of the banks' financial positions, thus raising capital adequacy. On the other hand, there are some studies that revealed a negative relationship between the non-performing loans ratio and the capital adequacy ratio, as credit risk may be linked to a capital adequacy weakness if the bank's risk management is weak (see Abusharba et al., 2013).

The last banking variable used in the model is the return on assets (ROA), which is expected to be positively associated with the capital adequacy ratio (see Polat and Al-Khalaf, 2014). The return on assets refers to the efficiency of the bank in managing its assets by achieving more profits, thus raising the levels of capital adequacy ratio, especially if a part of these profits is directed to the capital bases of banks.

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Regarding the economic conditions, we employ the real GDP growth rate, which is expected to have a negative effect on the capital adequacy ratio. This is explained by the fact that the decline in economic growth rates increases the risks surrounding the banks' business, due, for example, to the declines of cash flows of individuals and companies, thus increasing the risk to fulfill their obligations. Furthermore, the economic sentiment in the market may be affected, thus leading to increase the market risk, which, in turn, may force the bank to raise the levels of capital adequacy ratio. However, some studies have concluded that the relationship between the capital adequacy ratio and the real GDP growth rate may be positive (see Asarkaya and Ozcan, 2007), as the economic expansion periods may lead banks to generate more profits and the building of capital buffers as a precautionary measure.

Data on the capital adequacy ratio, the size of banks, the non-performing loans ratio, the growth of provisions, and the return on assets are gathered from financial stability surveys; while data on real GDP growth rate are collected from the World Development Indicators published by the World Bank.

3.2. Preliminary analysis of data

The descriptive statistics for all variables displayed in Table 1 indicate that the Bahraini banks record the highest capital adequacy ratio, with an average of 21.4%, which indicates that these banks

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experience high financial solvency that enables them to absorb unexpected financial shocks. The Palestinian banks record the lowest average capital adequacy ratio (15.2%). It is worth noting that all the countries experience high levels of capital adequacy compared to the internationally applied ratio according to Basel III requirements, which is 10.5%. The average ratio for all banks under study is 18.7%, which indicates that the Arab banking sector records high levels of capital adequacy that enhance its ability to absorb any potential shocks. The results also reveal that the volatility of the capital adequacy ratio differs across countries, as shown by the values of standard deviation. Additionally, there is evidence of discrepancy in the averages and volatility of the banking and economic determinants of the capital adequacy ratio across Arab countries.

The empirical correlations between the capital adequacy ratio and the bank-specific and economic factors displayed in Table 2 are computed across countries and over the full panel of economies. The values by country show evidence of mixed (positive and negative) correlations between the capital adequacy ratio and the other determinants across Arab countries. For the whole panel of economies, the capital adequacy ratio is positively linked with the bank assets (0.052), the non-performing loans ratio (0.133), and the real GDP growth rate (0.090). However, the capital adequacy ratio is negatively correlated to the growth of provisions (-0.031) and the return on assets (-0.180). These correlation values are not determinant regarding the nature of the relationship between the

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capital adequacy ratio and the factors under consideration, leading us to conduct a meticulous analysis of the sensitivity of the capital adequacy ratio to the changes in the considered determinants in the Arab region based on the above model and estimation issues to achieve the objectives of the study.

4. Model and estimation issues

4.1. Model

We assess the sensitivity of the capital adequacy ratio in the Arab banking sector to the changes in the banking and economic variables by estimating the following model:

$$\begin{cases} CAR_{it} = \alpha_0 + \alpha_1 SIZ_{it} + \alpha_2 PRO_{it} + \alpha_3 NPL_{it} \\ \qquad + \alpha_4 ROA_{it} + \alpha_5 GDP_{it} + u_{it} \\ \qquad i = 1, 2, \dots, N, \ t = 1, 2, \dots, T \end{cases} \quad (1)$$

where i stands for cross-section dimension (bank) and t for time series dimension (time period), CAR_{it} is the capital adequacy ratio, SIZ_{it} is the size of banks, PRO_{it} is the growth of provisions, NPL_{it} is the non-performing loans ratio, ROA_{it} is the return on assets, GDP_{it} is the real GDP growth rate, and u_{it} is the error term. Under these conditions, the coefficients α_1, α_2, α_3, and α_4 measure the effects of the banking factors (bank assets, growth of provisions, non-performing loans ratio, and return on assets) on the capital adequacy ratio, and α_5 shows how the capital adequacy ratio reacts to the fluctuations in the real GDP growth rate.

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4.2. Estimation issues

We adopt a suitable GMM method to estimate the model specified above, linking the capital adequacy ratio with the selected banking and economic factors over a period of seven years for a panel of 30 banks from six countries, by pooling cross-section and time series data. The GMM technique has the advantage to control for any potential endogeneity that may arise from explanatory variables. The current study makes use of the system GMM technique in the framework of dynamic panel data models, developed by Blundell and Bond (1998), which considers lagged and differenced versions of the independent variables as instruments to estimate the model coefficients.

Practically, the model is written as follows:

$$Y_{it} = \beta_0 + \beta_1 Y_{i,t-1} + \beta_2 X_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

where Y_{it} is the capital adequacy ratio, X_{it} is the vector of banking and economic factors, and μ_i stands for unobserved bank specific effects.[3] The model given by Eq. (2) can be transformed, by taking the first difference, as follows:

$$\Delta Y_{it} = \beta_1 \Delta Y_{i,t-1} + \beta_2 \Delta X_{it} + \Delta \varepsilon_{it} \quad (3)$$

[3] Note that $E(\mu_i) = 0$, $E(\varepsilon_{it}) = 0$, and $E(\mu_i \varepsilon_{it}) = 0$.

The application of the Ordinary Least Squares (OLS) method to estimate the model generates a biased estimate of the coefficient β_1, thus leading to the adoption of an alternative procedure to alleviate this shortcoming. For this purpose, the GMM technique is used based on the following moment conditions by assuming that the errors are not serially correlated, and the independent variables are not correlated with future values of the errors (see Carkovic and Levine, 2005):

$$E\left[Y_{i,t-j}\left(\varepsilon_{it}-\varepsilon_{i,t-1}\right)\right]=0,\ \ j\geq 2,3,\ldots,(T-1);\ t=3,4,\ldots,T \quad (4)$$

$$E\left[X_{i,t-j}\left(\varepsilon_{it}-\varepsilon_{i,t-1}\right)\right]=0,\ \ j\geq 2,3,\ldots,(T-1);\ t=3,4,\ldots,T \quad (5)$$

To solve the problem of weak instruments, Blundell and Bond (1998) suggest combining the models in differences and levels in a system of equations such that

$$E\left[Y_{i,t+p}\varepsilon_{it}\right]-E\left[Y_{i,t+q}\varepsilon_{it}\right]=0,\quad \forall\, p,q \quad (6)$$

$$E\left[X_{i,t+p}\varepsilon_{it}\right]-E\left[X_{i,t+q}\varepsilon_{it}\right]=0,\quad \forall\, p,q \quad (7)$$

In this context, the following additional moment conditions are imposed:

$$E\left[\Delta Y_{i,t-1}(\mu_i+\varepsilon_{it})\right]=0 \quad (8)$$

$$E\left[\Delta X_{i,t-1}(\mu_i+\varepsilon_{it})\right]=0 \quad (9)$$

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Consistent and efficient estimates of the model coefficients are determined by the system GMM procedure based on the moment conditions given by Eqs. (4), (5), (8) and (9).

5. Discussion of the results

5.1. Determinants of the capital adequacy ratio

The system GMM results of the responses of the capital adequacy ratio to the changes in the banking and economic variables from the set of 30 Arab banks over the 2014-2020 period are reported in Table 3. They reveal that the capital adequacy ratio is positively and significantly affected by its past own value at the 1% significance level. As regards the bank-specific factors, the results indicate that the size of assets, the non-performing loans ratio, and the return on assets are relevant drivers of the capital adequacy ratio for the Arab banking sector since the associated coefficients are positive and statistically significant at the 1% level.[4] Indeed, an increase of one unit in the size of banks, the non-performing loans ratio, and the return on assets tends to increase the capital adequacy ratio by 0.007, 0.229, and 0.626 unit, respectively.

For the non-performing loans ratio, the result may be explained by the fact that according to Basel III requirements, higher credit risk

[4] Note that Ahmad et al. (2008) find that the non-performing loans exert a positive impact on the capital adequacy ratio in a developing economy.

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leads to higher capital adequacy requirements, thus enhancing the ability of the banking system to absorb financial shocks. Regarding the return on assets, the result is consistent with the expectations and the findings of previous studies, such as Asarkaya and Ozcan (2007) and Vu and Dang (2020). Indeed, achieving more profits would enhance the capital bases of the banks, especially in the case of efficient management of the banks, as they usually build more capital buffers during normal times to absorb shocks during stress periods.

It is also found that the growth of provisions does not have the power to affect the capital adequacy ratio, as the related coefficient is not statistically significant at conventional levels. Regarding the economic conditions, the findings reveal that the capital adequacy ratio responds positively and significantly to the fluctuations in the real GDP growth rate.[5] Indeed, an increase of one unit in the real GDP growth rate generates an increase of 0.248 unit in the capital adequacy ratio. This result is expected and may be explained by the fact that in times of economic prosperity, the banks build capital buffers in anticipation of stress times, and financial and economic crises.

5.2. Diagnostic analysis

We employ the Wald test for overall significance of the model, the second-order autocorrelation test for no serial correlation in the first-

[5] This result is consistent with some other studies, such as Dao and Nguyen (2020).

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differenced errors, and the Sargan test for validity of the over-identifying restrictions to check whether the estimated model fits well the data. The test outcomes presented in Table 3 are summarized as follows: *i*) the Wald test shows evidence of overall significance of the model, *ii*) there is evidence of no serial correlation in the first-differenced errors, and *iii*) the over-identifying restrictions are valid. Overall, the diagnostic analysis supports the consistency and validity of the system GMM estimators.

Conclusion and policy implications

The study presents an analysis of the responses of the capital adequacy ratio to the changes in the bank-specific factors and economic conditions for a panel of 30 banks over six Arab countries from 2014 to 2020 by applying the system GMM technique in the framework of dynamic panel data models. The estimate outcomes point to the importance of the influence of the bank-specific factors and economic conditions on the capital adequacy ratio. Indeed, the capital adequacy ratio reacts positively and significantly to the fluctuations in the past own value, the size of banks, the return on assets, the non-performing loans ratio, and the real GDP growth rate. It is also found that the growth of provisions does not have the power to influence the capital adequacy ratio. Based on the obtained results, the study provides important policy recommendations for the banking decision-makers in the Arab region to enhance the capital adequacy ratio:

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- Enhancing the application of Basel III requirements, given their important role in strengthening the banking sector and its ability to withstand financial shocks.
- Conducting permanently stress tests to capture all kinds of risks that may affect capital adequacy.
- Adopting reliable standard models when building the expected credit loss (ECL) model when applying IFRS 9.
- Adopting the best practices and international standards in the supervision of the banking sector.
- Including economic variables in the econometric models used to measure risks in banks, whether in early warning systems, stress tests, risk map, forecasting banking and financial crises, risk management, and IFRS 9.

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Table 1. Summary statistics of the variables

Variable	Bahrain	Kuwait	Morocco	Oman
CAR				
Mean	0.214	0.173	0.198	0.188
Std. Dev.	0.067	0.015	0.089	0.044
SIZ				
Mean	22.664	17.233	21.677	14.284
Std. Dev.	0.627	0.683	1.966	1.472
PROV				
Mean	0.254	0.075	0.021	0.904
Std. Dev.	1.184	0.186	0.123	1.684
NPL				
Mean	0.073	0.018	0.060	0.048
Std. Dev.	0.043	0.009	0.022	0.068
ROA				
Mean	0.014	0.011	0.015	0.007
Std. Dev.	0.006	0.003	0.014	0.017
GDP				
Mean	0.018	-0.007	0.026	0.008
Std. Dev.	0.032	0.030	0.041	0.035

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Table 1 - bis. Summary statistics of the variables

Variable	Palestine	Sudan	Full panel
CAR			
Mean	0.152	0.197	0.187
Std. Dev.	0.035	0.154	0.083
SIZ			
Mean	7.319	6.480	14.943
Std. Dev.	0.757	1.180	6.457
PROV			
Mean	0.460	0.329	0.341
Std. Dev.	0.915	0.505	0.980
NPL			
Mean	0.026	0.021	0.041
Std. Dev.	0.014	0.022	0.041
ROA			
Mean	0.016	0.036	0.016
Std. Dev.	0.006	0.017	0.015
GDP			
Mean	0.008	0.029	0.014
Std. Dev.	0.055	0.031	0.039

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Table 2. Correlations between the capital adequacy ratio and the other variables

Country	Bahrain	Kuwait	Morocco	Oman
SIZ	0.002	-0.159	-0.766	-0.465
PROV	-0.023	-0.038	-0.145	-0.009
NPL	0.134	-0.482	-0.380	0.666
ROA	0.402	0.153	-0.051	-0.727
GDP	0.030	-0.097	0.169	-0.384

Table 2 - bis. Correlations between the capital adequacy ratio and the other variables

Country	Palestine	Sudan	Full panel
SIZ	-0.628	-0.470	0.052
PROV	0.104	-0.113	-0.031
NPL	-0.247	-0.128	0.133
ROA	0.073	-0.401	-0.180
GDP	0.033	0.168	0.090

Table 3. System GMM estimates

	Estimate	Standard Error
CAR(-1)	0.330***	0.006
SIZ	0.007***	2.344E-4
PRO	0.001	0.001
NPL	0.229***	0.054
ROA	0.626***	0.108
GDP	0.248***	0.019
Wald Test	13737.410	
	[0.000]	
Second-Order Autocorrelation Test	0.650	
	[0.516]	
Sargan Test	27.115	
	[0.102]	

Notes: Wald test for overall significance of the model, Second-order autocorrelation test for no serial correlation in first-differenced errors, and Sargan test for over-identifying restrictions. The values in brackets are the *p*-values of the tests. *** denotes statistical significance at the 1% level.

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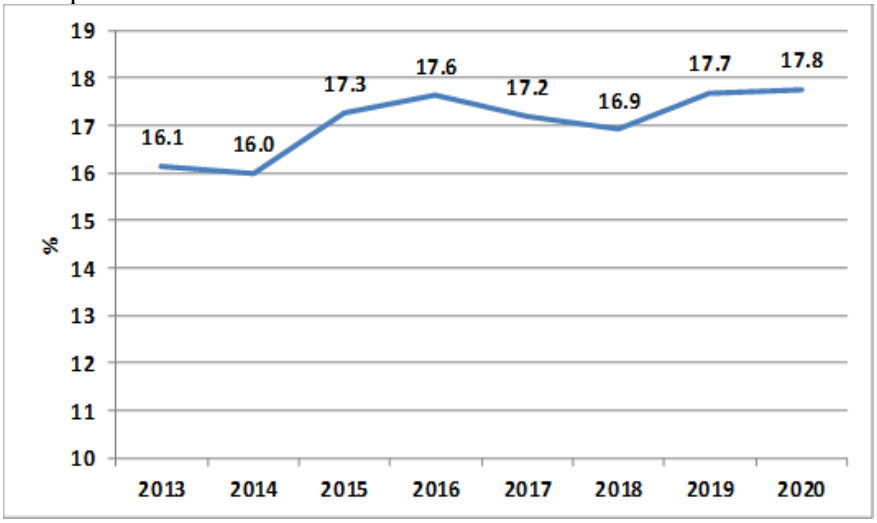
Figure 1. Capital adequacy ratio in the Arab banking sector over the 2013-2020 period



Source: Financial Stability Report (2021), Arab Monetary Fund

Figure 2. Capital adequacy ratio across Arab countries over the 2013-2020 period

Source: Financial Stability Report (2021), Arab Monetary Fund

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