European Journal of Business and Management Research
www.ejbmr.org

Bank Efficiency, Competition and Concentration in MENA Region Countries: A Granger Causality Approach

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ABSTRACT

In this paper, we aim to explore the causal relationship among the bank efficiency, competition, and concentration in the banking systems of 15 countries in the MENA region (Jordan, UAE, Bahrain, Algeria, Saudi Arabia, Kuwait, Morocco, Turkey, Tunisia, Oman, Palestine, Qatar, Lebanon, Egypt, and Mauritania), by modeling econometric panel data over 2008–2018. Banking efficiency is measured by Data Envelopment Analysis (DEA), while the level of competition is measured by the Boone Indicator, and the level of concentration is measured by the HHI index. Granger causality is used to estimate the relationship among these variables. Results indicate the presence of a significant effect of banking efficiency on banking competition and banking concentration.

Keywords: Efficiency, Competition, Concentration, DEA, Boone, HHI, Granger, MENA.

Submitted: September 27, 2022

Published: November 03, 2022

ISSN: 2507-1076

DOI: 10.24018/ejbmr.2022.7.6.1688

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I. Introduction

The effect of banking efficiency on banking competition and market concentration in the banking sector remains one of the main controversial topics in the banking field, the great importance of the banking sector is shown by what this sector does in achieving development and its impacts on the economies of countries, also achieving banking efficiency contributes to reducing it is costs and increasing profits, and thus provide lower prices for the banking services which lead to more banking concentration which expected to increase competition and efficiency.

The banking competition provides the best banking services to customers in the easiest and fastest way, raising the level of quality of services and increasing the options available to customers in the banking sector. Furthermore, it enhances its competitiveness, which has a positive effect on the national economy.

There are three main hypotheses have been presented to explain these relationships:

A. The Efficient Structure Hypothesis (ESH)

According to Demsetz (1973), it has been assumed that efficient banks can lower production costs and thus gain higher profits and greater market shares. Besides, it is supported by Smirlock (1985), that market concentration is not a random event, but rather as a result of the efficiency, as more efficient banks could obtain greater market shares from other less efficient banks in the market, thus the market would become more concentrated and the banks could exploit greater market power, as the greater the market power of the banks, the lower the levels of competition, that is, (ESH) assumes a positive (negative) causal relationship extending from efficiency to market power (competition).

B. The Quiet Life Hypothesis (QLH)

Hicks (1935) finds that the best monopoly profits are the quiet life, where market power allows firms to enjoy a "quiet life". According to (Berger and Hannan, 1998), it is suggested that managers can use the market power of banks to achieve extraordinary profits without making efforts to act or control the cost to increase the efficiency of the banks, and thus, lead to increased strength monopolization in the market leads to a decrease in efficiency, while increased competition increases the efficiency of banks.

C. The Information Generation Hypothesis (IGH)

Marquez (2002) assumes that fierce competition between banks may lead to a decrease in the efficiency of banks; where in competitive markets, each bank has specific information about a small group of customers. When competition increases, banks will offer customers less expenses to attract them from other banks. This may lead to the ease with which customers move from their current bank to another bank to obtain more benefits, i.e. competition between banks leads to a decrease in their ability to collect information, which leads to a higher probability of the borrower's adverse selection and thus lower bank efficiency.

In this paper, we focus on the analysis of the relationship between efficiency, competition and concentration of MENA countries banking systems. Using central banks data for 15 countries in MENA region over the period 2008-2018, we apply DEA (Data Envelopment Analysis) to estimate the degree of banking efficiency, HHI (Herfindahl-Hirschman Index), to estimate the banking concentration and Boone

indicator to estimate the degree of competition, then we have used the Engel Granger Causality approach to test the direction of the relationship Causality between efficiency, competition and concentration, and the opposite.

II. Literature Review

This section tries to present some of the previous studies, which has been conducted in the fields. First, is banking efficiency. Second, banking competition and concentration. Finally, the relationship between them.

A. Bank Efficiency

Rahman *et al.* (2013) investigate the efficiency of 63 Islamic banks in MENA countries, over the period 2006 to 2009, by using the Data Envelopment Analysis (DEA) model. The results indicate that Islamic banks achieve a high degree of technical efficiency, which indicates the ability to control costs and use inputs to maximize outputs. Islamic banks from Asian countries are relatively more efficient, and most of them are from the Gulf countries.

Jadi (2014) analyzes the operational efficiency of 7 private banks in Algeria, using the Stochastic Frontier Approach (SFA) model over the period 2006-2012. The results indicate that small-sized banks are more efficient in managing their costs than large-sized banks, and the banks under study are efficient in terms of substitution between their inputs, and they do not have the ability to control their costs through the prices of their inputs because they have not achieved price flexibility.

Alber (2016) aims to investigate the relationship between banking competence and financial stability using a sample of 15 countries in the MENA region over the period 2004-2013, using the Regression Analysis Data Panel. Banking efficiency was measured by DEA, financial stability was measured by Z-Score index, and the most important results indicated that banking efficiency and financial stability might affect each other.

Hassan (2019) uses DEA technique to measure the efficiency of ten commercial banks listed on the Egyptian Stock Exchange over the period 2014 to 2017. Two outputs were identified (loans, net bank revenue), and three inputs were identified (debt, depreciation, and general expenses), the study concluded that most of the commercial banks listed on the Egyptian Stock Exchange do not have the technical efficiency, meaning that they do not improve the mixing of input elements to achieve a certain level of output.

B. Bank Competition and Concentration

Řepková and Stavárek (2014) estimate the relationship between banking concentration and competition in the banking sector of Turkey over the period from 2002 to 2010. Banking concentration is applied by three indicators (CR3, CR5, and Herfindahl-Hirschman: HHI Index), and Panzar-Rosse Index used to measure banking competition. The most important results were that the banking sector is almost not concentrated, the Turkish banking sector is an industry with monopolistic competition, and banks in Turkey do not operate in a competitive environment.

Igbinosa and Osagie (2017) tries to measure the degree of concentration and competition in the banking industry for four African countries (Nigeria, South Africa, Egypt, and Kenya) during the period 2005-2013, using two indicators for concentration (HHI Index, CR5). The Panzar-Rosse measures the degree of competition. The most important result is that banking is concentrated with a few banks that control a large share of the market size, and the banking sector in South Africa is the most concentrated, followed by Egypt and Kenya, while the least concentrated in Nigeria, and banks in these countries It operates under conditions of monopolistic competition.

González *et al.* (2017) focus on investigating the relationship between competition and bank stability for 356 banks operating in MENA countries over the period 2005 - 2012. Results found that competition increases in Gulf countries than in other non-Gulf countries, and the importance of market structure as an explanatory factor for financial stability. Concentration is not related to uncompetitive markets, and there is a positive relationship between competition and concentration, and Islamic banks are less stable (riskier) than conventional banks.

Ahi and Laidroo (2009) aim at analyzing the relationship between bank stability and competition in 27 Europe countries over the period from 2004 to 2014, Bank stability is measured by Z-Score and loan loss reserves ratio, three indicators of banking competition used (Boone, Lerner & HHI). Most important there is a linear relationship between bank stability and banking competition, but if there is no potential linear relationship for this correlation, the results appear to be more varied across the various competition indicators.

Căprarua *et al.* (2020) investigate the relationship between competition and diversification in the European banking sector, through a sample of 1570 commercial banks in 28 countries of the EU during the period 2000-2016, the ratio of non-interest income to total income and the share of off-balance sheet items to total assets as an indicator of diversification, two indicators were used to measure banking competition the Adjusted Lerner Index & Boone Indicator. The most important results indicate that competition leads to an increase the bank diversification, bank performance, efficiency, and research and development expenditures have positive effects on diversification.

C. The Relationship Between Banking Efficiency, Banking Competition and Concentration

Poshakwale and Qian (2011) investigate the relationship between banking competition and efficiency and economic growth in Egypt, by examining the effect of financial reforms on competition and production efficiency in the banking sector over the period 1992 - 2007, two indicators using to measure competition, Panzar-Rosse and Lerner, two indicators used to measure banking efficiency, DEA and SFA. The main result is that reform has a significant impact on competition and production efficiency. The results also indicated the existence of monopolistic competition in the Egyptian banking sector, there is a large causal relationship between efficiency and competition in the short term, and it seems that the measure of cost efficiency positively affects competition in the industry.

Ferreira (2012) attempts to Investigate the bank efficiency, market concentration, and economic growth of 27 countries

in the EU over the period 1996 - 2008, banking concentration was measured by two indicators (CR3 and HHI), and banking efficiency was measured by DEA. Results indicate that there is a general trend to increase the concentration of five countries (France, Germany, Spain, the United States of Britain, and Italy), and the levels of concentration remain relatively low for the rest of the countries, and the general trend is to decrease the cost efficiency of banks, as well as There is a negative relationship between efficiency and concentration, and the more cost-effective banks operate in less concentrated markets

Bakour and Gallali (2014) aim to explore the relationship between efficiency and competition between Islamic and conventional banks in the MENA region for 157 conventional banks and 66 Islamic banks in 13 countries over the period 2004 to 2013.

The SFA is used to measure banking efficiency. Panzar-Rosse used to measure banking competition, the most important findings that the existence of a positive relationship between competition and banking efficiency, that commercial banks in the MENA region are characterized by efficiency on average, and Islamic banks are more efficient than conventional banks, and that existence of a monopoly in competition.

Elfeituri (2015) focuses on examining the relationship between banking efficiency, competition, performance and market structure, for 149 conventional banks in MENA region countries over the period 1999-2012, relying on the Unbalanced Panel Analysis model. Panzar-Rosse index was used to measure banking competition, DEA to measure efficiency, and HHI index to measure banking concentration, while profitability is measured through the index of return on assets (ROA) and return on equity (ROE). The most important results indicate that some economies in the MENA region can be described as less concentrated, while others enjoy a high and medium degree of market focus, a positive and important relationship between interest margins, and profitability.

My Phan (2015) evaluates the relationships between banking competition, concentration, and banking efficiency in six Asian countries over period 2005-2012, competition was measured by Lerner Index, and efficiency was measured by SFA. The most important results found that banks in these countries are efficient and highly competitive, and the levels of concentration in banking markets have a tendency to decrease and decrease from country to country, and the results showed a negative relationship between banking concentration and banking competition across the banking systems of those countries, and that banking concentration has a positive effect on efficiency, while competition has a negative impact on Efficiency.

Alber (2015) aims at analyzing the effects of bank size, age and ownership on efficiency of Egyptian banks, as measured by Data Envelopment Analysis (DEA) according to CCR method. This has been conducted using Wilcoxon signed rank test, as applied on a sample of 10 banks during the period from 1984 to 2013.

Apergis and Polemis (2016) assess the relationship between competition and efficiency in the banking sector for 10 countries in MENA Region over the period from 1997 to 2011. Competition is measured by Panzar-Rosse, and efficiency is measured by DEA.

The most important finding is that the average cost efficiency was relatively high 77.6%, indicating that banks only need to improve by 22.4%, to reach the limits of cost efficiency, there is not any significant difference in the level of cost efficiency in all MENA countries, as well as cost efficiency has a negative significant impact on competition, which indicates that progress in terms of cost-effectiveness reduces competition.

Bukhalala (2017) analyzes the degree of competition and efficiency between conventional banks and Islamic banks in Algeria over the period 2004-2014, for a sample that includes 11 banks. Competition is measured by the Lerner index and efficiency by DEA. The most important results indicated a weakness and a decrease in the degree of competition in general at the level of the Algerian banking sector due to the continuing high monopolistic behavior of public banks.

The Islamic bank is considered less efficient than traditional private and public banks and there is no real competition between Islamic banks and conventional banks due to the inefficiency of the Islamic bank in the optimal use of the available resources.

Yu (2017) measures the relationship between cost efficiency, banking competition, and profitability in major economies in Asian countries, using a sample of 278 commercial banks over the period 2005-2012 before and after the global financial crisis. Three indicators are used to measure banking competition, Panzar-Rosse, Lerner and Boone, and efficiency is measured by SFA. Findings have shown that competition between banks in industrialized countries has become more intense in 9 Asian economies in the wake of the financial crisis, and there are two economies (China and India) that play a major role in this banking competition and that the bank size and differences across countries are the important determinants of banking efficiency.

Phan *et al.* (2019) studied the relationship between competition, efficiency and stability for four Asian countries over the period 2004-2014, banking competition measured by Lerner index, while banking efficiency was measured by DEA and SFA, and bank stability measured by Z-Score Index. The most important results have showed that the cost efficiency scores measured by the SFA model were higher than those obtained through the DEA model, increase in competition may lead to a decrease in stability, and the existence of a negative relationship between bank stability and banking competition.

Banyen and Biekpe (2020) investigates the causal relationship between financial integration, banking competition, and banking efficiency for 405 banks in 47 African countries. The unbalanced panel model has been used over period 2007-2014, the Lerner index has been used for banking competition, SFA used for banking efficiency. The most important results are a steady rise in banking competition and efficiency in Africa, as well as the gradual convergence of banking competition and efficiency in those countries, and cost-effectiveness in all African banking markets, evidence of the positive benefits of financial integration in the banking sector. The results have indicated that the increase in competition has a significant positive

effect on the efficiency, and there is a negative relationship between competition and efficiency.

Comparing for the previous studies this study investigates the relationship between banking efficiency, banking competition and banking concentration for 15 countries in the MENA region over the period 2008-2018 and examines the causal relationship between them by using Granger Causality test.

III. Research Hypotheses

This paper aims at testing the following three hypotheses:

- **First Hypothesis, HO1:** There is no significant effect of banking efficiency on banking competition & concentration.
- **Second Hypothesis, HO2:** Banking efficiency does not cause banking competition and concentration.
- **Third Hypothesis, HO3:** Banking competition and concentration does not cause banking efficiency.

IV. Measuring Variables

In order to test the effect and causality relationship between banking efficiency, competition and market concentration, bank data were retrieved from the BankScope database for the fifteen countries chosen in MENA region over the period 2008 and 2018, the different website of central banks with annual frequency, the International Financial Statistics (IFS), data of the IMF, and Arab Monetary Fund (AMF). Chosen measures are shown in Table I.

The general model for the research can be illustrated to study the impact of the independent variables on the dependent variables, through (1), (2) and (3).

$$Y1it = \alpha + \beta1\, X1it + \beta2\, X2it + \varepsilon\, it \quad (1)$$

$$Y2it = \alpha + \beta1\, X1it + \beta2\, X2it + \varepsilon\, it \quad (2)$$

$$Y3it = \alpha + \beta1\, X1it + \beta2\, X2it + \varepsilon\, it \quad (3)$$

V. Descriptive and Diagnostic Statistics

A. *Descriptive Statistics*

Table II illustrates descriptive statistics of the research variables using a sample of 15 countries, over the period 2008-2018, with total observation 165.

B. *Normality Test*

Regarding to Normality test, Table III illustrates that Jarque-Bera values indicate that there are 3 variables are normally distributed X2, Y2 & Y3 at p-value of 0.01.

C. *Multicollinearity Test*

Regarding the Multicollinearity test, Table IV illustrates that the correlation coefficient between independent variables is 0.199, while Table V illustrates the Variance Inflation Factor **(VIF)** which indicates that the coefficient for all the independent variables is less than 10, which means that there is no Multicollinearity problem between the independent variables.

TABLE I: Measuring Banking Efficiency, Competition And Concentration Variables

Calculation method	Sign	Variable
Bank efficiency - Independent variables		
Data Envelopment Analysis: (DEA)	X1	Bank Efficiency
Non-Interest Expenses to Gross Income	X2	Operation Efficiency
Bank Competition - Dependent variables		
Boone Indicator $\pi_{it} = \alpha + \beta \ln (c_{it})$	Y1	Bank Competition
Herfindahl-Hirschman Index (HHI Index) $HHI = \sum_{i=1}^{n} s_i^2$	Y2	Bank Concentration
Log (Total Assets)	Y3	Bank Size

Source: Prepared by the researcher to clarify the study variables and measurement indicators.

TABLE II: Descriptive Statistics

Variables	Sign	Minimum	Maximum	Mean	Std. Deviation
DEA Model	X1	0.419	1	0.899	0.100
Operation efficiency	X2	-0.152	0.703	0.433	0.123
Boone Indicator	Y1	-0.225	0.919	-0.025	0.082
HHI Index	Y2	0.012	0.315	0.109	0.072
Bank Size	Y3	0.088	0.210	0.130	0.031

Source: Outputs of data processing using EViews 10.

TABLE III: Normality Test

Variables	Sign	Jarque- Bera Probability
DEA Model	X1	0.000
Operation efficiency	X2	0.12158*
Boone Indicator	Y1	0.000
HHI Index	Y2	0.16422*
Bank Size	Y3	0.02401*

Source: Outputs of data processing using EViews 10.

TABLE IV: Correlation Coefficients Between Research Variables

Variables	Sign	X1	X2	Y1	Y2	Y3
DEA Model	X1	1	-	-	-	-
Operation efficiency	X2	-0.199*	1	-	-	-
Boone Indicator	Y1	0.098	-0.301**	1	-	-
HHI Index	Y2	0.004	0.202**	-0.082	1	-
Bank Size	Y3	0.284**	0.048	-0.065	-0.064	1

Source: Outputs of data processing using EViews 10.

TABLE V: VARIANCE INFLATION FACTOR TEST (VIF)

Independent Variables	Sign	VIF
DEA Model	X1	1.142
Operation efficiency	X2	1.105

Source: Outputs of data processing using EViews 10.

TABLE VI: DURBIN-WATSON (D-W)

Study Models	D-W
The first sub-hypothesis model Y1	1.73
The second sub-hypothesis model Y2	2.50
The third sub-hypothesis model Y3	1.25

Source: Outputs of data processing using EViews 10.

TABLE VII: LINEAR REGRESSION MODELS

Independent variables		Pooled Regression	Fixed Effects	Random Effects
Constant	Coefficient	0.030454	0.189086	0.064347
	P-Value	0.6382	0.0097*	0.3006
X1 DEA	Coefficient	0.032214	0.000631	0.022522
	P-Value	0.6069	0.9927	0.7058
Operation efficiency X2	Coefficient	-0.195042	-0.495449	-0.253113
	P-Value	0.0002*	0.0000*	0.0000*
R- Squared		0.091985	0.333413	0.123948
Prob. (F- Statistic)		0.000403*	0.000000*	0.000022*

*, **, *** represents the statistical significance of P-value at levels 1%, 5% and 10%. No. of banks is 15 over period 2008 to 2018. No. Of Observation 165.

Source: Outputs of data processing using EViews 10.

A. Autocorrelation Test

Regarding the Autocorrelation test, Table VI illustrates that the Durbin-Watson **(D-W)** values for all models after the first difference are far from 0, as well as from 4, and getting close to 2, which means that there is no Autocorrelation problem in the study models.

VI. TESTING HYPOTHESES

This section is for investigates the effect of each banking efficiency on banking competition and concentration.

To investigate these effects, a panel data analysis has been conducted using the multiple linear regression model through the least squares method. As illustrated in Table VII, there are three main models: Pooled Regression Model (**PRM**), Fixed Effects Model (**FEM**) and Random Effects Model (**REM**).

The multiple linear regression in Table VII illustrates that the fixed effects are most appropriate for Panel data for this study, but this can be confirmed after using the following two tests:

1) Wald Test

To compare the Pooled Regression Model and the Fixed Effects Model, the following results are shown in Table VIII.

The results presented in Table VIII indicate that the Wald test shows a P-Value of less than 5%, which means rejection of the null hypothesis and acceptance of the alternative one. That is, the fixed effects model is the appropriate model for the study data, which leads to applying the second test.

TABLE VIII: WALD TEST

P-Value	F-Statistic
0.0004	8.205558

Source: Outputs of data processing using EViews 10.

2) Hausman Test

To compare the Fixed Effects Model and the Random Effects Model, the following results are shown in Table IX.

TABLE IX: HAUSMAN TEST

P-Value	Chi-Square.Statistic
0.0000	28.305555

Source: Outputs of data processing using EViews 10.

The results presented in Table IX indicate that the Hausman test shows a P-Value of less than 5%. This means rejecting the null hypothesis and accepting the alternative hypothesis. The mean fixed effects model is the appropriate model for the study data. This means that both the Wald Test (F-statistic) and Hausman Test confirmed that the Fixed Effects Model (FEM) is the most appropriate model for the study, which will be applied to test the study hypotheses, each hypothesis separately, as follows in detail.

A. First Hypothesis

HO1: There is no significant effect of banking efficiency on banking competition & concentration.

HO1, 1: There is no significant impact of banking efficiency on banking competition according to Boone Indicator.

The estimate of (1) is as follows: Bank Competition = 0.189086 + 0.000631 Bank Efficiency -0.495449 Operation Efficiency.

HO1, 2: There is no significant effect of banking efficiency on banking concentration according to HHI Index.

The estimate of (2) is as follows: Bank Concentration = 0.072948 + 0.006962 Bank Efficiency + 0.069988 Operation Efficiency.

HO1, 3: There is no significant effect of banking efficiency on bank size.

The estimate of (3) is as follows: Bank Size = 0.116409 + 0.014867 Bank Efficiency + 0.000682 Operation Efficiency.

B. Second Hypothesis

HO2: Banking efficiency does not cause banking competition and concentration.

HO2.1: Banking efficiency according to the DEA model does not cause banking competition according to the Boone indicator.

HO2.2: Banking efficiency according to the DEA model does not cause banking concentration according to HHI Index.

HO2.3: Banking efficiency according to the DEA model does not cause the bank size.

HO2.4: Operation efficiency does not cause banking competition according to the Boone indicator.

HO2.5: Operation Efficiency does not cause banking concentration according to HHI Index.

HO2.6: Operation efficiency does not cause the bank size.

TABLE X: RESULTS OF THE FIRST SUB-HYPOTHESIS TEST, HO1, 1

Independent variables		Fixed Effects Model
Constant	Coefficient	0.189086
	P-Value	0.0097*
	Std. Error	0.072203
X1 - DEA	Coefficient	0.000631
	P-Value	0.9927
	Std. Error	0.068420
Operation efficiency - X2	Coefficient	-0.495449
	P-Value	0.0000*
	Std. Error	0.068237
R- Squared		0.333413
Prob. (F- Statistic)		0.000000*

Source: Outputs of data processing using EViews 10.

TABLE XI: RESULTS OF THE SECOND SUB-HYPOTHESIS TEST, HO1, 2

Independent variables		Fixed Effects Model
Constant	Coefficient	0.072948
	P-Value	0.0692***
	Std. Error	0.039854
X1- DEA	Coefficient	0.006962
	P-Value	0.854000
	Std. Error	0.037766
Operation efficiency - X2	Coefficient	0.069988
	P-Value	0.0651***
	Std. Error	0.037665
R- Squared		0.737300
Prob. (F- Statistic)		0.000000*

Source: Outputs of data processing using EViews 10.

TABLE XII: RESULTS OF THE THIRD SUB-HYPOTHESIS TEST, HO1, 3

Independent variables		Fixed Effects Model
Constant	Coefficient	0.116409
	P-Value	0.0000*
	Std. Error	0.002796
X1 - DEA	Coefficient	0.014867
	P-Value	0.0000*
	Std. Error	0.002649
Operation efficiency - X2	Coefficient	0.000682
	P-Value	0.796800
	Std. Error	0.002642
R- Squared		0.993253
Prob. (F- Statistic)		0.000000*

Source: Outputs of data processing using EViews 10.

C. Third Hypothesis

HO3: Banking competition and concentration do not cause banking efficiency.

HO3.1: Banking competition according to Boone indicator does not cause banking efficiency according to the DEA model.

HO3.2: Banking competition according to Boone indicator does not cause operation efficiency.

HO3.3: Banking Concentration according to HHI Index Does not cause Banking Efficiency According to the DEA Model.

HO3.4: Banking Concentration according to HHI Index does not cause Operation Efficiency.

HO3.5: Bank size does not cause bank efficiency according to the DEA model.

HO3.6: Bank size does not cause operation efficiency.

Testing the second, the third main hypothesis and their sub-hypotheses require testing the causal relationship between these variables by applying the Granger Causality Estimated test in both directions between all independent and dependent variables, to determine the causal relationship between them, the results are presented in Table XIII.

VII. SUMMARY AND CONCLUDING REMARKS

This paper attempts to investigate the relationship between banking efficiency, banking competition, and banking concentration using a sample of 15 MENA countries, that includes (Jordan, UAE, Bahrain, Algeria, Saudi Arabia, Kuwait, Morocco, Turkey, Tunisia, Oman, Palestine, Qatar, Lebanon, Egypt, and Mauritania) over the period 2008 to 2018, using panel analysis according to fixed effect model. Results indicate:

- With regard to the **first Hypothesis (HO1),** "There is no significant effect of banking efficiency on banking competition & concentration", the results indicate that, rejecting the null hypothesis and accepting the alternative hypothesis, with the presence of a significant effect of banking efficiency on banking competition and banking concentration.
- The presence of a significant effect of banking efficiency on banking competition and banking concentration is a natural result, consistent with the fact that increasing the bank's efficiency enables it to achieve quality in the services provided to its customers, as well as increasing the spread, and thus an increase in the size of the bank's assets. This also indicates the bank's ability to compete strongly with other banks.
- With regard to the **second hypothesis (HO2)**, "Banking efficiency does not cause banking competition and concentration", it has been shown that banking efficiency does not cause banking competition, banking concentration and bank size, while operational efficiency causes banking competition and bank size but does not cause bank concentration.

TABLE XIII: PAIRWISE GRANGER CAUSALITY TESTS

HO	F-Statistic	P-Value	Sub-Hypothesis testing
X1 does not Cause Y1	1.95525	0.1462	HO2,1: Accepted
Y1 does not Cause X1	1.47579	0.2329	HO3,1: Accepted
X1 does not Cause Y2	0.80748	0.4485	HO2,2: Accepted
Y2 does not Cause X1	2.38189	0.0969***	HO3,3: Rejected
X1 does not Cause Y3	1.24863	0.2908	HO2,3: Accepted
Y3 does not Cause X1	0.12527	0.8824	HO3,5: Accepted
X2 does not Cause Y1	5.94572	0.0035*	HO2,4: Rejected
Y1 does not Cause X2	0.08896	0.9149	HO3,2: Accepted
X2 does not Cause Y2	1.66364	0.1940	HO2,5: Accepted
Y2 does not Cause X2	0.55390	0.5762	HO3,4: Accepted
X2 does not Cause Y3	3.30077	0.0404**	HO2,6: Rejected
Y3 does not Cause X2	6.96790	0.0014*	HO3,6: Rejected

*, **, *** represents the statistical significance of P-value at levels 1%, 5% and 10%.

Source: Outputs of data processing using EViews 10.

- With regard to the **third hypothesis HO3** "Banking competition and concentration does not cause banking efficiency", the results show that banking competition does not cause banking efficiency, while banking concentration causes banking efficiency only, and bank size causes operational efficiency only.
- The previous causal results indicate that the relationship between banking efficiency banking competition and banking concentration is not straightforward and that there are other factors such as (the regulatory framework by central banks, international legislation such as Basel Committee, competition with financial institutions, etc.) may affect the size and direction of this.
- It is also clear that the causal trend between banking efficiency, banking competition and concentration may determine what the bank's policies and strategies should be directed in terms of enhancing the bank's efficiency and increasing its profits, by providing more innovation in products and enhancing the quality of banking products. Besides, performance may be affected by information security (Alber & Nabil, 2016) and by competitive advantages (Alber, 2013).

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