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The Impact of Macroeconomic Variables, Bank-Specific *Factors* and the Crisis Followed Libyan Revolution on Libyan Banks Efficiency

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The Impact of Macroeconomic Variables, Bank-Specific *Factors* and the Crisis Followed Libyan Revolution on Libyan Banks Efficiency

ملخص الدراسة:

أجريت هذه الدراسة للتعرف على تأثير المتغيرات الاقتصادية (الناتج المحلي الإجمالي، التضخم) ومتغيرات المصرف وكذلك تأثير الأزمة التي أعقبت الثورة الليبية2011 على كفاءة المصارف التجارية العاملة في ليبيا. تم استخدام تحليل الانحدار للوحة البيانات الغير متوازنة للمصارف التجارية الليبية المدرجة في السوق المالي الليبي وعددها سبعة مصارف للفترة من 2005 إلى 2013. ولتقدير الكفاءة كمتغير تابع تم استخدم تحليل مغلف البيانات، بالإضافة إلى ذلك، استخدم تحليل الانحدار المتعدد (توبيت) لأنه يسمح بتحليل العوامل التي تؤثر على كفاءة المصارف عندما يكون المتغير التابع محدود القيمة. تشير النتائج إلى أن متغيرات المصرف المستخدمة في الدراسة قادرة على تفسير جزء كبير من كفاءة المصارف الليبية، وفي المقابل، تكشف الدراسة أن متغيرات الاقتصاد الكلي ليس لها تأثير على كفاءة المصارف الليبية، كما تشير النتائج إلى أن كفاءة المصارف الليبية تأثرت بشكل إيجابي بالأزمة التي أعقبت الثورة الليبية.

الكلمات الدالة: كفاءة المصارف، تحليل الانحدار المتعدد، السوق المالي الليبي، مغلف البيانات.

1. Introduction

Libya's banking system is dominated by five banks (Jumhoria Bank, Wahda Bank, Sahara Bank, Umma Bank and the National Commercial Bank) which are owned in full or have majority stake in them by Central Bank of Libya, these banks constitute almost 90% of Libya's banking sector assets. In 2007, five foreign banks were short listed for the privatization of Wahda Bank. These branches are France, Italy, Jordan, Bahrain and Morocco institutions. They bid on 19% of the share of Wahda Bank, with the option to increase their ownership to 51% in three to five years. France's BNP Paribas acquired 19% of Libya's Sahara Bank in 2007, and took operational control of the bank (Alrafadi et al., 2015).

The banking system of Libya is undergoing a substantial modernization program to upgrade available services and products, establish a functioning national payments system, facilitate use of non-cash payment instruments and institute new standards of accounting and training. Although the foreign banks are technically able to enter the Libyan market under the banking law of 2005, the central bank has delayed their entry until the completion of the reform process (International Business Publications, 2007).

The banking sector in Libya encountered large and very important changes with the installation of a new national payments system, a program which was implemented in 2005 following consultation with the World Bank (Panorama Report, 2008). In light of the recent changes of the Libyan banking sector, and the Libyan revolution in 2011, studying the determinants of banks efficiency has become a significant area of research. The importance of research in this area lies in its contribution to enhancing the economic growth and stability and to strengthen the risk management in banks.

Measurement and analysis of banks efficiency has received increasing attention in recent years. But, the investigation has received very little attention especially the impact of Libyan revolution on banks efficiency of Libya. Therefore, the objective of this study is identifying the impact of Bank-specific, Macroeconomic variables and the crisis followed 2011 Libyan revolution on Libyan banks efficiency.

This study is organized as follows: discussion of the related existing literature, methodology, results and discussion and conclusion.

2. Literature Review

The literature provides several studies on the evaluation of banking efficiency; particularly in Libya. Alrafadi et al., (2014) estimated the determinants of the efficiency of Libyan banks over the period 2004-2010 using Data Envelopment Analysis for assessing technical efficiency and Tobit regression model to identify potential determinants of efficiency. The results of the study showed positive relationship between bank efficiency, and return on assets, size of operation, capital adequacy and government ownership.

Grigorian and Manole (2006), Seelanatha (2007), Sufian and Habibullah (2010), Garza-Garcia (2012), Shah et al., (2012) and Noor and Ahmad (2012) applied the DEA to measure the efficiency of banks and the Tobit model to find out the determinants of bank efficiency. The findings of Grigorian and Manole (2006) indicated that equity capital ratios, market concentration, foreign ownership, capital adequacy and GDP per capita, were all positively related to the efficiency. Seelanatha (2007) examined the

determinants of bank efficiency in Sri Lanka. The results showed that technical efficiency had positive relationships with capital strength, loans and liquidity; and negative relationships with old banks. Similarly, Sufian and Habibullah (2010) analyzed the determinants of banking efficiency of the Thai. The results of the regression analysis revealed that capital strength and loans were positively related to the banks efficiency. The findings suggested that the global financial crisis 2008 was negatively related to bank efficiency; whereas, the inflation and gross domestic product do not have a significant impact on bank efficiency.

Sufian et al., (2012) employed the panel regression analysis to examine the factors which influence the efficiency of the Malaysian domestic Islamic banks during the period from 2006 to 2010. The results revealed that liquidity and gross domestic product have positive relationships with Islamic banks efficiency, whereas, the inflation exerts negative influence on efficiency of Islamic banks.

Meanwhile, Garza-Garcia (2012) investigated the efficiency determinants of the Mexican banking industry. The results revealed that capital, loans, and GDP growth were positively related to the banks efficiency. The findings suggested that expenses and inflation rate were negatively related to banks efficiency. Also, Shah et al.,(2012) investigated the effect of banks' specific factors on the efficiency using data from banks of Pakistan. The findings indicated that bank size is insignificant in its relationship with efficiency.

Noor and Ahmad (2012) investigated the efficiency determinants of Islamic banks in 25 countries. The studies found a positive relationship with banks efficiency and GDP, bank size, capitalization and operating expense. Also, the results showed that loans have a negative relationship with bank efficiency. On the other hand, the deposits, inflation and the global financial crisis 2008 have an insignificant negative relationship with bank efficiency.

In recent years, Singh and Fida (2015) estimated the determinants of the technical efficiency of Oman banks using Tobit model. The study revealed that liquidity and profitability have positive and significant effect on technical efficiency, but bank size has insignificant positive effect. More recently, Tesfay (2016) examined the determinants of Ethiopia commercial banks efficiency over the period 2003 - 2012 using Tobit model. The study results found that deposit has positive and significant effect on bank efficiency, whereas, profitability, loan quality, expenses and bank size do not. Similarly, Lema (2017) examined the determinants of the technical efficiency of commercial banks in Ethiopia over the period from 2011 to 2014. The DEA was employed to estimate the technical efficiency and Tobit model was used to examine the determinants of technical efficiency. The study found that liquidity risk, return on asset and market share have positive and significant effect on the technical efficiency.

Batir et al., (2017) used Tobit regression analysis to determine the factors influencing the efficiency of conventional and participation banks in Turkey over the period of 2005–2013.The study found that expenses and loan quality have a significantly negative relationship with efficiency of conventional banks. Also, the findings indicated that GDP growth and inflation have negative association with the efficiency of both types of banks.

The above review of research indicated that only one study examined the determinants of Libyan banks efficiency and that the variables: the liquidity ratio, loans, annual inflation rate and gross domestic product growth, have not been yet studied. Moreover, the effect of 2011 revolution on the efficiency of Libyan banks has not been investigated. This study therefore was conducted to provide new empirical evidence on the efficiency of the banking industry in Libya.

3. Data and Methodology

The data of Macroeconomic variables was collected from the reports and publications of the Central Bank of Libya. Regarding the bank variables were collected from the balance sheet and income statement of seven Libyan banks which are Jumhoria Bank, Wahda Bank, Sahara Bank, National Commercial Bank, Assaray Trade and Investment Bank, Commerce and Development Bank and Mediterranean bank. These banks have been listed in the Libyan financial market, and their data were collected online from website of the financial market. This study used an unbalanced panel for the period of 2005 to 2013. The unbalanced panel was used because the available data differs among the Libyan banks.

The study used the Data Envelopment Analysis (DEA) approach to estimate the technical efficiency as the dependent variable. The panel regression method was used to analyze the efficiency determinants of Libyan banks. In cases with a limited dependent variable (where the DEA index ranges between 0 and 1) the Tobit model is known to generate consistent estimates of regression coefficients (Grigorian and Manole 2006). Acommonly implemented model in previous studies is that the use of the Tobit model can handle the characteristics of the distribution of efficiency measures and thus provide results that can provide important policy guidelines to improve performance (Batir et al., 2017). The Tobit model was developed by Tobin (1958) and was employed to analyze the factors that influence banks efficiency in Libya. The Econometrics program E-views 7.1 software for analyzing the data and producing the regression results was used.

3.1 Estimation Model

The regression models can be written as follows:

$$TE = \alpha_0 + \beta_1 LITA + \beta_2 LOTA + \beta_3 INF + \beta_4 GDPGR + \beta_5 DLRE + \varepsilon$$

where:

TE: Technical Efficiency as the Dependent Variable

LITA: Liquid over Total Assets

LOTA: Loans over Total Assets

INF: Annual Inflation Rate

GDPGR: Gross Domestic Product Growth Rate

DLRE: A Dummy Variable, 2011 Libyan Revolution Events

α is intercept, β is regression coefficient and, ε is an error term.

3.2 Efficiency Measure

In the banking literature, parametric and non-parametric approaches for the estimation of bank efficiency can be used, and the main method frequently used in estimating bank efficiency is the non-parametric approach, Data Envelopment Analysis (Tahir et al., 2009). The DEA approach was used to estimate technical efficiency for Libyan banks during the period from 2005 to 2013 for each bank. Following Tahir et al., (2011), the study used two inputs (total deposits, overhead expenses) and two outputs (total earning assets, total loans) to estimate the technical efficiency for Libyan banks.

The efficiency of each bank is computed as follows:

$$\mathbf{TE} = \sum_{j=1}^{n} \mathbf{U}j \ \mathbf{Y}jk \ / \sum_{i=1}^{m} \mathbf{V}i \ \mathbf{X}ik$$

where:

Y_{jk} is the amount of the *j*th output produced by the *k*th bank, X_{ik} is the amount of the *i*th input used by the *k*th bank, U_j is the output weight, V_i is the input weight.

X_{ik} , $Y_{jk} \geq 0$, $i = 1,\ldots, m$, $j = 1,\ldots, n$, $k = 1, \ldots, s$

U_j , $V_i \geq 0$, $i = 1,\ldots, m$, $j = 1,\ldots,n$

$$\sum_{j=1}^{n} \mathbf{U}j \ \mathbf{Y}jk \ / \sum_{i=1}^{m} \mathbf{V}i \ \mathbf{X}ik \leq 1$$

3.3 Bank Efficiency Variables

Bank-specific and macroeconomic variables are Factors can influence on the efficiency of banks. Accordingly, panel regression model examine the relationship between Libyan banks efficiency and the potential determinant variables.

Table 1: Description of Variables

Dependent Variable		***TE***	The technical efficiency equals the total bank outputs divided by total bank inputs by using the DEA method.
Independent Variables	Bank-specific variables	***LITA***	The liquidity ratio is cash and short term fund placements with banks and financial institutions divided by total assets.
		LOTA	The ratio of total loans over total assets.
	Macroeconomic Variables	***INF***	The annual inflation rate is the annual change in the consumer price indicators.
		GDPGR	Gross domestic product growth is the real growth of the gross domestic product.
	Dummy Variable	***DLRE***	A dummy variable is included to examine the effect of the 2011 Libyan revolution events on the efficiency of Libyan banks, "1" for the period of the events and "0" for other periods.

4. Results and Discussion

Table 2 shows the descriptive statistics of the variables used in the regression analyses.

Table 2: Descriptive statistics of variables

Var.	Mean	Median	Std. Dev.	Skewness	Kurtosis	Obs
TE	0.9564	1.0000	0.0790	-1.6174	4.1611	38
LITA	0.3396	0.2799	0.1461	0.9775	2.7834	38
LOTA	0.2839	0.2258	0.1512	1.0229	3.7448	38
INF	0.0393	0.0260	0.0200	0.2609	1.1833	38
GDPGR	0.0391	0.0500	0.0559	-0.6355	4.3965	38

The results of table 2 indicate that, on average, the mean value of technical efficiency (TE) is 95.6% over the entire period. There is also a difference between the mean and median of TE which shows that there is a difference in efficiency among the banks. The skewness and kurtosis are commonly employed to determine the distribution of the data. According to Gujarati (2003) the variables follow a normal distribution when the value of skewness equals zero or very close to zero, and the value of kurtosis equals 3 or very close to three. The values of skewness and kurtosis for the variables included in the table indicate that the data are normal distribution.

Table 3 presents the Variance Inflation Factor (VIF) between the independent variables in the model to test the multi-collinearity problem. The VIF measures the impact of collinearity among the variables in a regression model (Gujarati, 2003).

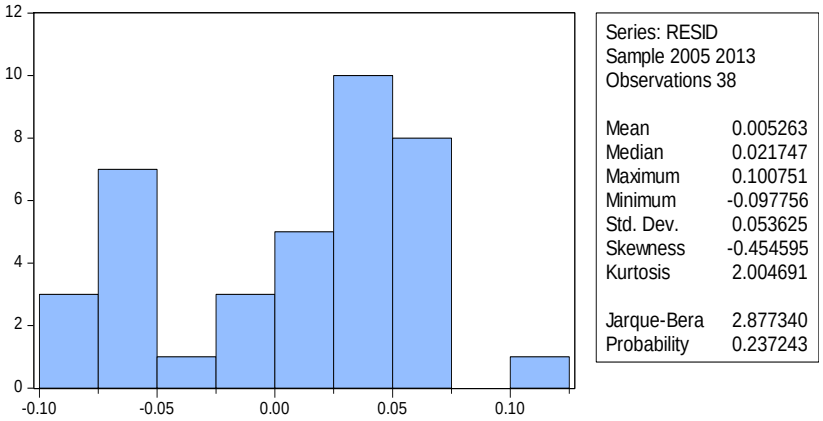
Table 3: The Variance Inflation Factor (VIF)

Variables	***Centered VIF***
LITA	1.59775
LOTA	1.25759
INF	1.13978
GDPGR	1.18523
DLRE	1.61785

The values of VIF for the variables included in the model are between (1.13 and 1.61). This indicates that the model does not suffer from any multicollinearity problems because all VIF values are less than 10 (Gujarati, 2003).

The violation of the normality assumption in limited dependent variable models may be quite severe (Gujarati, 2003). Also, Greene (2003) points out that the non-normality of the residual is important violation that can face the usage of the Tobit regression. Thus, the Jarque–Bera (JB) test of normality was used to test the normality of the residual of model.

Figure 1: explains the probability distribution of the residuals and the results of the Jarque–Bera test



The application of the Jarque–Bera test shows that the JB statistics is 2.877 and the probability of obtaining such a statistic under the normality assumption is 0.237. Therefore, the residuals are normally distributed.

The heteroscedasticity is an important violation that can face the usage of the Tobit regression (Brooks, 2008) and (Greene, 2003). Table 4 displays the results of the White heteroscedasticity test, that, Prob. F-statistic (0.164) and Prob. chi2 (0.202)**.** This indicates that the model does not suffer from heteroscedasticity problem.

Table 4: The White heteroscedasticity test

F-statistic	Prob. F-statistic	Chi-Sq- Statistic	Prob>chi2
1.592889	0.1643	23.82821	0.2028

Table 5 presents the Tobit regression result. The relative value of the estimated log likelihood value confirms the model's ability to the explain efficiency.

Table 5: Tobit regression results

Independent Variables	**Coefficient**	**Prob.**
C	0.97431***	0.0000
LITA	-0.28334***	0.0009
LOTA	0.15548**	0.0267
INF	0.489431	0.3419
GDPGR	-0.060647	0.6724
DLRE	0.13195***	0.0001
R^2	0.338884	
Log likelihood	50.89133	
No. of obs	38	

*, ** and *** indicate the significance levels of 10, 5, 1 percent, respectively.

The liquidity to total assets (LITA) has a negative and significant impact on Libyan banks efficiency. This result indicates that, banks with more liquidity have lower efficiency, where such banks lead to low funds available for lending; thereby, causing low efficiency. This result means that liquidity is a significant factor that contributes towards the efficiency of Libyan banks.

Loans to total assets (LOTA) have a positive and significant effect on banks efficiency. The result suggests that the high efficiency of banks is consistent with high loans. In banking literature, Sufian and Habibullah (2010) and Garza-Garcia (2012) have found that banks with higher loans are relatively better to exhibit higher efficiency levels.

For the impact of inflation rate (INF) the result reveals that INF has an insignificant impact on banks efficiency. The result of this study is supported by the studies of Sufian and Habibullah (2010), Sufian et al., (2012) and Noor and Ahmad (2012).

The macroeconomic variable gross domestic product growth rate (GDPGR) has a negative and statistically insignificant impact on banks efficiency. However, this is against expectation, but this finding remains consistent with study of Sufian and Habibullah (2010). The negative and an insignificant impact of the GDPGR in banks efficiency does not provide support to the argument of the association between economic growth and banking sector efficiency.

Libyan revolution events as a dummy variable (DLRE) have a positive and significant impact on banks efficiency. This result means that the efficiency of Libyan banks is affected positively by the crisis followed the Libyan revolution. This finding is acceptable because the Libyan banking sector witnessed a recovery during the years 2012-2013.

Conclusion:

This paper investigated the impact of macroeconomic variables, Bank-specific *factors* and to examine the effect of 2011 Libyan revolution on Libyan banks efficiency. In order to achieve that, the panel data regression estimation was employed with unbalanced data on seven Libyan commercial banks. The study used the Data Envelopment Analysis approach to estimate the technical efficiency. In addition, Tobit multiple regression was used to analyze the factors that influence banks efficiency. The study findings indicate that, liquidity is a significant factor that contributes towards the efficiency of Libyan banks. The study also reveals that, loans have a positive and significant effect on banks efficiency. Meanwhile, the gross domestic product growth rate and inflation rate are not able to explain the variability of Libyan banks efficiency. Other findings of the study reveal that, the efficiency of Libyan banks is affected positively by the Libyan revolution events. The results of the study suggest that, policy makers in Libyan banks should focus more on bank specifics to increase the efficiency of Libyan banks, while they should formulate appropriate policies to enable the Libyan banks to benefit from economic growth.

Abstract

This study was conducted to identify the impact of Macroeconomic variables (gross domestic product, inflation), Bank-specific *factors* and the crisis followed Libyan revolution in 2011 on Libyan banks efficiency. Panel regression analysis was employed with unbalanced data on seven Libyan commercial banks which are listed in the Libyan financial market using data from the period of 2005 to 2013. This study used the Data Envelopment Analysis approach to estimate the technical efficiency as the dependent variable. In addition, Tobit multiple regression which allows limited dependent variables was used to analyze the factors that influence banks efficiency. The results indicate that a significant part of the efficiency of Libyan banks can be attributed to the bank specifies *factors* (liquid over total assets, loans over total assets). Meanwhile, the study reveals that macroeconomic variable does not have a significant impact on the efficiency of Libyan banks. The results also suggest that the efficiency of Libyan banks is positively affected by the crisis followed the Libyan revolution.

Keywords: Banks Efficiency, Data Envelopment Analysis, Panel Regression Analysis, Libya.

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