Determinants of Banking Performance of Licensed Specialised Banks in Sri Lanka: A Time Series Analysis

H. E. K. Fernando*,, T. M. J. A. Cooray****

* Mathematics Unit, Sri Lanka Institute of Information Technology, Sri Lanka
** 2Department of Mathematics, University of Moratuwa, Sri Lanka

DOI: 10.29322/IJSRP.9.12.2019.p9668
http://dx.doi.org/10.29322/IJSRP.9.12.2019.p9668

Abstract- Financial sector plays a vital role for the economic development of a country. Stability of banks is vital for a profitable and healthy financial system of the country since they provide funds for investment by controlling funds from savings to productive uses for money. Licensed Specialised banks (LSB) operating in Sri Lanka are mainly engaged in lending for national development projects and lending in regional level but legalized to limited engagements in foreign exchange. The present study was carried out to model the determinants that mostly affect the banking performance of LSBs operating in Sri Lanka. Secondary financial data was collected from Central Bank of Sri Lanka and Time Series data was analyzed using Eviews software. Banking performance was measured through the variables, Return of Assets (ROA) and Return of Equity (ROE) modelled via fitting relevant Time Series models. The results show that ROA and ROE can be significantly modelled with Loan Quality, Efficiency and Capital Adequacy ratio. It was found that performance of LSBs in Sri Lanka depends on the factors Loan Quality, Efficiency, Capital Adequacy ratio and Loan Quality.

Index Terms- Banking Performance, Licensed Specialized Banks, Time Series,

I. Introduction

A time series is a collection of observations over a specific time period. Time series analysis should account for the internal structure (such as autocorrelation, trend or seasonal variation) of the data obtained and should use the structure to forecast future values of the series [1].Some important characteristics to consider when first looking at a time series are data trends, seasonality, outliers, long run cycles and constant variance [2]. According to these characteristics, one can try fitting time series regressions such as Autoregressive moving average (ARMA) models, Autoregressive integrated moving average (ARIMA) models, Vector autoregression (VAR) models, Autoregressive conditional heteroskedasticity (ARCH) models… etc [2].

The banking sector of Sri Lanka consists of Licensed Commercial Banks (LCBs) and Licensed Specialised Banks (LSBs) [3]. As the end of 2014, it was found that 58% of total assets of financial system is accounted by the banking sector of Sri Lanka [4]. Banks play a critical role within the Sri Lankan financial system, as they are engaged in provision of liquidity to the entire economy, while transforming the risk characteristics of assets [3]. Banks facilitate all parties to carry out their financial businesses [5]. But banks can create weakness in financial system through mismatches in maturity of assets and liabilities and their interconnectedness [4]. Thus, the soundness of banks is highly important since any failure will affect the economy of Sri Lanka [6].

The main difference between Licensed Commercial Banks (LCBs) and Licensed Specialised Banks (LSBs) is that LCBs are legalized to accept demand deposits from the public (i.e. operate current accounts for customers) and they are authorized dealers in foreign exchange which enables them to engage in a wide-range of foreign exchange transactions, whereas LSBs are legalized to limited engagements in foreign exchange with Central Bank's approvals [7]. However LSBs are permitted to accept savings and time deposits on which interest is paid by the bank [7]. At present, there are 7 LSBs operating in Sri Lanka [3]. Some of them are national level banks while the rest are regional level banks. Banks which operate at national level engage in long term lending for development projects while banks which operate at regional level mainly engage in short term lending [7].

Banking performance is usually measured through a combination of financial ratios like Return of Assets (ROA) and Return of equity (ROE) since investment opportunities are mostly visible through financial analysis measuring various aspects of the performance [8].

Studies that have been carried out on banking performance in various countries have shown that Capital Ratio [9], size [9] and Liquidity [9] have positive impact and Activity Mix [9] and Overhead Expense Management [9] and Interest Rate [10] have negative impact on banking performance.

Results from a study on factors affecting performance of commercial banks in Uganda yielded Capital

Adequacy, Credit Risk/Loan Quality and Management Inefficiency are having a significantly negative impact on ROE while Interest Income are having a significantly positive impact on ROE [11].

Banking performance measured through ROA is negatively affected by Liquidity [10][12],Operating Cost [10], Capital Adequacy Ratio (CAR) [11][12], Credit Risk/Loan Quality [11], Management Inefficiency [11], whereas ROA is positively affected by Size [10][13], Interest Income [11], Annual Inflation Rate [11].

Capital Adequacy Ratio [8][11][14][15][16][17][18], Operating Efficiency [14], GDP [14][19], Asset Quality [15], Liquidity [20], Management Efficiency [15][21], Cost Income Ratio [19][22], Size [16][17][19], Interest rate risk (Net Interest Income/ Total Asset) [23], Liquidity risk (Total Deposit/Total Asset) [23], Capitalization risk (Equity/Total Asset) [23], Credit Risk [11][18][23], Diversification [23][21], National Income [23], Loan Loss Provision to Total Assets [24] and Inflation rate [24] have significant impact on ROE.

Further, previous studies suggests that Capital Adequacy Ratio [8][11][12][15][18], IETTL (Interest Expense over Total Loans) [8], NIM (Net Interest Margin) [8], Asset Quality [15], Management Efficiency [11][15][21], Inflation [11][15][25], NPL(non-performing loans) [19], Size [10][18][19], Liquidity [20], Ownership [19], Credit Risk [11][18][23], Diversification [21][23], GDP [18], National Income [23], Loan Loss Provision to Total Assets [24], Total Overhead Cost to Total Assets [24] also substantially affect ROA.

In accordance to the literature, the study was carried out to determine the factors affecting banking performance of Licensed Specialised Banks after the end of civil war in Sri Lanka. Time series analysis was done considering many independent variables while taking ROA and ROE as independent variables measuring the banking performance. Many time series models were tried and the models which didn't satisfy the assumptions of the specific model were rejected without reporting. Models satisfying the assumptions are compared to choose the best fit and significant factors affecting banking performance of LSBs in Sri Lanka are identified from those models.

II. Methodology

Financial data of Licensed Specialized banks was collected from the library of Central bank of Sri Lanka for the period of 2008 to 2017 quarterly. The initial literature review suggested that the performance of LSBs are measured through Return of Assets (ROA) and Return on Equity (ROE) and many factors affect the performance of a bank.

By a thorough literature survey, the following independent variables were identified. Capital Adequacy Ratio (CAR), Current & Savings deposits to total deposits (CASA), Cost Inefficiency (CI), Efficiency Ratio (EFF), Liquidity (LIQ), Loan Market Competition (LMC), Loan Quality (LQ), Market Profit Opportunity (MP), Net Interest Margin (NIM), Non-performing Advances Ratio (NPL), Provisions Coverage Ratio (PCR), Credit Risk (RISK), Total Assets (TA), Total Loans and Advances to Total Assets (TLTA).

Values for all considered variables were calculated using standard formulas. The data were analysed using EViews (version 10) software for the above variables taking ROA and ROE as dependent variables.

Initially the Granger causality test [26] was used to determine whether one time series is useful in forecasting another. Granger Causality test checks the following hypothesis.

H_0: *The variable x does not Granger Cause the variable y* Versus

H_a: *The variable x Granger Cause the variable y*

The variables which does not Granger Cause ROA and ROE were removed from further analysis.

Then for the selected variables, unit root test was done to check whether the variables are stationary at level, 1st difference and 2nd difference. Also, the correlogram was checked. Unit root test checks the following hypothesis.

H_0: *The series is not stationary*
Versus H_a: *The series is stationary*

Different time series regression models were fitted and residual analysis for each model was done. From all the significant models, a comparison was done to find the best fitted model for the data.

The fitted models had general formats as follows.

1. $ROA_t = \mu_0 + \mu_1\, ROA_{t-1} + \mu_2\, ROA_{t-2} + \sum_{i=1}^{n} \alpha_i x_{it} + \sum_{i=1}^{m} \beta_i x_{it-1} + \sum_{i=1}^{l} \gamma_i x_{it-2} + \varepsilon$
2. $lgROA_t = \mu_0 + \mu_1\, lgROA_{t-1} + \mu_2\, lgROA_{t-2} + \sum_{i=1}^{n} \alpha_i x_{it} + \sum_{i=1}^{m} \beta_i x_{it-1} + \sum_{i=1}^{l} \gamma_i x_{it-2} + \varepsilon$
3. $ROE_t = \mu_0 + \mu_1\, ROE_{t-1} + \mu_2\, ROE_{t-2} + \sum_{i=1}^{n} \alpha_i x_{it} + \sum_{i=1}^{m} \beta_i x_{it-1} + \sum_{i=1}^{l} \gamma_i x_{it-2} + \sum_{i=1}^{l} a_i x_{it-3} + \sum_{i=1}^{l} b_i x_{it-4} + \varepsilon$

4. $lgROE_t = \mu_0 + \mu_1\, lgROE_{t-1} + \mu_2\, lgROE_{t-2} + \sum_{i=1}^{n} \alpha_i x_{it} + \sum_{i=1}^{m} \beta_i x_{it-1} + \sum_{i=1}^{l} \gamma_i x_{it-2} + \sum_{i=1}^{l} a_i x_{it-3} + \sum_{i=1}^{l} b_i x_{it-4} + \varepsilon$

Where,

ROA - Return of Assets

ROE - Return of Equity

lgROA - logarithmic of ROA

lgROE - logarithmic of ROE

x_i – independent variables including Loan Quality (LQ), Efficiency (EFF) and Capital Adequacy Ratio (CAR).

ε – error term

$t = 2008\,Q1, 2008\,Q2, \ldots, 2016\,Q4$

$\mu_i, \alpha_i, \beta_i, \gamma_i, a_i, b_i$- coefficients of various independent variables.

The objective of this study was to find the determinants affecting banking performance of Licensed Specialised Banks in Sri Lanka. Based on the objective, the above models were tried using EViews software to conclude the following research hypotheses.

H_0: *There is no significant impact of independent variable to performance of Licensed Specialised Banks in Sri lanka* Versus

H_a: *There is a significant impact of independent variable to performance of Licensed Specialised Banks in Sri Lanka*

A time series regression assumes the residuals are normally distributed with zero mean, constant variance and independent. Residual analysis was done to determine whether the fitted models satisfy the assumptions for residuals. Hypotheses used in residual analysis are given in table 1.

Models with residuals normally distributed and mean around zero with low skewness, low AIC, SIC values, kurtosis around 2 were selected as best models for ROA and ROE measuring banking performance of Licensed Specialised Banks of Sri Lanka.

Table 1: Hypothesis used in residual analysis.

Residual Analysis	**Hypothesis used**
Randomness of residuals - Correlogram	H_0: *Residuals are random* Versus H_1: *Residuals are not random.*
Normality of residuals	H_0: *Residuals are normally distributed* Versus H_1: *Residuals are not normally distributed.*
Constant variance of residuals - White Test for Heteroskedasticity	H_0: *Residuals are not heteroskedastic (Constant variance of residuals)* Versus H_1: *Residuals are heteroskedastic*
Residuals are serially correlated - Breusch-Godfrey Serial Correlation LM Test	H_0: *Residuals are not serially correlated* Versus H_1: *Residuals are serially correlated*

III. Results and Discussion

Using pairwise Granger Causality test shown below, it was found that LQ, EFF and CAR Granger Cause ROA and ROE. LQ Granger Cause ROE at lag 1.

Table 2: Table of probabilities resulted by Granger Causality Test.

	Does not Granger Cause				
	ROA	**ROE**	**LQ**	**CAR**	**EFF**
ROA		0.325	0.004	0.018	0.870
ROE	0.684		0.004	0.021	0.702
LQ	0.006	0.123		0.134	0.967
CAR	0.002	0.017	0.437		0.58
EFF	0.024	0.009	0.083	0.631	

As per results from Granger Causality Test, LQ, EFF and CAR variables were chosen as independent variables of the study as the variables Granger Cause ROA and ROE. Using unit root test, the stationarity of all variables was checked at level, 1st difference and 2nd difference and the results obtained were summarized as follows.

Table 3: Table of stationarity of the variables.

Variable	Level	1st difference	2nd difference
ROA	Non-stationary	Non-stationary	Stationary
ROE	Non-stationary	Stationary	Stationary

CAR	Non-stationary	Stationary	Stationary
LQ	Stationary	Stationary	Non-stationary
EFF	Non-stationary	Stationary	Stationary

These results facilitate to decide which the variables to include in the model based on the assumption of the model.

Model for ROA

Many models were fitted and the assumptions on residuals were checked. Only the models satisfying the assumptions were shown in this section.

Model A_1 : $lgROA_t = \alpha_0 + \alpha_1\, lgROA_{t-1} + \alpha_2 LQ_t + \alpha_3 EFF_t + \alpha_4 EFF_{t-2} + \alpha_5 CAR_{t-2}$

Model A_2 : $lgROA_t = \gamma_0 + \gamma_1\, lgROA_{t-1} + \gamma_2\, lgROA_{t-2} + \gamma_3 CAR_{t-2} + \gamma_4 LQ_{t-2}$

Here lgROA is the logarithmic of ROA. Since the kurtosis values for ROA is high, logarithmic of ROA was used. Above models were fitted and the following results were obtained.

Table 4: Results obtained for Model A_1 and Model A_2.

Model A_1 Variable	Model A_1 Coefficient	Model A_2 Variable	Model A_2 Coefficient
Constant	-1.771** (0.396)	Constant	-1.071** (0.347)
LQ	29.983** (8.743)	LGROA (t-1)	0.671** (0.141)
EFF	-0.741* (0.270)	LGROA (t-2)	-0.313* (0.132)
EFF (t-2)	1.017** (0.262)	LQ (t-2)	28.17* (10.337)
CAR (t-2)	0.063** (0.02)	CAR (t-2)	0.054* (0.02)
LGROA (t-1)	0.357** (0.107)		

Standard errors are reported in parentheses. *, ** indicates significance at 95% and 99% level of significance.

Model A_1: The model is significant since probabilities are less than 0.05 level of significance.There is a significant effect of LQ_t, EFF_t, EFF_{t-2},CAR_{t-2} and $lgROA_{t-1}$ to $lgROA_t$on banking performance of Licensed Specialised Banks in Sri Lanka.

Model A_2: Since probabilities are less than 0.05 level of significance, there is a significant impact of LQ_{t-2}, CAR_{t-2}, $lgROA_{t-2}$ and $lgROA_{t-1}$ to $lgROA_t$ of Licensed Specialised Banks in Sri Lanka. Therefore, the model is significant.

Table 5: Table of comparison of model A_1 and model A_2.

	Model A_1	**Model A_2**
Akaike Info Criterion (AIC)	-0.202476	-0.112213
Schwarz criterion (SBC)	0.066881	0.112251
R-squared	80.5%	77.3%
Durbin Watson statistic	1.726698	1.627818
Standard Error of regression (SE)	0.201983	0.213830

Summary of the fitted models A_1 and A_2 were given in Table 4 and 5. From table 5 it can be concluded that model A_1 is better than model A_2, since AIC, SBC, SE of regression are lower in model A_1 than model A_2 and R-squared is higher than model A_2. Therefore, model A1 was chosen as the best model relating ROA, LQ, EFF and CAR. Residual analysis was done to check whether the assumptions on residuals hold for model A_2.

Residuals	**Statistics**
Mean	-4.33×10^{-16}
Median	0.012443
Maximum	0.409625
Minimum	-0.410260
Standard Deviation	0.186054
Skewness	-0.281643
Kurtosis	2.957744
Jarque-Bera	0.452024
Probability	0.797709

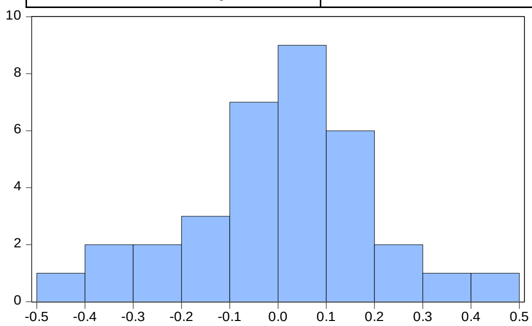

Figure 1: Results obtained for normality of residuals for model A_1.

The normality of residuals was checked and since probability is greater than 0.05 level of significance, residuals are normally distributed. Kurtosis is around 3 and skewness is a small value implying that this is good model.

The correlogram was checked to see if the residuals are random.

Q-statistic probabilities adjusted for 1 dynamic regressor

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob*</th></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>1</td><td>0.114</td><td>0.114</td><td>0.4815</td><td>0.488</td></tr>
<tr><td>**| . |</td><td>**| . |</td><td>2</td><td>-0.271</td><td>-0.287</td><td>3.2860</td><td>0.193</td></tr>
<tr><td>**| . |</td><td>.*| . |</td><td>3</td><td>-0.212</td><td>-0.154</td><td>5.0661</td><td>0.167</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>4</td><td>0.052</td><td>0.022</td><td>5.1745</td><td>0.270</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>5</td><td>0.197</td><td>0.104</td><td>6.8188</td><td>0.234</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>6</td><td>0.058</td><td>0.015</td><td>6.9653</td><td>0.324</td></tr>
<tr><td>**| . |</td><td>.*| . |</td><td>7</td><td>-0.207</td><td>-0.148</td><td>8.9096</td><td>0.259</td></tr>
<tr><td>***| . |</td><td>**| . |</td><td>8</td><td>-0.386</td><td>-0.336</td><td>15.924</td><td>0.043</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>9</td><td>0.113</td><td>0.122</td><td>16.549</td><td>0.056</td></tr>
<tr><td>. |*. |</td><td>.*| . |</td><td>10</td><td>0.129</td><td>-0.146</td><td>17.394</td><td>0.066</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>11</td><td>0.029</td><td>-0.024</td><td>17.438</td><td>0.096</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>12</td><td>-0.037</td><td>0.052</td><td>17.515</td><td>0.131</td></tr>
<tr><td>. |*. |</td><td>. |** |</td><td>13</td><td>0.110</td><td>0.240</td><td>18.226</td><td>0.149</td></tr>
<tr><td>. | . |</td><td>.*| . |</td><td>14</td><td>-0.002</td><td>-0.096</td><td>18.226</td><td>0.197</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>15</td><td>0.011</td><td>-0.011</td><td>18.234</td><td>0.251</td></tr>
<tr><td>.*| . |</td><td>**| . |</td><td>16</td><td>-0.093</td><td>-0.235</td><td>18.822</td><td>0.278</td></tr>
</table>

Figure 2: Figure of correlogram obtained for residuals for model A_1.

From figure 2, the residuals are random since all probability values are higher than 0.05 significance level. Thus, the assumption of random residuals holds for the model.

Table 6: Results obtained for testing serial correlation and heteroskedasticity for model A_1.

Breusch-Godfrey Serial Correlation LM Test		**Heteroskedasticity Test: White**	
Probability (F statistic)	0.2455	Probability (F statistic)	0.3826
Probability (Chi-Square)	0.1753	Probability (Chi-Square)	0.3418

From table 6, it is evident that the residuals are not serially correlated since probability values for Serial Correlation LM test are higher than 0.05 significance level. Also since probability values obtained for White Heteroskedasticity Test are greater than 0.05 level of significance, it is apparent that the variance of residuals is a constant.

Residuals analysis indicate that residuals are random, normally distributed around mean zero and constant variance and residuals are not correlated. Since all assumptions for residuals hold for model A_1, it was concluded that model A_1 is a good model for ROA. And the fitted model was as follows.

$$lgROA_t = -1.770528 + 0.357015\, lgROA_{t-1} + 29.98268\, LQ_t - 0.740957\, EFF_t + 1.016939\, EFF_{t-2} + 0.062897\, CAR_{t-2}$$

Model for ROE

Many models were fitted and the assumptions on residuals were checked. Only models satisfying the assumptions are reported.

Model E_1: $ROE_t = \beta_0 + \beta_1 ROE_{t-1} + +\beta_5 ROE_{t-2} + \beta_2 EFF_{t-1} + \beta_3 EFF_{t-2} + \beta_4 EFF_{t-3} + \beta_5 CAR_{t-2} + \beta_6 CAR_{t-3}$

Model E_2: $lgROE_t = \gamma_0 + \gamma_1\, lgROE_{t-1} + \alpha_2 LQ_t + \gamma_3 CAR_t + \gamma_4 CAR_{t-2}$

Here lgROE is the logarithmic of ROE. Since the kurtosis values for ROE is high, logarithm of ROE was used. Above models were fitted and the following results were obtained.

Table 7: Results obtained for Model A_1 and Model A_2.

Model E_1		Model E_2	
Variable	**Coefficient**	**Variable**	**Coefficient**
Constant	3.526 (6.717)	Constant	0.811 (0.431)
ROE (t-1)	1.030** (0.133)	LGROE (t-1)	0.708** (0.101)
ROE (t-2)	-0.379** (0.121)	LQ	28.557* (10.005)
EFF (t-1)	-29.380** (7.008)	CAR	-0.0759** (0.021)
EFF (t-2)	52.655** (10.034)	CAR (t-2)	0.064** (0.021)
EFF (t-3)	-23.72** (6.879)		
CAR (t-2)	1.837** (0.359)		
CAR (t-3)	-1.669** (0.388)		

Standard errors are reported in parentheses. *, ** indicates significance at 95% and 99% level of significance.

Since probabilities are less than 0.05 level of significance except for the constant for the results obtained for Model E_1. There is a significant impact of EFF_{t-1}, EFF_{t-2},EFF_{t-4}, CAR_{t-2}, CAR_{t-4} and ROE_{t-1} to ROE_t to the performance of LSBs in Sri Lanka. Therefore, the model is significant. From the results obtained for Model E_2 since probabilities are less than 0.05 level of significance except for the constant, the models is significant and it can be concluded that there is a significant impact of LQ_t, CAR_t, CAR_{t-2} and $lgROE_{t-1}$ to $lgROE_t$ to performance measured by ROE of Licensed Specialised Banks in Sri Lanka.

Table 8: Table of comparison of model E_1 and model E_2.

	Model E_1	Model E_2
Akaike Info Criterion (AIC)	5.402572	0.005392
Schwarz criterion (SBC)	5.765362	0.229857
R-squared	82.8%	71.3%
Durbin Watson statistic	1.927372	2.081558
Standard Error of regression (SE)	3.250273	0.226781

Summary of the fitted models E_1 and E_2 were given in Table 8. From table 5 it can be concluded that model E_2 is better than model E_1, since AIC, SBC SE of regression are lower in model E_2 than model E_1 although R-squared is higher than model E_1. Therefore, model E_2 was chosen as the best model relating ROE, LQ and CAR.

Residual analysis was done to check whether the assumptions on residuals hold for model E_2.

Residuals	Statistics
Mean	-4.38×10^{-16}
Median	-0.040790
Maximum	0.443060
Minimum	-0.452691
Standard Deviation	0.212593
Skewness	0.478455
Kurtosis	2.944416
Jarque-Bera	1.301584
Probability	0.521632

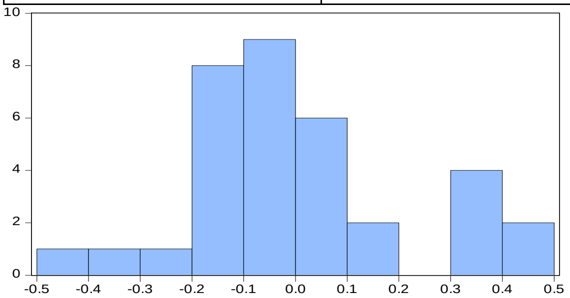

Figure 3: Results obtained for normality of residuals for model E_2.

The normality of residuals was checked and since probability is greater than 0.05 level of significance according to figure 8, it is evident that residuals are normally distributed. Acquiring a value is close to 3 for kurtosis and small value for skewness imply that this is good model. The correlogram was checked to see if the residuals are random.

.

Q-statistic probabilities adjusted for 1 dynamic regressor

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob*</th></tr>
<tr><td>. | . |</td><td>. | . |</td><td>1</td><td>-0.053</td><td>-0.053</td><td>0.1031</td><td>0.748</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>2</td><td>-0.034</td><td>-0.037</td><td>0.1465</td><td>0.929</td></tr>
<tr><td>.*| . |</td><td>.*| . |</td><td>3</td><td>-0.130</td><td>-0.135</td><td>0.8170</td><td>0.845</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>4</td><td>0.102</td><td>0.087</td><td>1.2385</td><td>0.872</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>5</td><td>-0.012</td><td>-0.013</td><td>1.2447</td><td>0.941</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>6</td><td>-0.032</td><td>-0.044</td><td>1.2890</td><td>0.972</td></tr>
<tr><td>.*| . |</td><td>. | . |</td><td>7</td><td>-0.079</td><td>-0.061</td><td>1.5723</td><td>0.980</td></tr>
<tr><td>***| . |</td><td>***| . |</td><td>8</td><td>-0.361</td><td>-0.397</td><td>7.7168</td><td>0.462</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>9</td><td>0.135</td><td>0.094</td><td>8.6141</td><td>0.474</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>10</td><td>0.161</td><td>0.157</td><td>9.9298</td><td>0.447</td></tr>
<tr><td>.*| . |</td><td>.*| . |</td><td>11</td><td>-0.067</td><td>-0.165</td><td>10.169</td><td>0.515</td></tr>
<tr><td>**| . |</td><td>.*| . |</td><td>12</td><td>-0.234</td><td>-0.175</td><td>13.210</td><td>0.354</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>13</td><td>0.091</td><td>0.078</td><td>13.697</td><td>0.396</td></tr>
<tr><td>. | . |</td><td>.*| . |</td><td>14</td><td>-0.016</td><td>-0.129</td><td>13.713</td><td>0.471</td></tr>
<tr><td>. |*. |</td><td>. | . |</td><td>15</td><td>0.117</td><td>0.064</td><td>14.595</td><td>0.481</td></tr>
<tr><td>. | . |</td><td>.*| . |</td><td>16</td><td>-0.059</td><td>-0.148</td><td>14.831</td><td>0.537</td></tr>
</table>

Figure 4: Figure of correlogram obtained for residuals for model E_2.

Figure 4 confirms that residuals are random since all probability values are higher than 0.05 significance level.

Table 9: Results obtained for testing serial correlation and heteroskedasticity for model A_1.

Breusch-Godfrey Serial Correlation LM Test		**Heteroskedasticity Test: White**	
Probability (F statistic)	0.8849	Probability (F statistic)	0.9860
Probability (Chi-Square)	0.8579	Probability (Chi-Square)	0.9599

From table 9 it is apparent that the residuals are not serially correlated since probability values obtained for Breusch-Godfrey Serial Correlation LM Test are higher than 0.05 significance level. And since probability values obtained for White Heteroskedasticity Test are greater than 0.05 level of significance, it is evident that the variance of residuals is a constant.

Residuals analysis for model E_2 indicate that residuals are not correlated, random, normally distributed around mean zero and constant variance verifying that the assumptions of the model fitted holds.

Since all assumptions for residuals hold for model E_2, it was concluded that model E_2 is a good model for ROE. And the fitted model was as follows.

$$lgROE_t = 0.810728 + 0.708440\, lgROE_{t-1} + 28.55666\, LQ_t - 0.075897\, CAR_t + 0.064428\, CAR_{t-2}$$

IV. Conclusion

The following models were obtained for banking performance of Licensed Specialised Banks in Sri Lanka.

$$lgROA_t = -1.770528 + 0.357015\, lgROA_{t-1} + 29.98268\, LQ_t - 0.740957\, EFF_t + 1.016939\, EFF_{t-2} + 0.062897\, CAR_{t-2}$$

$$lgROE_t = 0.810728 + 0.708440\, lgROE_{t-1} + 28.55666\, LQ_t - 0.075897\, CAR_t + 0.064428\, CAR_{t-2}$$

It was evident that performance of Licensed Specialised Banks in Sri Lanka is significantly related to the factors Loan Quality, Efficiency and Capital Adequacy ratio. Also Loan Quality have highest impact on the performance of Licensed Specialised Banks in Sri Lanka.

For the study, financial data from 2008 quarter 1 to 2016 quarter 4 was used since Central Bank of Sri Lanka did not possess any data before that for Licensed Specialised Banks in Sri Lanka. More accurate models can be extracted for larger number of data points. Hence it was a limitation for the study.

After the war in Sri Lanka LSBs takes a main role in the rapid urbanization of country as a main supplier of housing market with rapid economic growth. Thus, it is suggested to apply time series analysis after some years to accurately model financial data of LSBs Sri Lanka to optimize banking performance.

References

[1] U. of Zurich, "Time Series Analysis - Basic Techniques." [Online]. Available: http://www.biosym.uzh.ch/modules/models/Modeling_Basics/Time_Series/timeseries.xhtml.

[2] The Pennsylvania State University, "Applied Time Series Analysis." [Online]. Available: https://newonlinecourses.science.psu.edu/stat510/lesson/1.

[3] Central bank of Sri Lanka, "Banking Sector." [Online]. Available: https://www.cbsl.gov.lk/en/financial-system/financial-system-stability/banking-sector.

[4] Central bank of Sri Lanka, "Annual Report 2015," 2016. [Online]. Available: https://www.cbsl.gov.lk/en/publications/economic-and-financial-reports/annual-reports/annual-report-2015.

[5] Central bank of Sri Lanka, "Financial Sector," 2017. [Online]. Available: https://www.cbsl.gov.lk/en/statistics/statistical-tables/financial-sector.

[6] Central bank of Sri Lanka, "Financial System Stability Review 2012," 2012. [Online]. Available: https://www.cbsl.gov.lk/sites/default/files/cbslweb_documents/publications/fssr/fssr_2015e.pdf.

[7] H. S. E. Silva, "Role of information technology in leveraging performance : a study in Sri Lankan banking sector," *Digital Library, University of moratuwa Sri Lanka*, 2007. [Online]. Available: http://dl.lib.mrt.ac.lk/handle/123/597.

[8] S. Jha and X. Hui, "A comparison of financial performance of commercial banks: A case study of Nepal," *African J. Bus. Manag.*, vol. 6, no. 25, pp. 7601–7611, 2012.

[9] S. Yamuna, "Determinants of Profitability in the Banking Sector : A study with special reference to Private Commercial Banks in Sri Lanka," in *Proceedings of the Third International Synposium*, 2013, vol. 6–7, no. 1, pp. 19–24.

[10] V. E. I. W. Weersainghe and T. R. Perera, "Determinents of Profitability of Commercial Banks in Sri Lanka," *Int. J. Arts Commer.*, vol. 2, no. 10, pp. 141–170, 2013.

[11] N. Frederick, "Factors Affecting Performance of Commercial Banks in Uganda -A Case for Domestic Commercial Banks," *Int. Rev. Bus. Res. Pap.*, vol. 11, no. 1, pp. 95–113, 2015.

[12] A. Cekrezi, "Factors affecting performance of commercial banks in Albania," in *The European Proceedings of Social & Behavioral Sciences*, 2015, pp. 4–13.

[13] Asma' Rashidah Idris, F. F. A. H. Asari, N. A. A. Taufik, N. J. Salim, R. Mustaff, and K. Jusof, "Determinant of Islamic Banking Institutions' Profitability in Malaysia," *World Appl. Sci. J.*, vol. 12, 2011.

[14] M. Mushtaq, N. U. Hassan, M. S. Yaqub, and

M. H. Awan, "Determinants of Commercial Banks Performance : Empirical Evidence from Pakistan," *J. Appl. Environ. Biol. Sci.*, vol. 4, pp. 15–21, 2014.

[15] O. V. Okoth and K. G. Berhanu, "Determinants of Financial Performance of Commercial Banks in Kenya," *Int. J. Econ. Financ. issues*, vol. 3, no. 1, pp. 237–252, 2013.

[16] I. Saba, R. Kibriya, and R. Kouser, "Antecedents of Financial Performance of Banking Sector: Panel Analysis of Islamic, Conventional and Mix Banks in Pakistan," *J. Account. Financ. Emerg. Econ.*, vol. 1, no. 1, pp. 9–30, 2015.

[17] H. Youssef, "Determinants of Egyptian Banking Sector Profitability: Time-Series Analysis from 2004-2014," *Int. J. Bus. Econ. Sci. Appl. Res.*, pp. 73–78, 2016.

[18] I. A. Gyamerah and B. Amoah, "Determinants of Bank Profitability in Ghana," *Int. J. Account. Financ. Report.*, vol. 5, no. 1, pp. 173–187, 2015.

[19] I. G. Ben Ameur and S. M. Mhiri, "Explanatory Factors of Bank Performance Evidence from Tunisia," *Int. J. Econ. Financ. Manag.*, vol. 2, no. 1, pp. 143–152, 2013.

[20] H. A. H. Al-Tamimi, "Factors influencing performance of the UAE Islamic and conventional national banks," *Glob. J. Bus. Res.*, vol. 4, 2010.

[21] N. Petria, B. Capraru, and I. Ihnatov, "Determinants of banks ' profitability : evidence from EU 27 banking systems," *Procedia Econ. Financ.*, vol. 20, no. 15, pp. 518–524, 2015.

[22] B. Căpraru and I. Ihnatov, "Banks' Profitability in Selected Central and Eastern European countries," in *21st International Economic Conference*, 2014, pp. 16–17.

[23] P. Lall, "Factors affecting U . S . Banking Performance : Evidence From the 2007-2013 Financial Crisis," *Int. J. Econ. Financ. Manag.*, vol. 3, no. 6, pp. 282–295, 2014.

[24] M. Abduh and A. Alias, "Factors Determine Islamic Banking Performance in Malaysia : A Multiple Regression Approach," *J. Islam. Bank. Financ.*, pp. 44–54, 2014.

[25] I. Setyawati, S. Suroso, T. Suryanto, and D. S. Nurjannah, "Does financial performance of Islamic banking is better? Panel data estimation," *Eur. Res. Stud. J.*, vol. 20, no. 2, pp. 592–606, 2017.

[26] I. G. N. Agung, *TIME SERIES DATA ANALYSIS USING EVIEWS*. John Wiley & Sons (Asia) Pte Ltd, Singapore, 2009.

Authors

First Author – H. E.K. Fernando, B.Sc. (Special)(Hons), PGDip, Sri Lanka Institute of Information Technology and fernandoeshani@gmail.com.

Second Author – T. M. J. A. Cooray, M.Phil, M.Sc, B.Sc , University of Moratuwa and cooray@uom.lk.

Correspondence Author – H.E.K. Fernando, fernandoeshani@gmail.com, eshani.f@sliit.lk, +94716538312.