THE IMPACT OF CAPITAL ADEQUACY RATIO ON BANKS' PROFITABILITY IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract

The safety and solvency of the banking institutions are related to the banks' capital. The banks' capital is regulated by international regulation and it is under the supervision of the central bank. Namely, Basel Accords determines the minimum of the capital adequacy ratios. The banks' capital adequacy ratio influences the working success of banking institutions and, at the same time, the kind of risks the banks can take over. This way, the capital adequacy ratio indirectly influences the banks' financial results. Hence, the main objective of the research in this paper is to analyze the impact of the capital adequacy ratio on the banks' profitability in North Macedonia. The empirical study is based on the utilization of the Auto-Regressive Distributed Lag (ARDL) method for time series analysis via EViews v10. The results of the study have shown that there is a positive, yet statistically insignificant relationship between the Capital Adequacy Ratio (CAR) and the Return on Average Assets (ROAA) of the Macedonian banks, both in the short- and long-run. However, the impact of Deposit-to-Asset Ratio (DAR) on ROAA is both positive and statistically significant both in the short- and long-run.

Keywords: *banks, Capital Adequacy Ratio (CAR), profitability, Return on Average Assets (ROAA), banking risks, North Macedonia*

***JEL classification**: G21*

1. Introduction

Banking institutions have a crucial role in the financial system of each national economy. The banking industry is one of the main constitutes of the financial sector. For permanent and continuous economic growth, the banking sector of any country must be both comprehensive and well-performing. The banking sector supports the economy's other sectors in several manners such as turning into a financing source, providing payments settlement facility and plays an important part in the trade of any product (Raza *et al*., 2019). Its main role is to absorb the liquid financial resources and allocate them in productive investment, which in turn accelerate the economic development of each economy. Thus, commercial banks play a crucial role in the economic resource allocation of countries by basically channeling funds from depositors to investors continuously (Ongore & Kusa, 2013).

The banking system in each country has an irreplaceable role in providing financial resources to the non-state sector to support economic development. Such a role of the banks is more meaningful in developing countries and transition economies where the banking system plays the dominant role in the financial system as the capital market is still in its initial step of development. Accordingly, the banks provide the businesses with the necessary financial resources for their investment projects and enable investors to invest their liquid financial resources into profitable projects. Consequently, banks accelerate the rate of economic growth in the economy. Because of the a.m., the improvement of the total banking system effectiveness is of big importance (Spaseska *et al*., 2017).

Regarding all this above, it is crucial to provide stability and safety of the banking system for each economy. Hence, the banking system's safety and stability mean an opportunity to accelerate the economic development of the country.

The safety and solvency of the banking institutions are related to the banks' capital. Therefore, the banks' capital is regulated by international regulation and it is under the supervision of the central bank. The capital adequacy ratio measures a bank's capital with respect to its risk-weighted assets, thus promoting financial stability and efficiency in economic systems throughout the world.

The capital adequacy ratio is calculated by adding Tier 1 capital to Tier 2 capital and dividing their sum by risk-weighted assets. Tier 1 capital is the core capital of a bank, which includes equity capital and disclosed reserves. This type of capital absorbs losses without requiring the bank to cease its operations; Tier 2 capital is used to absorb losses in case of liquidation.

As of 2020, under Basel III, a bank's Tier 1 and Tier 2 minimum capital adequacy ratio (including the capital conservation buffer) must be at least 10.5% of its risk-weighted assets (RWA) (BIS, 2019a). That combines the total capital requirement of 8% with the 2.5% capital conservation buffer. The capital conservation buffer recommendation is designed to build up banks' capital, which they could use in periods of stress (BIS, 2019b).

The banks' capital adequacy ratio influences the working success of the banking institutions and, at the same time, the kind of risks the banks can take over. In this way, the capital adequacy ratio indirectly influences the banks' financial results.

Increased bank's capital contributes to risk decreasing in the direction of amortization of the incomes that are not stable, with some restriction of the possibility for increase or failure in the work, and decreasing the dividend for the shareholders, due to the reason that the capital is more expensive than the debts. On the other hand, decreasing the banks' capital leads to increased banking risks, and also the possibility of failure. The banks that have higher capital are in a position to approve credits with lower interest rates, to lend money with lower interest rates, and to extend their working through opening their branches or completing business units in other towns and abroad. That means, the bigger the bank's capital, the greater the opportunities for riskier activities, but also for achieving higher banks' profit.

Regarding all these above, our study is aimed at investigating the relationship between the banks' profitability and capital adequacy ratio. The focus has been put on the investigation of one dependent variable, Return on Average Assets (ROAA) as a parameter resembling the banks' profitability, and how it depends on capital adequacy ratio as a proxy for capital adequacy of the banks and the banks' exposure on risks measured by Deposit-to-Asset Ratio (DAR), Non-Performing Loan Ratio (NPLs) and Loan-to-Deposit Ratio (LDR).

The rest of the paper is organized as follows. Section 2 deals with some previous work on the effect of the capital adequacy ratio on banks' profitability in different countries worldwide. Section 3 briefly introduces the reader to the capitalization ratio and profitability analysis of the Macedonian Banking System. Section 4 provides insights into the data, methodology, and results of the analysis, and explains the economic significance and messages of the obtained results. The last section concludes and recommends.

2. Related Research

It is widely recognized that capital can serve as a buffer to absorb unexpected losses, reducing the probability of insolvency and, therefore, the expected bankruptcy cost.

Higher capital is often supposed to be costly for banks, implying that higher capital reduces profitability, but according to the 'trade-off' theory, it may also reduce a bank's risk and hence the premium demanded to compensate investors for the costs of bankruptcy. (Osborne *et al*., 2012).

However, capital requirements imposed by regulators, if they are binding, force banks to hold capital above their private optimal and hence force banks above their internal optimal capital ratio to impose costs on banks.

Therefore, higher capital requirements imposed by regulatory reforms have an impact on banks' funding costs, with additional cost and income pressures through liquidity requirements (including larger holdings of low-yielding high-quality liquid assets, and less reliance on short-term wholesale funding) (KPMG, 2016). Consequently, according to Basel III, higher capital requirements impact banks' profitability.

In the short run, high profitability may drive higher capital ratios since profits are a source of capital (Osborne *et al*., 2012). In the long run, a more profitable bank may desire a smaller capital buffer since it knows that it will be able to draw on internal funds to fund expected investment opportunities or avoid regulatory censure (Milne & Whalley, 2001).

Hence, to analyze the impact of the capital adequacy ratio on the banks' profitability, extensive studies have been conducted about the relationship between banks' profitability and capitalization ratios.

Batten & Vo (2019) examined the determinants of bank profitability in Vietnam. The results of their study revealed that bank size, capital adequacy, risk, expense, and productivity have strong impacts on profitability. Another related study was done by Ajayi *et al*. (2019). They investigated the effect of the Capital Adequacy Ratio (CAR) on the Profitability of Deposit Money Banks (DMB's) and their results have shown that there exists a strong positive relationship between the CAR and ROA of Deposit Money Banks (DMBs). In a similar study, Abba *et al*. (2018) analyzed the bank-specific determinants of CAR in the Nigerian Deposit Money Banks (DMBs) using balanced panel data collected from financial statements of 12 selected quoted banks for the ten years 2005-2014. The results found out that ROA is the most important determinant of CAR and the Capital Adequacy Ratio of Nigerian deposit money banks is well above the regulatory minimum set by CBN as well as the requirements of the Basel Accord. In his study, Alshatti (2016) tried to investigate the crucial determinants of profitability in the case of Jordanian commercial banks. A balanced panel data for these banks (2005-2014) was used to achieve this purpose, and ROA and ROE were used as banks' profitability measurements. Findings indicated that there is a positive association between capital adequacy, capital and leverage, and banks' profitability, and a negative association between asset quality and banks' profitability. Besides, this study found that improving Jordanian banks' profitability needs well-capitalized banks accompanied by high capital adequacy. Similar results were obtained by the research of Al-Sabbagh (2004). He observed that the CAR had a high positive correlation (about +0.75) with Returns on Assets of Jordanian banks, which meant that as ROA increased, CAR also increased. Also, Al-Tamimi & Obeidat (2013) observed a strong direct, yet statistically significant relationship between ROA and capital adequacy in Jordanian commercial banks.

Aktas *et al*. (2015) investigate the impact of bank-dimensional and environmental factors on the banks' capital adequacy ratio (CAR) in the South-Eastern European (SEE) region and found out that ROA, leverage, liquidity, net interest margin, and risk have all statistically significant effects in determining CAR for the banks in the region. Agbeja *et al*. (2015) in their research explored the interactions between capital adequacy and the banks' profitability. Their findings indicated that capital adequacy has a significant positive effect on the bank's profitability. So, they suggest that banks with more equity capital are perceived to have more safety and such advantage can be translated into higher profitability. The higher the capital ratio, the more profitable a bank will be. Furthermore, Olalekan & Adeyinka (2013) analyzed the effect of capital adequacy on the profitability of deposit-taking banks. The results of their study for the primary data have shown that there is a non-significant relationship, but the secondary data analysis revealed a positive and significant relationship between capital adequacy and bank profitability. So, their finding indicates that the profitability of the bank is strongly determined by capital adequacy. On the other side, the study of Hoffmann (2011) has shown a negative link between the capital ratio and profitability, which supports the notion that banks are operating over-cautiously, ignoring potentially profitable trading opportunities. Similarly, Büyükşalvarcı & Abdioğlu (2011) examined the determinants of Turkish banks' Capital Adequacy Ratio and its effects on the financial positioning of banks using panel data methodology. Their findings indicate that there is a positive relationship between return on assets (ROA) and capital adequacy ratio (CAR).

As per the Republic of North Macedonia, there are limited studies focused on the relationship between both capital adequacy ratio and banks' exposure on risks measured by Deposit-to-Asset Ratio (DAR), Non-Performing Loan Ratios (NPLs), and Loan-to-Deposit Ratio (LDR) and banks' profitability, on the other hand. Notable among them is the study conducted by Ćurak *et al*. (2012). They analyzed the determinants of Macedonian banking sector profitability and the results of their research have shown that there are three groups of determinants (bank-specific, industry-specific, and macroeconomic factors) that influence the profitability of the banks. The study of Georgieva Svrtinov *et al*. (2019) revealed that capital ratio, the growth rate in loans, bank size, and bank liquidity, have an inverse or negative correlation with credit risk, which means that if these variables increase, the credit risk will decrease. In their research, Gockov & Hristovski (2019) found out that capital adequacy and GDP growth rate have no statistically significant effect on the liquidity of Macedonian commercial banks, which confirms the relatively high regulations as well as the conservative nature of Macedonian banks' behavior. Iloska (2014) attempted to identify the determinants that affect bank profitability, on a sample of Macedonian banks. Her empirical findings indicate that operating expenses and loan-loss provisions exhibit a negative relationship with bank profitability, while the staff expenses, bank size, and the share of loans in total assets positively affect the profitability. On the other side, Jolevski (2017) analyzed non-performing loans as a most important part of the loan portfolio with direct consequences on the financial and solvent position and stability of banks. With statistical methods, a significant impact of the non-performing loans on banks' performance indicators was empirically confirmed.

3. Capital Adequacy Ratio and Banks' Profitability: Evidence from North Macedonia

Capital is an important indicator of financial stability and bank safety. By showing how much risk a bank can take, it is an indicator of the banks' growth, maintenance, and existence in a competitive and fast-growing financial market. Banks that can guarantee the Capital Adequacy Ratio (CAR) have the power to resist financial crises, thus protecting the bank itself and the funds from depositors (Usman *et al*., 2019).

The main role of capital is to protect financial institutions from all kinds of unsecured and uninsured risks that may turn into losses (Gabriel, 2016). It has four different functions:

- It has a loss-absorbing function, allowing the bank to cover any losses using its own funds. It means that the assets can fully cover the liabilities as long as the aggregate losses do not exhaust the capital. Banks do not usually need equity to cover operating losses coming from their normal business activities. Indeed, the interest margins and other spreads they set are sufficient to cover their ordinary expenses. The most important risk for which the financial institutions need equity concerns the borrower default, making some assets partly or entirely irrecoverable;
- Secondly, capital has a confidence function, because it convinces the banks' creditors and the depositors that their deposits and assets are safe. The ability of banks to absorb losses indicates that they can use their assets to cover the liabilities, which builds and sustains their credibility;
- It has a financing function, meaning that it provides funds to finance fixed investments. This function is very important for startup financial institutions since the money brought by the equity holders is used for buying equipment, land, and buildings. Banks should always have permanent capital coverage for fixed assets, meaning that any additional investment in these assets should be compensated with a capital raise;
- Finally, equity has a restrictive function, which puts some limits on various banking transactions or types of assets. It prevents banks from taking a too large number of chances. In this restrictive function context, capital is a good base for limitations on credit exposure and foreign exchange positions that are not well secured (Svitek, 2001, 40).

The banks' capital structure has been of special importance for the institutions that regulate the banking sector in all countries for decades. The basic task of these institutions is to protect deponents' and creditors' resources and to provide a stable and safe banking system. Although in a larger part, some elements, such as liquidity and interest sensibility, are more important for the banking system stability, the capital adequacy ratio, after all, is the biggest challenge for the regulatory institutions, because it shows how high risks one bank can take and is an indicator for the growth, maintenance and the banks' existence in the competitive and fast-growing financial market.

Capital adequacy refers to the amount of equity capital and other securities that a bank holds as reserves against risky assets as a hedge against the probability of bank failure. Capital adequacy is used to determine whether a bank has enough capital to support the risk on its balance sheet i.e. it is used to mitigate bank solvency problem(Agbeja *et al.*, 2015, 91).

One of the most important measures of the capital strength of a bank is the capital adequacy ratio, which is the amount of a bank's regulatory capital, expressed as a percentage of its risk-weighted assets. A bank with a high capital adequacy ratio is considered to be above the minimum requirements needed to suggest solvency. Therefore, the higher a bank's CAR, the more likely it is to be able to withstand a financial downturn or other unforeseen losses.

Prudential guidelines on capital adequacy set out three main elements that determine a bank's capital adequacy. These are credit risk associated with exposures, market risk arising from banking activities, and the form and quality of capital held to support these exposures (Aruwa & Naburgi, 2014).

Currently, the minimum ratio of capital to risk-weighted assets is 10.5% under Basel III. Minimum capital adequacy ratios are critical in ensuring that banks have enough cushions to absorb a reasonable amount of losses before they become insolvent and consequently lose depositors' funds (Beers, 2019).

The following graph (Figure 1) depicts the capital adequacy of banking institutions in the Republic of North Macedonia (2009:Q1 – 2020:Q3), measured by the Capital Adequacy Ratio (CAR).

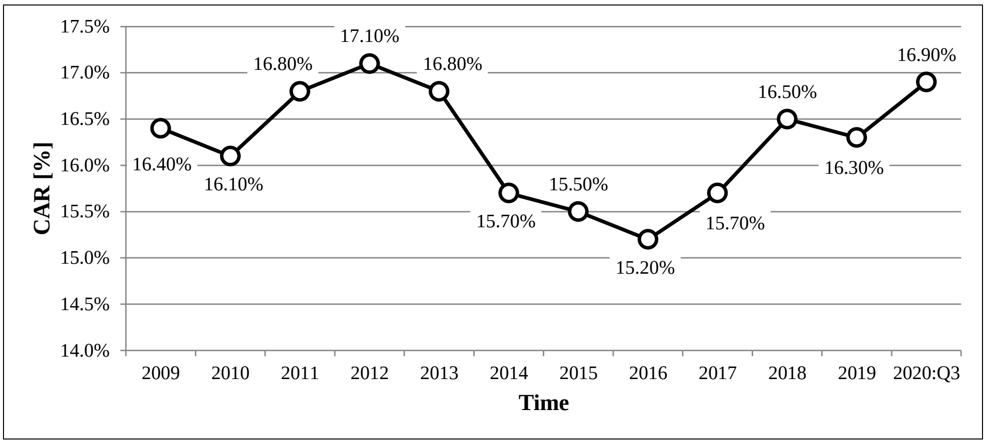


Figure 1. Capital Adequacy Ratio (CAR), 2009:Q1 – 2020:Q3
(Source: National Bank of the Republic of North Macedonia)

Based on the results shown in the previous graph, a positive trend can be spotted. So, it can be concluded that both the solvency and the capital adequacy ratio of the banking institutions are at a stable and satisfactory level and they are higher than the projected minimum according to Basel III.

The solvency of the banking system, expressed through the capital adequacy ratio up to 2016 is in a slow decreasing, but at the end of 2016, it is still high (it equals 15.2%, versus 15.5%, as of December 31, 2015), and allows enough room to absorb the possible unexpected losses for banks. The amendments to the Banking Law, adopted in October 2016, which started to apply from March 2017, mean significant modernization of the regulatory framework, by introducing the new rules of the Basel Committee and the European regulations on the so-called capital buffers, whose fulfillment will further strengthen the solvency of banks. The amendments to the capital adequacy regulations from December 2016, which increased the significance, but also strengthened the quality of the most important component of the own funds - the Tier 1 capital, are also in this direction (NBRNM, 2017).

The indicators of solvency and capitalization of the banking system increased in 2017, 2018, and 2019, which is mainly due to the faster growth of the capital items. The higher growth of banks' funds relative to risk exposure led to improved solvency and thus improved capacity to handle unexpected losses. The growth of own funds is due to the retained profit, ordinary share emission, and emissions of new subordinated instruments, while the growth of risk-weighted assets was mostly concentrated in assets weighted by credit risk. Most of the growth of own funds was used to meet the capital buffers and meet the capital requirements for credit risk coverage, but part of this growth remains free, above the minimum regulatory and supervisory requirements.

One of the most important challenges the banks faced back in 2017, was compliance with the capital requirements established by the Basel III International Framework (both in terms of the new structure of the own assets, and in terms of the requirement to maintain a specific amount of capital buffers) which started with implementation in March 2017. However, the relatively high amount and quality of banks' assets, allowed a solid capacity for being compliant with the new capital requirements. More specifically, starting from March 2017, the banks are required to calculate and maintain a minimum level of capital adequacy ratio of 8%, but also the level of core capital (6%)

and the level of the regular core capital (4.5%). Besides, all banks are required to maintain a capital buffer for the protection of the capital, in the amount of 2.5% of the risk-weighted assets.

Even in 2020, the year of the global COVID-19 pandemic, the solvency and capitalization ratios of the Macedonian banking system featured growth. Thus, in the second quarter of 2020, the banking system successfully sustains a high capitalization and stable solvency position. All solvency and capitalization ratios of the banking system noted enhancement, which mostly resulted in the growth of capital positions. The reinvestment of the gains in banks' funds and the newly issued shares contributed mostly to the annual growth of the banks' funds. Banks use most of the quarterly increase in their funds to raise the excess capital above the minimum level necessary to cover the risks, whose share in their own funds increased to 10.4% (compared to 7.4% in the first quarter of 2020). The result of the stress-test simulations shows further strengthening of the banking system resilience, as compared to the end of the previous quarter (NBRNM, 2020a, 60).

According to Podder (2012), the profitability of a bank is the efficiency of a bank at generating earnings. Among the large set of performance measures for banks used by academics and practitioners alike, the profitability of banks is generally measured by return on assets (ROA), return on equity (ROE), or cost-to-income ratio. Besides, given the importance of the intermediation function for banks, the Net Interest Margin (NIM) is typically monitored (ECB, 2010).

In our study, we used Return on Average Assets (ROAA) as a measure of banks' profitability, because ROAA incorporates the broadest aspect of the banking business as it mirrors the ability of bank management to generate profits from the available bank asset. Moreover, it is considered to be a core performance indicator used in the majority of empirical studies. This ratio is calculated as net profit after tax divided by the total assets. The ROAA figure gives investors an idea of how effectively the bank is converting the money it has to invest in net income. The higher the ROAA number, the better, because the company is earning more money on less investment.

The following graph (Figure 2) shows the profitability of banking institutions in the Republic of North Macedonia, measured by Return of Average Assets (ROAA). According to the National Bank of the Republic of North Macedonia, the profitability of the banking sector has had a trend of continuous improvement during the last 10 years.

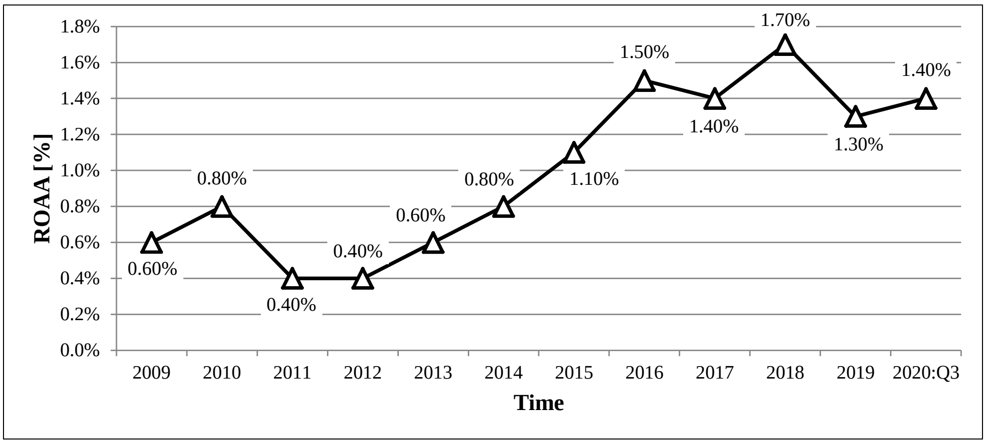


Figure 2. Return of Average Assets (ROAA), 2009:Q1 – 2020:Q3
(Source: National Bank of the Republic of North Macedonia)

It can be concluded that up to 2015, the value of ROA was under 1%, and from 2016 up to nowadays, the value is greater than 1%. Actually, "in 2016, against a background of historically low interest rates and in conditions of slower economic growth and domestic political instability, banks registered a positive financial result and realized solid rates of return on average assets and average equity and reserves. According to NBRNM the improvement of profitability and strengthening of the operational efficiency in banks is most significant, in conditions of higher growth of net interest income relative to the growth of operating costs, primarily costs for employees. However, banks face a challenge in terms of the further maintenance of the level of profitability, in conditions of less room for 'managing' profitability due to historically very low interest rates and the intention to gradually abandon the application of adjustable interest rates, which in the medium run will impose a need for changes in their participation in the credit and deposit market and the area of risk management" (NBRNM, 2017).

During 2018, the most successful year, Macedonian banks registered high profits from their operations, which significantly improved the indicators used for monitoring the profitability and efficiency of the banking sector. The rates of return on average assets and average capital and reserves equaled 1.7% and 16%, respectively, which are at the 2007 level when the banking sector was in a high-growth stage. Such movements are mainly a result of the one-off factors in the first quarter of the year (a larger amount of non-performing claims from one larger non-financial company was collected by several banks and capital gains were realized from the sale of equity stake. These are irregular events that contributed to the profitability increase of the banking sector), with the regular bank activities also contributing mainly through the segments that generate non-interest income. The net interest income decreased moderately on annual basis, thus contributing negatively to the annual growth of the banking sector's profit for the first time since 2010. Namely, in conditions of a stable domestic environment and revival of the economic activity, banks increased their volume of activities, but this was not enough to support the growth of interest income, which is in the zone of annual decline for the second consecutive year. An additional factor in the increase of the profitability of the banking sector was the improved operational efficiency, amid mitigated decrease of operating costs, as well as growth in net commission income. The high increase in banks' profitability was achieved through prudent risk management, which contributed to improving banks' risk profiles (NBRNM, 2018, 77).

In 2019, the Macedonian banking system continued to be profitable, but with lower financial results as compared to 2018. The reduced financial result mainly reflects the exhaustion of effects by one-off factors which caused high-profit growth in the first half of 2018. Consequently, the profitability and efficiency indicators on monitoring the banking sector decreased, but still maintain at an appropriate level. Net interest income, as the driving component of total banks' income, continued to decrease moderately, given the low-interest rates, and higher deposit growth, compared to banks' lending activity. Thus, the challenge remains for banks to generate positive growth rates of net interest income or expand their sources of income through diversification of banking activities, but also to reduce operating costs, and consequently, to ensure sustainable profitability of the banking sector in a medium and long term (NBRNM, 2020b, 90–91).

Such positive financial results of the Macedonian banking sector continued in 2020, even though it was an extremely difficult year imposed by the global pandemic, which affected all society segments. Namely, according to data of listed companies on the Macedonian Stock Exchange, three banks are in the top 5 companies with the highest financial results. It means that in terms of global pandemic and health crisis, the banking sector in Macedonia is the most profitable one.

4. Research Methodology

4.1 Objectives and Main Research Hypothesis of the Study

The primary objective of the study is to find out the relationship between the Capital Adequacy Ratio (CAR) and banks' profitability in North Macedonia, expressed by the Return on Average Assets (ROAA). In that context and having minded the findings elaborated worldwide, the main research hypothesis can be specified as "Capital adequacy has a positive, yet significant impact on banks' profitability".

4.2 Data

To reach the goals of the research, the study is restricted to investigate the dependency of a single dependent variable from four independent variables, as follows:

- *Dependent variable*
  - Return on Average Assets (*ROAA*), as a proxy of banks' profitability [%];
- *Independent variables*
  - Capital Adequacy Ratio (*CAR*), as a measure of the capital adequacy [%];
  - Deposit-to-Asset Ratio (*DAR*), as a measure of banks' liquidity;
  - Non-Performing Loans Ratio (*NPLs*), as a measure credit risk [%];
  - Loan-to-Deposit Ratio (*LDR*), as a measure of liquidity risk exposure.

All the data used in this research have been exploited from secondary sources only, i.e. the data for the dependent and all the independent variables can be found in the annual financial stability reports (NBRNM, 2020c) and banking system indicators and reports issued online by the National Bank of the Republic of North Macedonia (NBRNM, 2020d). The data used is in the form of quarterly time series, covering the period from 2005:Q1 to 2019:Q4 (15 years × 4 quarters/year = 60 observations).

4.3 Methodology

The order of integration of each of the individual variables has been determined using two tests, the Augmented Dickey-Fuller Test (ADF Test) (Dickey & Fuller, 1979) and the Phillips-Perron Test (PP Test) (Phillips & Perron, 1988).

The analysis of the independent variables' impact on the dependent variable is being carried out by building and evaluating a corresponding ARDL (Auto-Regressive Distributed Lag) model. Regression models such as this have long been used to examine relationships between time series variables. However, they gained renewed interest in recent years as a method for examining cointegrating (i.e. long-term) relationships between I(0) and I(1) variables, based on the work of Pesaran & Shin (1998) and Pesaran *et al*. (2001).

In its basic form, the general ARDL(p, q_1, q_2, q_3, q_4) regression model, regarding its five-variable representation, comprised of a dependent variable, Y_t, and four regressors, $X_{k,t}$, $k = 1, \ldots, 4$, looks like this:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{p} \lambda_i \cdot \Delta Y_{t-i} + \\ + \sum_{j=0}^{q_1} \delta_{1j} \cdot \Delta X_{1,t-j} + \sum_{j=0}^{q_2} \delta_{2j} \cdot \Delta X_{2,t-j} + \sum_{j=0}^{q_3} \delta_{3j} \cdot \Delta X_{3,t-j} + \sum_{j=0}^{q_4} \delta_{4j} \cdot \Delta X_{4,t-j} + \\ + \varphi_1 \cdot Y_{t-1} + \varphi_2 \cdot X_{1,t-1} + \varphi_3 \cdot X_{2,t-1} + \varphi_4 \cdot X_{3,t-1} + \varphi_5 \cdot X_{4,t-1} + \varepsilon_t \quad (1)$$

where:

Y_t is the dependent variable;

$X_{k,t}$, $k = 1, \ldots, 4$; are the independent variables;

Δ is the first-differencing operator;

$p \geq 1$ is the optimal number of lags for the dependent variable;

$q_k \geq 0$, $k = 1, \ldots, 4$; are the optimal number of lags for the independent variables;

Y_{t-i}, $i = 1, 2, \ldots, p$; are the lagged values of the dependent variable;

$X_{k,t-j}$, $j = 0, 1, 2, \ldots, q_k$; $k = 1, \ldots, 4$; are the lagged values of the independent variables;

β_0 is a constant (intercept);

λ_i, $i = 1, 2, \ldots, p$; are the short-run coefficients of the dependent variable;

δ_{kj}, $j = 0, 1, 2, \ldots, q_k$; $k = 1, \ldots, 4$; are the short-run coefficients of the independent variables;

φ_1 is the long-run coefficient of the dependent variable;

φ_p, $p = 2, \ldots, 5$; are the long-run coefficients of the independent variables;

ε_t is the disturbance (white noise) term.

Equation (1) clearly shows that the ARDL model uses a combination of the endogenous and exogenous variables, i.e. the expression on the right side of the equation (1) contains the lagged value(s) of the dependent variable, as well as both the current (for $j = 0$) and lagged (for $j > 0$) values of the independent variables. The model is called 'autoregressive' in the sense that Y_t is explained (in part) by lagged values of itself, up to the lag p. It also has a 'distributed lag' component, in the form of successive lags of the explanatory variables $X_{k,t}$, up to the lag q_k, $k = 1, \ldots, 4$.

Equation (1) assumes that there is cointegration (i.e. long-run relationship) among the variables, so it includes two components on its right side, given by expressions (2) and (3):

$$\sum_{i=1}^{p} \lambda_i \cdot \Delta Y_{t-i} + \sum_{j=0}^{q_k} \delta_{kj} \cdot \Delta X_{k,t-j}\ , k = 1, \ldots, 4 \quad (2)$$

$$\varphi_1 \cdot Y_{t-1} + \varphi_2 \cdot X_{1,t-1} + \varphi_3 \cdot X_{2,t-1} + \varphi_4 \cdot X_{3,t-1} + \varphi_5 \cdot X_{4,t-1} \quad (3)$$

Expression (2) refers to the traditional ARDL short-run terms, whilst expression (3) consists of the long-run (i.e. cointegrating) terms.

These two components allow one to make inferences on a short-run and a long-run, as well as to examine Granger causality. If the usual error correction term (ECT) is substituted for the long-run terms given by expression (3), what is obtained is the traditional error correction model (ECM). The ARDL Bound Test approach may be viewed as a form of an unrestricted error correction model because all the long-run terms are specified and not restricted.

As in this particular case, an ARDL model can be specified when some of the variables are of an order of integration I(0), i.e. stationary at level, and some of them are of an order of integration I(1), i.e. those variables become stationary after being first-differenced.

Having minded equation (1), the existence of cointegration among variables is being determined using the F-statistics of the ARDL Bounds Test, which tests the following null hypothesis:

$$H_0: \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = 0,$$

i.e. there is no cointegration between the variables Y_t and X_t;

The two possible outcomes of the ARDL Bounds Test are the following ones:

- If F-statistics is significant, H_0 is being rejected in favor of the alternative hypothesis, meaning that cointegration exists, so the analysis should encompass both the specification of a Vector Error Correction Model (VECM) to examine the long-run dynamics and the ARDL short-run specification, to examine short-run causality;

- If F-statistics is not significant, H_0 is not being rejected, meaning that there is no cointegration among the variables; the analysis should encompass only the ARDL short-run specification, to examine short-run causality;

- In the end, model diagnostics have been performed, to check the fulfillment of the basic assumptions for the ARDL approach:
    - Data must be free from autocorrelation;
    - Data must be free from heteroskedasticity;
    - Data must be normally distributed;
    - The model should be stable.

All the analyses have been carried out using the econometric package EViews v10.

5. Results and Discussion

The result of the ADF and PP tests are given in Table 1 (ADF Test) and Table 2 (PP Test). Both tests agree upon the order of integration of the observed variables: all of them, except CAR, are of the order of integration I(1), i.e. they are not stationary at level, but they all become stationary after being first-differenced. Notwithstanding, the variable CAR is stationary at level, i.e. its order of integration is I(0). The mixture of variables of different orders of integration (I(0) and I(1), but not I(2) or higher), is a key premise for building an ARDL model.

Table 1. Results of the ADF Test
(Source: EViews v10 output, authors' calculations)

		Variable				
		ROAA	*CAR*	*DAR*	*NPLs*	*LDR*
At level	t-Statistics	–1.646088	–3.744069	–1.220608	–1.524062	–2.620072
	Crit. value (1%)	–3.555023	–3.555023	–3.548208	–3.550396	–3.555023
	Crit. value (5%)	–2.915522	–2.915522	–2.912631	–2.913549	–2.915522
	Crit. value (10%)	–2.595565	–2.595565	–2.594027	–2.594521	–2.595565
First difference	t-Statistics	–4.287649		–10.73208	–3.904811	–7.212087
	Crit. value (1%)	–3.555023		–3.548208	–3.550396	–3.548208
	Crit. value (5%)	–2.915522		–2.912631	–2.913549	–2.912631
	Crit. value (10%)	–2.595565		–2.594027	–2.594521	–2.594027
	Order of integration	I(1)*	I(0)*	I(1)*	I(1)*	I(1)*

* = The Null hypothesis that the time series has a unit root has been rejected at α = 1% level of significance

** = The Null hypothesis that the time series has a unit root has been rejected at α = 5% level of significance

*** = The Null hypothesis that the time series has a unit root has been rejected at α = 10% level of significance

Table 2. Results of the PP Test
(Source: EViews v10 output, authors' calculations)

		Variable				
		ROAA	*CAR*	*DAR*	*NPLs*	*LDR*
At level	t-Statistics	–2.301142	–4.360505	–1.860299	–1.858089	–2.351831
	Crit. value (1%)	–3.546099	–3.546099	–3.546099	–3.546099	–3.546099
	Crit. value (5%)	–2.911730	–2.911730	–2.911730	–2.911730	–2.911730
	Crit. value (10%)	–2.593551	–2.593551	–2.593551	–2.593551	–2.593551
First difference	t-Statistics	–10.90056		–10.69105	–7.002054	–7.252867
	Crit. value (1%)	–3.548208		–3.548208	–3.548208	–3.548208
	Crit. value (5%)	–2.912631		–2.912631	–2.912631	–2.912631
	Crit. value (10%)	–2.594027		–2.594027	–2.594027	–2.594027
	Order of integration	I(1)*	I(0)*	I(1)*	I(1)*	I(1)*

* = The Null hypothesis that the time series has a unit root has been rejected at α = 1% level of significance

** = The Null hypothesis that the time series has a unit root has been rejected at α = 5% level of significance

*** = The Null hypothesis that the time series has a unit root has been rejected at α = 10% level of significance

According to all VAR lag order selection criteria (LR, FPE, AIC, SC, and HQ), the optimal lag length is determined to be 1. The ARDL model that corresponds to a minimal value of AIC (Akaike Information Criterion) is ARDL(1, 0, 0, 1, 0), as portrayed in Figure 3.

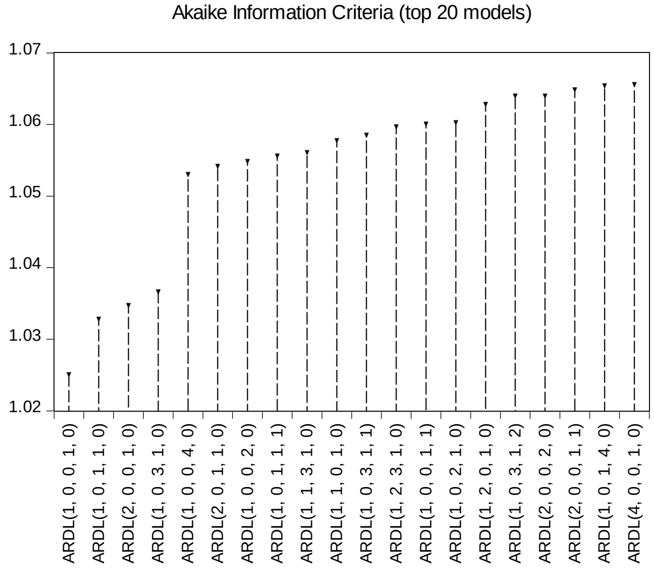


Figure 3. Top 20 model selection summary
(Source: EViews v10 output, authors' calculations)

The definition of the ARDL (1, 0, 0, 1, 0) model is given in Table 3.

Table 3. The details of the ARDL (1, 0, 0, 1, 0) specification
(Source: EViews v10 output, authors' calculations)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
ROAA(−1)	0.422529	0.117315	3.601664	0.0007
CAR	0.005109	0.068295	0.074805	0.9407
DAR	16.79230	7.164365	2.343865	0.0229
NPLs	−0.191742	0.078494	−2.442770	0.0180
NPLs(−1)	0.178566	0.075640	2.360737	0.0220
LDR	−2.696660	1.628518	−1.655898	0.1038
C	−9.034431	6.588293	−1.371286	0.1762

Given that $p = q_3 = 1$, and $q_1 = q_2 = q_4 = 0$ in Equation (1), the ARDL(1, 0, 0, 1, 0) can be represented as the equation (4).

$$ROAA_t = \beta_0 + \lambda_1 \cdot ROAA_{t-1} + \\ + \delta_{10} \cdot CAR_t + \delta_{20} \cdot DAR_t + \delta_{30} \cdot NPL_t + \delta_{31} \cdot NPL_{t-1} + \delta_{40} \cdot LDR_t \quad (4)$$

Given the coefficients in Table 3, Equation (4) can further be re-written as Equation (5):

$$ROAA = -9.03443094833 + 0.422528637554*ROAA(-1) + \\ 0.00510883272241*CAR + 16.7923006441*DAR - \\ 0.19174193645*NPLs + 0.178566202214*NPLs(-1) - \\ 2.69665952391*LDR \quad (5)$$

Based on the findings in Table 3, in the short-run:

- The first lag of *ROAA* has a positive (+0.422529), yet statistically significant (p-Value = 0.0007 ≤ 5%) impact on its current value;
- Also, the first lag of *NPLs* has a positive (+0.178566), yet statistically significant (p-Value = 0.0220 ≤ 5%) impact on the current value of *ROAA*; However, the current value of *NPLs* has a negative (–0.191742), yet statistically significant (p-Value = 0.0180 ≤ 5%) impact on the current value of *ROAA*; Besides, the result of the Wald Test on C(4) = C(5) = 0 shows that *NPLs* at level and its first lag can jointly influence the current value of *ROAA* (χ^2 = 6.067852, df = 2; p-Value = 0.0481 ≤ 5%), because there is a short-run Granger causality running from these two regressors to the target variable;
- The influence of *CAR* on the current value of *ROAA* is positive (+0.005109), but statistically insignificant (p-Value = 0.9407 > 5%);
- *DAR* has both a positive (+16.79230) and statistically significant (p-Value = 0.0229 ≤ 5%) impact on the current value of *ROAA*;
- Finally, *LDR* has a negative (–2.696660), but statistically insignificant (p-Value = 0.1038 > 5%) impact on *ROAA* at a 5% level of significance, which might be also considered barely statistically significant at a 10% level of significance.

Further on, the ARDL(1, 0, 0, 1, 0) model resume is given in Table 4.

Table 4. The ARDL (1, 0, 0, 1, 0) model resume
(Source: EViews v10 output, authors' calculations)

R-squared	0.763974	Mean dependent var	1.124270
Adjusted R-squared	0.736741	S.D. dependent var	0.735425
S.E. of regression	0.377338	Akaike info criterion	0.999642
Sum squared resid	7.403956	Schwarz criterion	1.246130
Log likelihood	–22.48945	Hannan-Quinn criter.	1.095861
F-statistic	28.05251	Durbin-Watson stat	2.179396
Prob(F-statistic)	0.000000		

It suggests that:

- R-squared value equals 0.763974; Given that the R-squared statistic measures the success of the regression in predicting the values of the dependent variable within the sample, in this case, the regressors (*CAR*, *DAR*, *NPLs*, and *LDR*) explain up to 76.40% of the variation of the target variable, *ROAA*;

- Adjusted R-squared value equals 0.736741; As a measure of goodness of fit of the model vis-à-vis the observed time series, such relatively high value (73.67%) points out the fact that the model includes regressors that highly contribute to the explanatory power of the model, which is a good-fitting one;

- The value of F-statistic is 28.05251, which is statistically significant, since Prob(F-statistic) = 0.000000 ≤ 5%); So, the null hypothesis, stating that all of the regression coefficients are zero, can be rejected in favor of the alternative one, i.e. not all regression coefficients are zero;

- The Durbin-Watson statistic is 2.179396 ≈ 2.00; Since this value is near to the value of 2.0, having minded the fact that the model is based on 50+ observations (59 exactly, after adjustments) and includes only a few independent variables (namely, 4 variables), it can be concluded that the model is free from a first-order serial correlation!

The output of the ARDL Bounds Test indicates that the null hypothesis H_0, stating that there is no cointegration among the observed variables, should be rejected in favor of the alternative one, since the value of F-statistic (5.311432) is higher than all values of the I(1) bound, at all levels of significance, as depicted by Table 5. There is a long-run relationship among the variables *ROAA*, *CAR*, *DAR*, *NPLs*, and *LDR*.

Table 5. Results of the Bounds Test
(Source: EViews v10 output, authors' calculations)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.311432	10%	2.45	3.52
k	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

The coefficient of the cointegrating equation (–0.577471) is both negative and statistically significant (p-Value = 0.0000 ≤ 5%). It means that there is a long-run Granger causality running from all the regressors to *ROAA*. The speed of the adjustment from a short-run towards long-run equilibrium is 57.75%, i.e. the system corrects its previous period of disequilibrium at a speed of 57.75% within one period of time (a quarter).

The Cointegrating Equation is given by Equation (6):

$$D(ROAA) = -9.034430948320 - 0.577471362446*ROAA(-1) + \quad (6)$$

$$0.005108832722*CAR^{**} + 16.792300644085*DAR^{**} - 0.013175734236*NPLs(-1) - 0.191741936450*D(NPLs) - 2.696659523905*LDR^{**} - 0.577471*(ROAA - (0.00884690*CAR(-1) + 29.07901887*DAR(-1) - 0.02281626*NPLs(-1) - 4.66977187*LDR(-1))$$

In Equation (6), variables *CAR***, *DAR***, and *NPL*** are interpreted as $Z = Z(-1) + D(Z)$, i.e. $CAR = CAR(-1) + D(CAR)$, $DAR = DAR(-1) + D(DAR)$, and $LDR = LDR(-1) + D(LDR)$.

The long-run coefficients are given in Table 6. Based on the findings in Table 6, in the long-run:

- Two of the regressors (*CAR* and *DAR*) have a positive impact on *ROAA*; the impact of *CAR* is not statistically significant (p-Value = 0.9405 > 5%); however, the impact of *DAR* is statistically significant (p-Value = 0.0106 ≤ 5%);
- Two of the regressors (*NPLs* and *LDR*) have a negative impact on *ROAA*; the impact of *NPLs* is statistically insignificant (p-Value = 0.6768 > 5%); however, the impact of *LDR* is statistically insignificant at 5% level of significance (p-Value = 0.0932 > 5%), but it is statistically significant at 10% level of significance (p-Value = 0.0932 ≤ 10%);

Table 6. The long-run coefficients and the Error Correction Term (ECT) (Source: EViews v10 output, authors' calculations)

Levels Equation Case 3: Unrestricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CAR	0.008847	0.117981	0.074986	0.9405
DAR	29.07902	10.96334	2.652388	0.0106
NPLs	–0.022816	0.054429	–0.419192	0.6768
LDR	–4.669772	2.730272	–1.710369	0.0932
EC = ROAA – (0.0088*CAR + 29.0790*DAR –0.0228*NPLs –4.6698*LDR)				

- The increase of *CAR* by 1% yields an increase of *ROAA* by 0.008847%, having minded the *ceteris paribus* principle;
- The increase of *DAR* by 1 yields an increase of *ROAA* by 29.07902%, having minded the ceteris paribus principle;
- The increase of *NPLs* by 1% is expected to decrease *ROAA* by 0.022816%, having minded the ceteris paribus principle;
- The increase of *LDR* by 1 is expected to decrease *ROAA* by 4.669772%, having minded the ceteris paribus principle;

The autocorrelation and partial autocorrelation functions of the residuals, together with the Ljung-Box Q-statistics for high-order serial correlation show that the autocorrelations and partial autocorrelations at up to four lags are nearly zero, and all Q-statistic values are insignificant with large p-Values, larger than 5%, which means that there is no serial correlation in the residuals (Table 5).

Table 7. Residual diagnostics: Correlogram and Q-statistics (Source: EViews v10 output, authors' calculations)

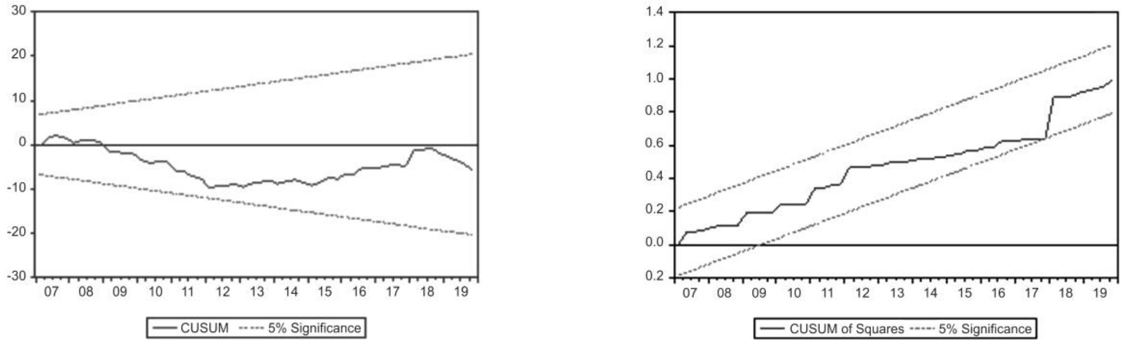
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.114	-0.114	0.8088	0.368
		2	0.053	0.040	0.9833	0.612
		3	-0.174	-0.166	2.9235	0.404
		4	0.251	0.222	7.0340	0.134

*Probabilities may not be valid for this equation specification.

The Breusch-Godfrey Lagrange multiplier test for general, high-order, ARMA errors, proves that the residuals, obtained from the ARDL model, are free from serial correlation up to order 4 (Obs*R-squared = 6.611329; Prob. Chi-Square(4) = 0.1579 > 5%). The null hypothesis H_0, stating that there is no serial correlation in the residuals up to the specified order (4), cannot be rejected at a 5% level of significance. In other words, there is no serial correlation in the residuals up to the specified order (4). The result from the Breusch-Pagan-Godfrey test proves that the residuals obtained from the ARDL model are free from heteroskedasticity (Obs*R-squared = 3.863910; Prob. Chi-Square(6) = 0.6951 > 5%). The null hypothesis H_0, stating that there is no heteroskedasticity in the specified model, cannot be rejected at a 5% level of significance.

The Ramsey RESET Test of the model correctness tests the null hypothesis claiming that the disturbance vector ε follows the multivariate normal distribution $N(0; \sigma^2 I)$. Since the p-Value of the obtained F-statistic is 0.9192 > 5%, it can be concluded that H_0 cannot be rejected at a 5% level of significance. So, the functional form of the ARDL model is appropriate and correct (i.e. the ARDL model is well specified): there are no omitted variables (the set of regressors includes all relevant variables), the variables are correctly specified, and there is no correlation between regressors and disturbance vector ε, which may be caused, among other things, by measurement error in regressors, simultaneity, or the presence of lagged values of the dependent variable and serially correlated disturbances.

The plot of CUSUM and CUSUM of Squares Tests remains between the 5% critical bound (Figure 4), which proves the stability of the parameters (i.e. coefficients) of the ARDL model. The ARDL(1, 0, 0, 1, 0) model is structurally stable.



(a) CUSUM (b) CUSUM of Squares

Figure 4. Plots of the CUSUM and CUSUM of Squares Tests (Source: EViews v10 output, authors' calculations)

Still, based on the Jarque-Bera test, the residuals are not normally distributed. The value of the Jarque-Bera test is 39.49077 and the Probability is 0.000000 ≤ 5%, meaning that the null hypothesis H_0, stating that residuals are normally distributed, is rejected at a 5% level of significance. Besides this particular inconsistency, all other findings of the residual diagnostics checks suggest that the analyzed ARDL model is correctly specified in terms that it can be used for hypothesis testing and forecasting purposes.

6. Conclusion

This paper has examined the effect of capital adequacy on profitability in Macedonian banks during the period from 2015 to 2019. The focus has been put on the investigation of one dependent variable, Return on Average Assets (ROAA) as a parameter resembling the banks' profitability, and how it depends on capital adequacy ratio as a proxy for capital adequacy of the banks and their exposure on risks measured by Deposit-to-Asset Ratio (DAR), Non-Performing Loans Ratio (NPLs) and Loan-to-Deposit Ratio (LDR). The empirical study is based on the utilization of the Auto-Regressive Distributed Lag (ARDL) method for time series analysis via EViews v10.

The main limitation of the work is that it operates with data at the sector level. Such data mask the significant variability of the observed indicators in units (banks) within the sector. Also, a significant limitation is that all used data, by nature, are averaged values for banks operating in the market.

The findings of the study indicated that capital adequacy relates positively, yet statistically insignificantly, to the profitability of Macedonian banks, both in the short- and long-run. However, the impact of Deposit-to-Asset Ratio (DAR) on ROAA is both positive and statistically significant both in the short- and long-run. Despite these, the Non-Performing Loans Ratio (NPLs) and Loan-to-Deposit Ratio (LDR) have both negative and, mainly, statistically insignificant impacts on the ROAA of the Macedonian banks, both in the short- and long-run.

Therefore, the results proved that the capital adequacy ratio determines the banks' profit and the banks will be able to improve their profitability by increasing their capital adequacy ratio. Thus, higher capitalization serves as a safety cushion and allows a bank to absorb any shocks that it may experience. Moreover, the banks that have higher capital are in a position to approve credits with lower interest rates, to lend money with lower interest rates, and to extend their working through opening their branches or completing business units in other towns and abroad. That means, the bigger the banks' capital, the greater the opportunities for riskier activities, but also for achieving higher banks' profit. Furthermore, the higher capital adequacy ratio will contribute to the overall safety and soundness of the entire banking system through better financial results. Accordingly, it can be concluded that the banks' capital is one of the determinants of the financial strength and stability of the Macedonian banking system and the financial system as a whole since banks have a dominant position (81.5% in total financial assets in 2019) in the financial system of Macedonian economy.

Consequently, to protect deponents' and creditors' resources and to provide a stable, safe, and profitable banking system, the banks' regulators should focus on continuous monitoring on capital adequacy and maintaining it at an optimal level. Developing and implementing effective banks' policies for risk assessment is of particular importance and, following it, the assessment of the adequate level of bank capital. Such banks' policies contribute to optimal capital adequacy ratio, which, in turn, ensures the achievement of the main goal of the banks, maximizing the financial results and value of the share capital.

The results of the study have shown that Deposit-to-Asset Ratio (DAR), as a measure of banks' liquidity, has a positive and statistically significant impact on ROAA. The deposits-to-assets ratio shows to what extent a bank's assets have been funded from a stable source, deposits. Deposits are the most important source of funds for banks and, higher levels of deposits are related to higher banks' liquidity. Higher numbers of this ratio mean that banks' deposit base is meaningful. A larger deposit-to-asset ratio signifies the safety of deposits and means that if the value of a bank's assets declines in the future, its deposits will generally be safer. Regarding all this above, the process of effective liquidity risk management is of great importance to banks. Since excess liquidity may lead to decreased banks' profitability, whilst a shortage of liquidity means an inability to meet the obligations, banks' management teams must determine and keep the optimal level of liquidity. Accordingly, Macedonian banks should focus more on liquidity risk management, i.e. they need to formulate and implement effective liquidity policies that will enhance liquidity management and ensure the desired liquidity level, which, in turn, will contribute to the improvement of the profitability of the Macedonian banking system.

While Deposit-to-Asset Ratio (DAR) has a positive and statistically significant impact on ROAA, the Loan-to-Deposit Ratio (LDR) and Non-Performing Loans Ratio (NPLs) have both negative but statistically insignificant impacts on the ROAA in the Macedonian banking system.

The Loan-to-Deposit Ratio (LDR) shows a bank's ability to cover loan losses and withdrawals by its customers and it is used as a measure of a bank's liquidity. Higher numbers of the ratio mean that the bank may not have enough liquidity to cover any unforeseen fund requirements. On the contrary, if the ratio is too low, the bank may not be earning as much as it could be. The findings in our research have shown insignificance negative impact on ROAA which means that the higher liquidity (expressed by lower Loan-to-Deposit ratio) will indicate lower profitability, e.g. the higher the ratio, the higher is the bank profitability. Our analysis indicates that the Loan-to-Deposit ratio was in a range between 85% and 92% during the analyzed period, e.g. close to the ideal value of this ratio, 80% to 90%. But, besides the high liquidity, the Macedonian banking sector is characterized by high profitability, which implies the conclusion that the liquidity of the Macedonian banks does not limit their profitability.

Similarly, the Non-Performing Loans Ratio (NPLs) has a negative impact on the profitability of Macedonian banks. Such results of the study were expected since a Non-Performing Loan is a risky asset and it implies the necessity of provisions for loans and advances losses, which reduces banks' profits. Also, it leads to the insolvency of banks, which could have a major effect on the economy as a whole. So, to maintain a healthy and sound banking system, but also to enable sustainable credit growth with all the consequent effects on the dynamics of total economic growth, it is crucial to urge activities and efforts to reduce the volume of Non-Performing Loans.

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