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Review Article

THE EFFECT OF LIQUIDITY RISK AND CAPITAL ADEQUACY ON BANK PERFORMANCE: PANEL DATA EVIDENCE FROM EMERGING COUNTRIES

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Abstract: *The study focuses on investigating the impact of liquidity risk and capital adequacy on banking profitability. This results from the fact that emerging countries mostly depend on banks as main financial institutions and therefore it is crucial to regularly follow the indicators which exert an influence on bank performance. The aim of the research is to recognize to which extent liquidity risk and capital adequacy impact banking profitability in West Balkan countries in the period from 2013 to 2025. In our case, bank profitability is measured in ROA. On the other side, liquidity risk is explained by liquid assets to total assets and loan-to-deposit ratio, whereas capital adequacy uses capital adequacy ratio and tier 1 capital ratio as its measurements. Along with that, bank size is used as an additional explanatory variable to ensure valid results of the research. In order to examine interdependence, a panel data regression model with random effects is used as a suitable method. The results show that almost every independent variable has a significant effect on ROA. The only exception is tier 1 capital ratio, which affects bank performance insignificantly. The results of our study would assist banking institutions in tracking dynamics of relevant explanatory variables in order to maintain banking stability on turbulent West Balkan market.*

Key words*: liquidity risk, capital adequacy, panel data regression, bank profitability.*

JEL classification*: G33, C21*

1. INTRODUCTION

Banks are regarded as a fundamental part of emerging financial markets since they operate with a dominant market position. This is especially the case with West Balkan countries whose financial systems are practically dependent on banking institutions (Milenković, Radovanov, Kalaš, & Marcikić Horvat, 2022). These countries have undergone serious changes in banking regulations and consequently banks have been more emphasized not only among other financial institutions, but they are often the subject of academic discussions. According to many authors, liquidity risk is a major concern as far as bank profitability is concerned since one illuquid bank can have destructive consequences on the whole banking system in general (Mashamba, 2018). Generally, liquidity refers to the ability of banks to cover their short-tem liabilities by liquid assets. That is why it is advisable for banks to possess liquid assets in large amounts as a part of a balance sheet. What makes liquidity even more considerable is the introduction of Basel III requirements, through which banks are more thoroughly monitored. Adequate liquidity enables banks to operate effectively and in order to meet the guidelines, banks should continuously look for additional sources of liquidity, which varies from clients' deposits and loans repayments to activities on money markets.

However, Mashamba (2018) points out that banking profitability is at risk of diminishing due to strict liquidity regulations. This should be

outlined since emerging markets highly depend on banks as financial institutions. If liquidity is not well-monitored and proactively maintained, there is a higher likelihood of liquidity risk to limit bank prosperity.

There is a variety of indicators which could reflect liquidity risk, but our research includes liquid assets to total assets (LATA) and loan-to-deposit ratio (LTD) as it was suggested in the study of Ebenezer, Islam, Yusoff and Rahman (2019). They also state that basic bank activites are based on liquidity since that is the only way banks' contribution on the economic growth and development could be ensured. Apart from them, Jedidia and Hamza (2015) put forward a view that liquidity risk could be minimized by diversification of resources and restrictions of asset transformations.

In line with that, capital adequacy also goes together with liquidity and inseparably infuences bank profitability. The explanation lies in the fact that banking profitability is proved to be influenced by high capitals ratios. That is why a huge number of research findings measure capital adequacy in capital adequacy ratio. Unlike liquidity ratio which limits banking profitability, Mashamba (2018) claims that a 18% rise in bank profitability results from a 10% rise in capital. To make the research more valid, our choice of variables also includes tier 1 capital ratio. It compares a bank's equity capital with its total risk-weighted assets (Grant, 2025).

Speaking of tier 1 capital, it is integral part of banking stability and it enables banks to maintain sufficient high-quality capital (Arin, Nyahas & Ekoja, 2025). It also prevents banking profitability from diminishing and banks' losses to increase. Moreover, tier 1 capital ratio is one of many guarantees of keeping liquidity under control and therefore its impact on bank performance should be examined. Taskinsoy (2018) outlines that both tier 1 capital ratio and capital adequacy ratio are used to assess to which extent capital requirements are fulfilled and for that reason one of objectives in our research is oriented to the impact of these variables on banking profitability.

As far as Basel III requirements are concerned, is addressed that capital adequacy ratio should be at least 8%, whereas tier 1 capital ratio should be at least 4.5% (Nickolas, 2023).

The introductory part of this research is continued with literature review, which consists of other similar studies connected to the topic. Then, there is part dedicated to suitable methodology and data relevance for the research. The next part summarizes the results of the random-effects model together with our statistical tests which ensure the reliability of the model. Along with that, there is a discussion part which compares the results of the conducted research with review of other authors' contributions. Finally, there is a conclusion with the possible suggestions as well as limitations.

2.LITERATURE REVIEW

Banking profitability is in the focus regarding quality evaluation of banking sector. So far, Basel guidelines have been implemented in order to ensure adequate banking profitability. According to the studies of Mashamba (2018), Ramadhanti, Marlina and Hidayati (2019), Sunaryo (2020) and Hamdi and Hakimi (2019), banking profitability is always targeted to be influenced by liquidity risk and capital adequacy. This is especially the case after global crisis in 2008 when Basel standards took hold of the banking sector. There is a huge diversity of variables which could measure bank performance, but along with the mentioned authors, we also opted for ROA. As for explanatory variables, loan-to-deposit ratio presents the percentage of bank's loans that it funds with its deposits. The definition of the variable claims that the size of the ratio reflects banking profitability proportionally. Nevertheless, Sari and Septiano (2020) suggested that loan-to-deposit ratio does not significantly influence banking profitability in Indonesia, which is considered as an emerging country. In order to prove that, the authors examined the effects on ROA by using path analysis. Further examination connected to emerging market was done in the study of Hakimi and Zaghdoudi (2017) where the authors claimed that loan-to-deposit ratio exerts a negative and significant influence on bank performance in Tunis by implementing random-effects model. Ramadhanti, Marlina and Hidayati (2019) were investigating the influence of liquidity and capital adequacy on profitability by using random-effects and came to the conclusion that loan-to-deposit ratio positively impact bank performance, since the greater the ratio, the more profitability increases.

This research applies to Indonesian market, which is emerging one. Abdelaziz, Rim and Helmi (2020) imply that liquidity is regarded as the essential pillar of banking activity and considered as main input to support banking profitability. By using loan-to-deposit ratio to measure liquidity risk and by performing seemingly unrelated regression, the authors realized that liquidity risk impacts banking profitability negatively. With regard to liquidity variables, liquid assets to total assets is also relevant as it reflects the banks' assets of liquid assets to overall available assets. By performing panel data regression on ROA, Đaković, Milenković and Andrašić (2024) pointed out that

loan-to-deposit ratio negatively influences ROA, with the explanation that liquidity significantly decreases profitability. Empirical results performed by a dynamic panel regression model in the research of Mashamba (2018) suggest that liquid assets to total assets and bank peformance are positively correlated in emerging economies, meaning.

On the other hand, Ebenezer, Islam, Yusoff and Rahman (2019) proved that liquidity risk measured in liquid assets to total assets has an insignificant impact on ROA in ASEAN- 5 countries (most of them are emerging), whereas loan-to-deposit ratio exerts positive significance on ROA. On contrary, by using panel data regression model Adelopo, Vichou and Cheung (2021) outlined that loan-to-deposit ratio impacts ROA negatively and significantly. What is more, the authors claim that by adhering to Basel III requirements, in most of developed countries liquidity risk has a negative impact on bank performance. Not only do Adelopo, Vichou and Cheung (2021) mention the essence of Basel III guideliness related to liqudity, but also they specify that capital adequacy is impated as well. These two indicators are always correlated in some way and therefore it is important to how capital adequacy and liquidity interfere and what effect they have on bank peformance. In order to test the effect of capital adequacy on bank peformance for banks listed on Indonesian stock exchange, Margono, Wardani and Safitri (2020) conducted a research by using panel data regression and presented that capital adequacy ratio influences bank performance positively and significantly.

Together with this variable, the authors included loan-to-deposit ratio as a form of liquidity risk and state that it makes the same effect on ROA as capital adequacy ratio.With regard to the research of Ramadhanti, Marlina and Hidayati (2019), the authors used a random-effects model on a data collected based on an emerging market and also concluded positive and significant interdependence between the variable and ROA. It is reasonable to expect this kind of effect on profitability, since capital adequacy ratio limits the possibility of risk increase and therefore profitability would not face difficulties. Similar study was performed by Sunaryo (2020) who includes in its scope mainly Asian emerging countries and by implementing multiple linear regression, the results revealed that capital adequacy ratio makes a positive and significant effect on bank performance.

However, loan-to-deposit ratio shows quite the opposite effect on ROA. The author outlines that capital adequacy ratio is the indicator that shows how the overall bank assets that contain risks are also funded from the bank's capital in addition to collected funds from the sources outside the bank. Also, Irawati, Maksum and Muda (2019) state that capital adequacy ratio describes bank's ability to cope with losses or possible financial risks.

Focusing on emerging country and by conducting a research based on panel data, they concluded that capital adequacy ratio is the variable of the major importance for banking profitability since it exerts a positive and significant effect on ROA. However, Puspitisai, Sudiyatno, Hartoto and Widati (2021) used path analysis with multiple regression analysis to discover the effect of loan-to-deposit ratio and capital adequacy ratio on ROA.

Unlike in the previous studies, the authors impled that the explanatory variables do not affect profitability. Along with this ratio, tier 1 capital ratio reflects the banks' financial strenght and enhances their risk profile. Arin, Nyahas and Ekoja (2025) examined the influence of tier 1 capital ratio on bank profitability by using regression discontinuity design where the results revealed that tier 1 capital ratio does not significantly influence ROA in emerging country.

They also outlined that ROA is not significantly affected by tier 1 capital ratio, since ROA expresses the possibility of assets to generate profit, unlike ROE which includes capital structure. In order to analyse Basel III standards more thorougly, additional research based on a fixed effects model was conducted on an emerging by Hossain (2024) where the author presented that tier 1 capital ratio negatively and significantly influences ROA.

Bank size is another explanatory variable of the essence for the research since it reflects the quality of the assets which is at the disposal of the bank. As Ercegovac, Klinac and Zdrilić (2020) stated, bank size reflects overall business and risk operation of an individual bank. They used dynamic panel models to test the impact of bank size on banking profitability of EU banks and found out that there is no significance on ROA. According to Adelopo, Vichou and Cheung (2021), by performing panel data regression on developed European countries, they revealed that bank size negatively and significantly affects ROA and this would mean that bank size is considered as a liability to the bank. Abdelaziz, Rim and Helmi (2020) as already mentioned authors also investigated the effect of bank size on profitability on emerging markets and concluded that there is a negative correlation between them. Finally, Mashamba (2018) claimed that bank size exerts insignificant effect on profitability because Basel III standards require banks to transfer their

unstable short-term assets to long-term funding instruments.

3.METHODOLOGY AND DATA

Our dataset covers the annual time series from the period 2013 to 2025. All of the variables are measured in percents, except for bank size and dependent variable, which are expressed in logarithmic form. As far as the source of data is concerned, all the data is derived from financial statement of a national bank of each country from West Balkan (Serbia, Bosnia and Herzegovina, Montenegro, Albania and North Macedonia).

The following table presents the variable selection.

Table 1: Variable selection

Variable	Symbol	Description	Expected effect
Dependent variable			
Log (Return on assets)	ROA	Net income/total assets	/
Independent variables			
Liquid assets to total assets	LATA	Liquid assets/total assets	+
Capital adequacy ratio	CAR	(Tier 1 capital + Tier 2 capital)/Risk-weighted assets	+
Log_bank size	log(BS)	log_total assets	-
Loan-to-deposit ratio	LTD	Total loans/total deposits	-
Tier 1 capital ratio	T1CR	Tier 1 capital ratio/Risk-weighted assets	__

Once the expected effect is stated, in order to

test the effects of the independent variables on bank performance, it is required to formulate adequate hypothesis.

H1: Liquid assets to total assets positively affects banking profitability.

H2: Capital adequacy ratio positively affects banking profitability.

H3: Bank size negatively affects banking profitability.

H4: Loan-to-deposits ratio negatively affects banking profitability.

H5: Tier 1 capital ratio negatively affects banking profitability.

The basic framework for variables examination is a regression model, which is presented in the following form (Jovičić and Dragutinović Mitrović, 2011):

$$y_{it} = \beta_{1it} + \sum_{k=2}^{K} \beta_{kit} x_{kit} + u_{it} \quad (1)$$

i = 1…,N; t=1…,T

where u_{it} is an error, β_{1it} is constant, β_{kit} refers to unknown regression parameters that vary across observational units and throughout the time (k=2…,K), x_{kit} is value of the *k* explanatory variable for *i* observational unit

By conducting a Hausman test, it can be concluded that a random-effect model is a suitable one for the model with a following equation (Mirović, Kalaš, Milenković, Andrašić and Đaković, 2024):

$$y_{it} = \beta_0 + \mu_i + \beta_1 x_{it1} + \cdots + \beta_n x_{itn} + \varepsilon_{it} \quad (2)$$

To conduct the research, it is necessary to design an adequate model with reference to the table 1, which is expressed as the following:

$Log(ROA_{it})=\beta_0+\mu_i+\beta_1 LATA_{it}+\beta_2 CAR_{it}+\beta_3 log(BS)_{it}+\beta_4 LTD+\beta_5 T1CR+\varepsilon_{it}$

4.RESULTS AND DISCUSSION

This part of the study focuses on the key findings from a random-effects model together with statistical tests which would ensure the validity of the variables.

These tests include descriptive statistics, correlation matrix with vif test, Breusch-Pagan test for heteroskedasticity as well as augmented Dickey-Fuller test for stationarity.

Our research was conducted by using STATA version 13 as statistical software

The empirical study is conducted by using panel data regression model.

Table 2: Descriptive statistics

Variable	Mean	St.dev.	Min	Max
Log(ROA)	0.6400	0.3903	-0.4948	1.3610
LATA	23.5061	5.8023	12.8607	41.1569
CAR	18.3831	2.1704	14.4000	23.4000
Log(BS)	6.4369	0.6763	5.2175	7.7049
LTD	252.1025	504.3774	0.5388	1460.26
T1CR	13.7525	6.8430	0.7550	22.3732

Source: Authors' calculations

There is desciptive statistics of all variables used for the research

Table 3: Correlation matrix

	ROA	LATA	CAR	BS	LTD	T1CR
ROA	1.0000	0.2252	0.3437	-0.2450	-0.3861	0.2890
LATA	0.2252	1.0000	0.2765	0.2929	-0.0440	0.1806
CAR	0.3437	0.2765	1.0000	0.3695	-0.1641	0.3621
BS	-0.2450	0.2929	0.3695	1.0000	0.1931	-0.4833
LTD	-0.3861	-0.0440	-0.1641	0.1931	1.0000	0.1743
T1CR	0.2890	0.1806	0.3621	-0.4833	0.1743	1.0000

Source: Authors' calculation

In order to conduct a valid panel model, it is of the essence to ensure that multicollinearity does not pose a problem. If there is evidence that multicollinearity is present, it is advisable not to perform a regression model. According to Asteriou and Hall (2007), correlation coefficients between the variables should be less than 0.9, which in our case means that our variables can be used for further analysis and it is shown table 3. Together with correlation matrix, Variance inflation test also plays a key role while examining the multicollinearity. Our calculation implies that mean VIF amounts to 3.24, which means that there is no presence of multicollinearity, since imposed limitation on VIF test is 10 as it is suggested by Mirović, Kalaš, Milenković, Andrašić and Đaković (2024). The presented values are revealed in table 4.

Table 4: VIF test

Variable	VIF	1/VIF
T1CR	4.54	0.22004
log(BS)	4.36	0.22936
CAR	4.02	0.24092
LTD	2.05	0.48723
LATA	1.22	0.81801
Mean VIF	3.24	

Source: Authors' calculation

Apart from multicollinearity, heteroskedasticity is also a serious setback for the correctness of the statistical findings. This could be proved by using Breusch-Pagan test. Since the test is conducted in order to make sure the variance of residuals remain constant across the range of independent variables, hypotheses for the test are formulated as follows:

H_0: Variance is constant
H_1: Variance is not constant

Table 5: Heteroskedasticity test

Breusch-Pagan Test	ROA
Results	Chibar 2 (1) = 0.28
	Prob > chibar 2 = 0.5968

Source: Authors' calculation

The test reveals that p-value is greater than 0.05, consequently the null hypothesis is accepted and we can conclude that variance is constant and heterskedasticity is not observed.

Table 6: Augmented Dickey-Fuller unit root test

Variable	ADF t statistic	Level Prob
Log (ROA)	-2.4689	0.0068
LATA	-2.2621	0.0118
CAR	-2.9266	0.0017
Log (BS)	-2.0278	0.0213
LTD	-2.3428	0.0096
T1CR	-1.9855	0.0235

Source: Authors' calculation

Table 6 presents the results of conducted ADF unit root test, which aims at proving stationarity of the variables. To answer whether the stationarity is present among the variables, the hypotheses must be stated:

H_0: All panels contain unit roots.

H_1: At least one panel is stationary.

It is of high significance to mention that stationarity among the variables is advisable to conduct a valid resarch afterwards. Since p-value of all the variables amount to less than 0.05, the authors reject the null hypothesis and imply that table 6 proves the stationarity of all the variables.

Each of the presented test has its own purpose to prove validity of the variables. Moreover, these tests are also the conditions which should be met to make the furher research possible.

In table 7 below the authors revealed the results of a random-effects panel model which is followed by in-depth discussion according to the relevance of the already mentioned literature.

Table 7: Random-effects model

Variable	Coefficient	Std.Error	t-statistic	Prob.
LATA	0.016376	0.005718	2.86	0.004
CAR	0.053697	0.021205	2.53	0.011
log(BS)	-0.179225	0.079354	-2.26	0.024
LTD	-0.000223	0.000054	-4.16	0.000
T1CR	0.007124	0.007899	0.90	0.367
R-squared	0.3809			
Adjusted R-squared	0.3284			
F-statistic	7.2600			
Prob (F-statistic)	0.0000			

Source: Authors' calculations

By conducting a panel data regression analysis, the authors achieve the efficiency of estimation together with handling the dynamics in a time-series period. West Balkan countries are known for their changeable banking sector and therefore the data is exposed to turbulence. The only way to achieve reliable results is taking static models into account. Panel models also assist in revealing trustworthy information especially when a time series is limited, which is the case with our research where the authors limited the time period from 2013 to 2025. Besides, panel data models are favourable among the researchers who tend to include a great number of heterogeneous observations (Dragutinović Mitrović, 2002). This undoubtedly can be applied to this research as it consists of numerous observations related to many variables taking five West Balkan countries into consideration. Table 7 offers the answers about the effects of explanatory variables on bank perfomance. Keeping in mind that p-values of CAR and LATA amount to less than 0.05 and their coefficients are greater than zero, it can be concluded that CAR and LATA positively and significantly infuence banking profitability. This effect between the variables was also expected as table 1 suggested. Therefore, H_1 and H_2 can be accepted according to the calculation of the random-effect model. As for LTD and BS, the results reveal that p-values are also less than 0.05, however their coefficients amount to less than zero. This undoubtedly suggest that LTD and BS affect ROA in a negative and significant way, which was also expected in table 1, meaning that H_3 and H_4 are accepted. As far as tier 1 capital ratio is concerned, it can be observed that it does not influence banking profitability, since its p-value is greater than 0.05, which results in not accepting H_5.

Taking the results of the regression into account, the authors state that they largely correspond to the results of the literature mentioned. It si worth mentioning that majority of authors conducted their research with assistance of panel regression models.To be more precise, Hakimi and Zaghdoudi (2017), Ramadhanti, Marlina and Hidayati (2019) use a random-effects model by evaluating the variables and their results are the same as our calculation with regard to LTD and CAR. Apart from them, Mashamba (2018), Adelopo, Vichou and Cheung (2021), Hossain (2024) and Ercegovac, Klinac and Zdrilić (2020) performed their calculations by using other dynamic and static panel models. These authors'

contributions are similar to our study with the exception of Mashamba (2018) speaking of emerging countries and Ercegovac, Klinac and Zdrilić (2020) speaking of developed ones where they pointed out that BS insignificantly influences banking performance. Since West Balkan countries are bank-oriented and quite dynamic markets, it is reasonable to expect that their bank size, i.e. the size of the assets affects bank performance negatively. The main reason for this kind of impact is the fact that some parts of bank assets (such as fixed assets, unliquid bonds) are dominant in balance sheets and it prevents banks from gaining additional profitability. The study of Hossain (2024) does not corresponds to our random-effects models as the author suggests that tier 1 capital ratio negatively and significantly impacts bank performance, which does not meet the circumstances on West Balkan market, where it is not common to expect a strict usage of Basel III requirements since the markets are emerging and prone to suffer financial turbulence. This is not applied to developed countries where Basel III guidelines are more implemented. LATA impacts ROA in the same way as the calculation in the findings of Mashamba (2018) and the author spoke in favour of LATA having a positive and significant effect on banking profitability unlike Ebenezer, Islam, Yusoff and Rahman (2019) who stated quite the opposite. Since liquid assets are the major source of further investment or loans issuance on West Balkan market, these assets might ensure strong bank profitability in the long run. Margono, Wardani and Safitri (2020), Ramadhanti, Marlina and Hidayati (2019) and Sunaryo (2020) revealed the same effect of CAR on bank performance as our calculations suggest. However, Puspitisai, Sudiyatno, Hartoto and Widati (2021) implied that CAR insignificantly impacts ROA, which is not the case with Balkan emerging countries since West Balkan banks are capable of coping with potential risks or losses due to its increased activities as leading institutions on financial markets.

According to the studies of Hakimi and Zaghdoudi (2017), Abdelaziz, Rim and Helmi (2020), Đaković, Milenković and Andrašić (2024), Adelopo, Vichou and Cheung (2021) and Sunaryo (2020), LTD affects in the same way as table 7 suggests, which is not in line with Ebenezer, Islam, Yusoff and Rahman (2019) and Ramadhanti, Marlina and Hidayati (2019). On the contrary, they all suggest positive and significant effect of LTD on banking profitability. Since our scope of countries is not exposed to risk lending strategies, that would result in lower LTD being more suitable for better bank performance. Higher LTD corresponds to implementing riskier strategies, which in fact would decrease banking profitability of West Balkan countries.

CONCLUSION

Banks deserve special attention while considering financial institutions due to their market dominance. Our analysis summarised interdependence between liquidity risk and capital adequacy on one side and banking profitability on the other, where all the explanatory variables, except from tier 1 capital ratio, presented significant effect on bank performance on West Balkan market. The primary objective for conducting this type of research is to investigate whether certain factors of liquidity risk and capital adequacy influence banking profitability. The results of the study offer banks more precise insight into which variables which are crucial for managing banking profitabilty. As for limitations, it is important to outline that time series covers the period from 2013 to 2025, which sometimes can be an obstacle throughout the examination when the longer series is observed. Besides, these results cannot be applied to developed countries as their coefficients of explanatory variables are slightly different. Since bank performance is under a heated discussion among researchers, there is always potential for further examination which would contribute to improvement of bank performance.

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