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INVESTIGATING THE RELATIONSHIP BETWEEN THE SINGLE-NAME CONCENTRATION RISK AND CAPITAL SURPLUS: EVIDENCE FROM THE MACEDONIAN BANKING SECTOR

ABSTRACT

Banks lend large funds to big clients and are exposed to concentration risk. The concentration risk is indirect credit risk exposure for the banks and it might cause large losses in case of default of the big clients. Therefore, prudent banks would increase their capital surplus as the concentration exposure rises in order to preserve their stability against deteriorating performances of the big clients. Thus, this paper investigates the effect of the single-name concentration risk on the capital surplus in the Macedonian banking sector. The analysis was done by employing Vector Error Correction Model on quarterly data from 2006q1 to 2018q4. The results suggest that the Macedonian banking sector is prudent and increases the capital surplus from 0.65 percentage points (p.p.) to 2.20 p.p., as the single-name concentration risk rises by 1 p.p. More concretely, a future increase of the banking sectors' large exposures by 53.7 million of euros (1 p.p. of the total gross loans as of 2018q4), would require an increase of the capital surplus by the minimum amount of 3.1 million of euros (0.65 p.p. of the minimum capital requirement as of 2018q4), under the assumption of not changing both the total gross loans and the minimum capital requirement, compared to 2018q4.

Keywords: *Capital Surplus, Single-Name Concentration Risk, Macedonian Banking Sector*

JEL: *C32, G21, G32*

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1. INTRODUCTION

Lending is the most significant profit-generating and risk-taking activity of the banks. The banks lend money to the economic agents, and undertake credit risk as a possibility for not collecting the money lent. The low level of exposure to credit risk is related to credit risk management based on the following criteria: solid analysis of the creditworthiness of the borrower, diversification of the loan portfolio and credit exposure limits set by the supervisor. Notwithstanding these criteria, the analysis of each client's creditworthiness is not perfect due to the asymmetric information between the banks and the borrowers and moreover, proper loan portfolio diversification and the credit exposure limits do not completely eliminate credit losses for the banks. In fact, the diversification of the loan portfolio and credit exposure limits, only allow for minimizing the losses from lending to the non-creditworthy clients relative to the income gained from the creditworthy clients. Over time, the creditworthiness' analysis may not imply credit risk occurrence and accordingly, the banks might lend large funds to certain clients (single-name), sectors (households or corporates) or industries, relative to the overall loan portfolio size, and still complying with the credit exposure limits. Therefore, the banks could create imperfect loan diversification, and consequently, the credit risk has an additional dimension as concentration risk. The concentration risk is banks' large lending to individual borrowers, industries and sectors, when compared to the overall loan portfolio or regulatory capital (Grippa and Gornicka, 2016). Additionally, as the source of the concentration risk is relatively high lending, then its interconnectedness with the credit risk is evident.

The concentration risk is very important for the stability of the individual banks and the total banking sector. Examples for high lending to large borrowers like Enron and WorldCom and the subsequent problems caused to the American banks at the beginning of the 2000s, only confirm the significance of this type of risk (Grippa and Gornicka, 2016). Furthermore, the concentration risk was an important factor for the recent two banking crises. Namely, the Global Financial crisis of 2007/08 was triggered by the high concentration of the American banks to the mortgage loans (Brunnermeier, 2009), and the concentrated banks' lending to poorly performing European countries contributed to the subsequent European debt crisis during 2011 and 2012 (Acharya et al., 2014). Thus, the concentration risk necessitates close monitoring from both banks and supervisors because when mismanaged, it materializes as credit default with a severe damaging impact on the overall economy.

Despite the unfavourable effects that the concentration risk might have on the banking sector and the overall economy, yet the banks could not be prevented from lending large funds to a single client, sector or industry within the exposure limits set by the supervisor.

Namely, large individual clients, sectors or industries might be very important for the overall economy and necessitate banks' support. Therefore, the concentration risk is an inevitability in the banks' credit risk management in the case of the monopolized economy and it could not be detrimental as long as it is properly managed. Furthermore, as the banks have been developing a traditional relationship with such large clients, sectors or industries, they get to know them better and reduce the information asymmetry problem as one of the main sources for the credit risk.

Nevertheless, the various unforeseen factors are always possible to affect the concentration risk to materialize into credit risk and therefore, it is very important this risk to be monitored regularly from the banks' risk management perspective because it could affect the capital adequacy as the ultimate absorber of credit risk losses. The concentration risk is not addressed in Pillar 1 of the Basel capital framework, because it relies on the assumption that the loan portfolio is well-diversified and accordingly, risk weights objectively evaluate the credit risk-weighted assets within the capital adequacy assessment process. However, the practical experience indicates that the loan portfolio might not be well-diversified. Therefore, Basel's Pillar 2 addresses the concentration risk and compensates for this drawback of Pillar 1. Pillar 2 predicts that banks should develop their own methodology for measuring the concentration risk and its' potential for credit risk losses as well as provide capital buffers for covering unexpected losses. More concretely, within the Pillar 2 framework, the banks assess the internal capital adequacy assessment process (ICAAP) and thus, they evaluate the risks not covered in Pillar 1 and set aside additional capital as loss absorber.

This study aims to investigate the relationship between the concentration risk and capital surplus for the Macedonian banks. The concentration risk is considered as the single-name credit risk exposure or more concretely, it is measured by the total value of large loans approved to individual borrowers as percentage of the total gross loan portfolio. Why is this relationship between the single-name concentration risk and capital surplus important to be considered? The single-name concentration risk has twofold nature in the sense that is a credit risk arising from large credit exposures to certain clients. Therefore, this risk is complicated from risk management's stance as, usually, the total sum of the large credit exposures exceeds the banks' capital capacity and therefore it requires many practices and knowledge to monitor this risk. If the large exposures default and risk materializes, then it could cause severe damage to the banking sector. Hence, for the banks and policymakers, knowing that banks have a solid capital surplus given the large credit exposures is especially important to maintain the stability of the financial sector as the banks are its core. This paper sets the research hypothesis as a positive relationship between the single-name concentration risk and capital surplus. Vector Error Correction Model (VECM) or known as the Johansen cointegration technique was applied for investigating the mentioned relationship throughout the period from 2006q1 to 2018q4.

The results confirm the hypothesis set above and suggest that the Macedonian banking sector is prudent and increases the capital surplus as the single-name concentration risk rises. Thus, this investigation finds a direct-proportionate relationship between the two variables and moreover, it assesses the average increase of the capital that the Macedonian banking sector sets aside as a response to the increase of the single-name concentration risk.

Additionally, to explain the aim of this paper in more detail, it has to be emphasized that from an ex-ante point of view, the regular monitoring of the creditworthiness of the large borrowers and compliance with the exposure limits is a primary defence from the concentration risk, unlike building up the large capital base that captures funds that could not be used for lending. However, as it was mentioned above, the asymmetric information that banks have compared to the borrowers could contribute to a less than perfect assessment of the creditworthiness, despite complying with the exposure limits. Furthermore, from an ex-post point of view, the banks might only cover the expected losses of the single-name concentration risk, with proper loan pricing (interest rate), provisions and collateral, but unexpected losses are always possible due to misperformance of the large borrowers that would reduce the banks' capital. The pricing and provisioning of the large loans are usually lower as the borrowers have solid creditworthiness and do not delay with servicing of the loans. Moreover, such borrowers have negotiation power and imposing high-interest rate is not always an option, while the provisioning might cover only a fraction of the large loan in a case of loss. The collateral taken is not always marketable at market prices depending on the market demand. Therefore, the capital is the ultimate buffer for covering the unexpected losses from the possible deteriorated performance of the large loans' borrowers.

With this study, the domestic policymakers get an insight into the banks' average increase of the capital surplus in order to cover the eventual unfavorable effects of the single-name concentration risk, having in mind that loan pricing, provisioning and collateral could not absorb the unexpected losses completely.

The paper is organized in the following manner: The first section is a review of the existing literature, whereas the following section provides an overview of the concentration risk within the loan portfolio of the Macedonian banks. Furthermore, the data, VECM methodology and estimations are presented and finally, conclusions are provided.

2. Literature overview

The Bank of Spain (BoS, 2008) provides guidelines to the banks for measuring the single-name and industry concentration risk. Additionally, the guidelines by the Bank of Spain indicate the Herfindahl–Hirschman Index (HHI) as measurement of both types of concentration risk and offers several interval values for the HHI and assigns corresponding multipliers for calculating capital surcharges. Namely, the multipliers are percentages by which banks are required to increase the capital requirement for credit risk in order to cover both the single-name and industry concentration risk. According to Kozak (2015), the methodology by the Bank of Spain is used by other non-Spanish banks such as RBC Bank in Georgia and Robinsons Bank of the Philippines. Moreover, the author applies this methodology for selected Polish banks for the period from 2008 to 2013 and indicates correct multipliers for covering the mentioned types of concentration risk.

Other literature, also investigates the relationship between the concentration risk and banks' capital and considers this issue from the aspect of proper measuring the concentration risk and calculating capital surcharges within Pillar 2 of Basel's capital framework. Therefore, Semper and Beltrán (2011) explain the shortcoming of not taking the single-name concentration risk within Basel's Pillar 1. According to the authors, the weakness of Pillar 1 relies on underestimating the capital requirement for the credit risk due to the assumption that a single debtor does not have a considerable effect on the portfolio value as a whole. Thus, this paper develops a mathematical procedure for calculating concentration index (CI) in which risk weights are taken into account. The CI should approximate the concentration risk (single-name and sectors) and it could help the banks for calculating capital surcharges within Pillar 2. Similarly, the study by Grippa and Gornicka (2016) assessed the capital surcharge for covering the concentration risk. Concerning the single-name concentration, the mathematical model developed by the authors, indicates a capital requirement of a maximum of 6.7% of the regulatory capital for covering the unfavourable concentration effects. However, these papers do not test the relationship between the concentration risk and banks' capital, but only provide mathematical models as guidelines for calculating capital surcharges to cover the concentration risk.

Juodis et al. (2009), is similar to the above-explained two studies concerning the mathematical derivation, but it differs from them in a sense of providing statistical relationship for a capital surcharge for the banks that do not have calculated risk parameters. Namely, the authors suggest that risk parameters such as probability of default (PD), loss given default (LGD) and exposure at default (EAD), assigned to a single client are important for calculating capital surcharge within the mathematical model developed in the paper. Furthermore, this paper finds a positive linear relationship between Herfindahl-Hirschmann Index (HHI) and required capital, which

could be used as alternative approach for a capital surcharge, by the banks not having calculated PD and LGD. Namely, HHI increase by unit yields to capital surcharge between 0.8545% and 1.3223% of the total credit portfolio.

With regard to the Macedonian banking sector, there is no such study made by using econometrical analysis that elaborates the relationship between any type of concentration risk and capital. There are studies by Eliskovski (2014) and Nenovski et al. (2018) that investigate capital buffer relative to other determinants, but the concentration risk is not taken into consideration. The first paper by Eliskovski (2014) investigates capital buffer determinants in the Macedonian banking sector for the period 2003q2 to 2013q3 and finds that non-performing loans ratio, non-performing loans coverage, profitability and exposure to currency risk positively affect capital buffer, while loan growth decreases capital buffer. The following two variables: Economic activity measured by the growth rate of the real gross domestic product (GDP) and loans to GDP gap³, do not affect the capital buffer according to this study. The second paper by Nenovski et al. (2018), among the many relationships considered, analyses the capital buffer determinants for the period from 2005q1 to 2015q2. The study has similar findings concerning the effect of the profitability upon the capital buffer, similarly to Eliskovski (2014), but it does not find a statistically significant effect of the credit risk determinants encompassed by non-performing loans and non-performing loans coverage and loans to GDP gap. Unlike the study by Eliskovski, Nenovski et al. (2018) estimated the negative effect of the real GDP upon the capital buffer. Moreover, this paper takes into account the effect of other determinants on the capital buffer, such as loans to deposits, the central bank bills interest rate, interest rate differential for the domestic currency loans, interest rate differential for the foreign currency loans. The estimated effect of these variables is positive.

Thus, having in mind the above-mentioned researches, it can be summarized that the literature develops various approaches to study the relationship between the single-name concentration risk and banks' capital. This study will rely on the approach implemented in the studies by Eliskovski (2014) and Nenovski et al. (2018) and moreover, the relationship between single-name concentration risk and capital surplus will econometrically be tested for the banking sector of North Macedonia. By applying the econometrical approach, this paper provides a simple model that might help the individual banks for estimating the capital surcharge for covering the single-name concentration, unlike relatively complex mathematical models developed by Semper and Beltrán (2011) and Grippa and Gornicka (2016). Also, the NBRNM would familiarize with the banking sector's capital build-up concerning the concentration risk of interest in this paper.

3 Loans to GDP gap is measured as suggested by the Basel capital framework (with lambda 400,000).

3. Regulatory treatment and stylized facts on the single-name concentration in the Macedonian banking sector

The banking sector is the core element of the total financial system of North Macedonia. Banks are traditional and loans and deposits, encompass the largest part of the balance sheet whereas investment activities take a small part. Furthermore, the banking sector is well-capitalized, profitable and highly liquid, making it a sound and reliable partner for the firms and households within the Macedonian economy.

Having in mind the aim of this paper, a couple of observations can be made about the Macedonian banks' exposure to the single-name concentration risk and its' regulatory treatment. Namely, this type of concentration risk arises from large exposure to single borrowers. According to the regulation imposed by the National Bank of the Republic of North Macedonia NBRNM (NBRM, 2007 and 2008)⁴, the large exposure is defined as total exposure to a single borrower or connected borrowers, equal to or higher than 10% of the bank's regulatory capital (own funds). Furthermore, the domestic regulation limits the single-name concentration risk by setting the following two limits for the exposure to nonfinancial borrowers that are not connected with the bank (subsidiary, manager or shareholder): (1) limit of maximum 25% of the regulatory capital, for the total exposure to a single borrower or group of connected borrowers and (2) the total amount of large exposures⁵ should not be over 8 times (800%) of the bank's regulatory capital.

The concentration risk⁶ is not fully taken into consideration by the domestic regulation on the methodology for determining capital adequacy i.e. Pillar 1. The domestic regulation requires the banks to calculate capital surcharge for the concentration risk within the ICAAP⁷ (NBRM, 2011) and it is in compliance with Pillar 2 of Basel's capital framework II.

4 Banking Law (Official Gazette of the Republic of Macedonia No. 67/07, 90/09, 67/10, 26/13, 15/15, 153/15, 190/16 and 7/19), available at http://www.nbrm.mk/content/Banking_Law_unof_OVofRM_7_19.pdf and Decision on Exposure Limits (Official Gazette of the Republic of Macedonia No. 31/08, No. 163/08, No. 43/09, No. 91/11, No. 100/12, No. 127/12 and No. 26/17), available at http://www.nbrm.mk/ns-newsarticle-decision_exposure_limits.nspix.

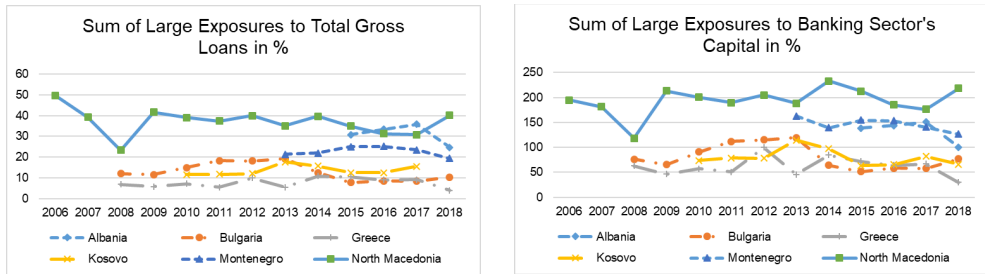
5 Sum of the large exposures to credit risk (10% and above 10% from the regulatory capital (own funds)) by individual bank for all banks in the banking sector divided with the banking sector's regulatory capital (own funds). The large exposures to credit risk are calculated before supervisory deductions.

6 It refers to all types of concentration risk: single-name, sector and industry. According to the NBRM (2012), the banks are obliged to determine the capital requirements in a case of exceeding of the large exposure limits prescribed in the Banking Law. There is no concrete capital requirements for covering the concentration risk when the exposure limits are not exceeded.

7 Decision on Risk Management (Official Gazette of the Republic of Macedonia No. 42/11 and No. 165/12), available at http://www.nbrm.mk/ns-newsarticle-decision_risk_management.nspix

The domestic regulation by the NBRNM neither imposes nor suggests a particular methodology for calculating capital surcharge for the concentration risk. More concretely, the Macedonian banks have the freedom to develop their own calculation or to adopt methodology from the mother bank for those that are subsidiaries of foreign banks. Furthermore, as the banks are obliged to report the ICAAP to the NBRNM, the methodology for each bank is under review of the NBRNM's supervision sector. The purpose of the supervisory review is to ensure that banks have adequate capital support against the concentration risk and all other risks included in ICAAP. It is important to note, that the supervisors in the NBRNM, primarily focus on the qualitative features and efficiency of the banks' risk management and its' ability to prevent losses. The capital size is also important and ultimate absorber of losses, but it does not compensate for the inefficient risk management (NBRM, 2011).

Figure 1: Single-name concentration risk per Balkan countries, measured as the sum of large exposures to gross loans and sum of large exposures to banking sector's capital in %.



Source: *International Monetary Fund (Financial Soundness Indicators Database).*

Figure 1 indicates that the Macedonian banking sector has highest single-name concentration risk compared to other Balkan countries, according to both indicators. The Macedonian banks have large exposures above 200% of the regulatory capital as of 2018, but below the ceiling of 800%, implying that eventual unforeseen and unfavourable performance of the borrowers with large loans might severely damage the banks if the provisioning is not sufficient⁸. Namely, as can be seen from the right graph of figure 1, the banking sectors of Bulgaria, Greece and Kosovo have sufficient regulatory capital to cover the large exposures⁹, neglecting the provisioning. Large exposures for Albania, Bulgaria, Greece, Kosovo and Montenegro are defined in similar manner across the countries considered.

⁸ Beside the regulatory capital, provisioning is additional buffer to cover the expected losses of the large exposures, but the data for provisioning are not available.

⁹ The large exposures to regulatory capital are below 100% as of 2018 for Bulgaria, Greece and Kosovo.

Namely, large exposure is defined as exposure to a borrower or group of connected borrowers, where its value is equal to or exceeds 10% of a bank's capital¹⁰.

Furthermore, it should be mentioned that the regulatory limit of "ratio of the sum of large exposures to banking sector's capital", is differently defined by the countries' supervisory regulative. Thus, the limit of the sum of large exposures to capital should not exceed more than the following limits: 700% of the regulatory capital for Albania (BoA, 2006), 300% of the Tier 1 capital for Kosovo (CBRK, 2013) and 800% of the regulatory capital for Montenegro (CBMNE, 2008). Bulgaria and Greece have a limit set for exposure to individual borrowers or group of connected borrowers, not to exceed more than 25% of the eligible capital or not more than 150 millions of euros, whichever the higher (EU, 2013). Bulgaria and Greece do not have a limit for the sum of the large exposures, but they consider the exposure to the individual borrower along with its connected clients. Although Bulgaria and Greece have different treatment of this indicator compared to other countries considered, yet they are put in figure 1 for comparison purposes.

4. Data

In order to assess the relationship between the Macedonian banking sector's capital surplus on one side and the single-name concentration risk on another, the following variables presented in Table 1 have been used. Single-name concentration risk is the key independent variable whose effect on the capital surplus has to be estimated. The banks' capital surplus is measured as the difference between the Tier 1 regulatory capital and the minimum capital requirement¹¹ and the difference expressed as percentage relative to the minimum capital requirement. The capital surplus is taken because the banks, in reality, operate with the excess capital above the minimum capital requirement (8% of the risk weighted assets¹² (RWA)), not with the total amount of capital. Namely, if a bank operating with a capital adequacy ratio below the regulatory prescribed minimum of 8%, then the NBRNM will impose corrective measures due to not complying with the regulatory requirement, notwithstanding the bank still has a positive size of the capital.

10 The term capital is differently defined for the countries considered. It refers to regulatory capital for a bank from Albania and Montenegro (BoA, 2014 and CBMNE, 2008), eligible capital for a bank from Bulgaria and Greece (EU, 2013) and Tier 1 capital for a bank from Kosovo (CBRK, 2013).

11 Minimum capital requirement is 8% of the risk weighted assets (RWA) for the Macedonian banking sector according to the Banking Law (Official Gazette of the Republic of Macedonia No. 67/07, 90/09, 67/10, 26/13, 15/15, 153/15, 190/16 and 7/19).

12 Minimum rate of Tier 1 is 6% of the risk weighted assets for the Macedonian banking sector according to the Banking Law (Official Gazette of the Republic of Macedonia No. 67/07, 90/09, 67/10, 26/13, 15/15, 153/15, 190/16 and 7/19).

Technically, a bank that has a capital adequacy ratio below the minimum as stipulated by the Banking Law, could not be considered as a functioning bank.

The banks' capital surplus is based on the Tier 1 regulatory capital due to the following reasons: Tier 1 is a measure of the banks' capital that contains capital items with the highest quality such as nominal shares and retained earnings, and it is the first loss absorber. Moreover, Tier 1 capital surplus is compared to the regulatory minimum for the total regulatory capital of 8% (not 6% of the RWA for Tier 1), in order to have a conservative measure as a dependent variable¹³.

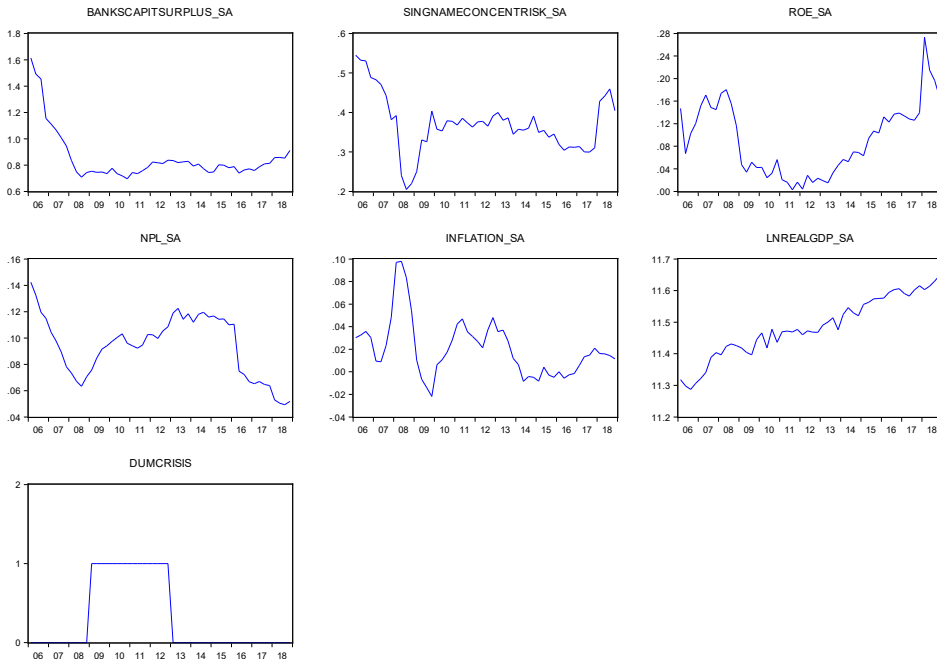
The variables used in this paper, encompass the supply side and the demand side on the Macedonian loan market. Namely, the real GDP variable is demand-side variable as representative of the income capacity of the Macedonian economy. The other variables are representatives of the supply-side on the loan market and they affect the banks' performances for building up the capital surplus and provide stable loan supply. More concretely, they represent the profit capacity of the banks for creating capital surplus (ROE), and the risk variables that are eventually covered by the regulatory capital such as the single-name concentration risk exposure and the credit risk exposure (nonperforming loans). The inflation rate has dual nature and could be considered as both demand and supply factor because both the banks and clients are affected by the higher inflation. Total gross loans are indirectly taken in the analysis, as the denominator in the key independent variable i.e. single-name concentration risk and in the secondary important variable - the NPL ratio. It should be noted that such defined measure for the single-name concentration risk (value of large exposures / total gross loans) considers only the size of the large exposures. It does not consider how risky the borrowers are to whom large exposures have been approved to, and this could be considered as a disadvantage of the measure¹⁴. Also, all the series are seasonally adjusted by using the additive Census X12 option in EViews 8.

13 Capital surplus is less when compared to 8% as higher threshold and thus it is conservative measure, unlike when comparing to 6% as lower threshold and consequently the capital surplus would be higher.

14 There is no information about the creditworthiness of the clients to whom the large exposures are approved to, or whether they are delaying the payment obligations and have offered well collateral.

Table 1: Definition of the variables and data sources

Abbreviation	Dependent/ independent variable	Description	Expected effect	Period	Source
Banks' capital surplus	Dependent	(Regulatory Tier 1 capital - minimum capital requirement) / minimum capital requirement, expressed in %; regulatory Tier 1 capital in millions of denars; minimum capital requirement in millions of denars calculated as RWA multiplied by 8% as regulatory capital adequacy minimum		2006q1 to 2018q4	International Monetary Fund, Financial Soundness Indicators Database
Single-name concentration risk	Independent	Value of large exposures / total gross loans, expressed in %; Value of large exposures to credit risk (10% and above 10% from the regulatory capital (own funds)) by individual bank for all banks in the banking sector in millions of denars; total gross loans in millions of denars	+ or -; Positive sign indicates prudent banking sector because it increases the regulatory capital surplus as loss absorber relative to rise of the single-name concentration risk; Negative sign indicates imprudent banking sector because increase of the single-name concentration risk at the expense of the regulatory capital could cause severe damage in a case of unfavorable risk materialization	2006q1 to 2018q4	International Monetary Fund, Financial Soundness Indicators Database
Return on equity (ROE)	Independent	Net income / capital, expressed in %; Net income in millions of denars; capital in millions of denars	+; Higher profitability of the banking sector is positively associated with the capital surplus because by retaining the earnings, the banks increase the regulatory capital	2006q1 to 2018q4	International Monetary Fund, Financial Soundness Indicators Database
Nonperforming loans (NPL) ratio	Independent	Nonperforming loans / total gross loans, expressed in %; nonperforming loans in millions of denars; total gross loans in millions of denars	+ or -; Positive sign indicates prudent banks as they increase the capital surplus when the bad loans rise; Negative sign indicates imprudent banks having less capital surplus in order to cover unfavorable effects of the credit risk	2006q1 to 2018q4	International Monetary Fund, Financial Soundness Indicators Database
Inflation rate	Independent	$(CPI_t - CPI_{t-4}) / CPI_{t-4}$, expressed in %; base 2010=100; CPI is Consumer Price Index	+ or -; The banks might increase the capital surplus as response to higher inflation in order to account for the macroeconomic instability; Positive inflation might decrease the capital surplus as long as the banks do not perceive the higher inflation as threat to the macroeconomic stability	2006q1 to 2018q4	State Statistical Office of North Macedonia
Real Gross Domestic Product (Real GDP)	Independent	Natural logarithm of the real GDP; real GDP at 2005 prices, in millions of denars	+ or -; A positive sign of the coefficient in front of this variable indicates that banks build up the capital surplus during expansion of GDP and create buffer timely; Negative coefficient indicates that banks decrease their capital surplus during good economic times, due to higher lending that increases RWA	2006q1 to 2018q4	State Statistical Office of North Macedonia
Dummy variable for the global financial crisis and subsequent European sovereign debt crisis	Independent	Variable to account for the unexpected effects of the mentioned crisis and takes values of 1 for the period from 2009q1 to 2012q4			

Figure 2: Graphical overview of the variables used

Source: *International Monetary Fund (Financial Soundness Indicators Database) and State Statistical Office*

5. Methodology and econometric specification

Johansen cointegration technique (Vector Error Correction Model-VECM) will be employed to assess the effect of the single-name concentration risk on the banking sector's capital surplus. The Johansen technique allows variables to be taken with the same order of integration and uses lags in order to mitigate the problem that might arise from the endogenous variables (Haris and Sollis, 2003). The integrative features of the variables were tested by employing two tests: The Augmented Dickey-Fuller test (ADF) and the Phillips-Perron test (PP)¹⁵. The results from the tests are conflicting for few variables meaning that both tests indicate different levels of integration for the same variable¹⁶, and also the tests estimate conflicting results depending on the critical values for 1%, 5% and 10% statistical level¹⁷. However, despite these conflicting results, the tests show that all the variables are non-stationary in the level and that are integrated of order 1 - $I(1)$ ¹⁸.

¹⁵ Intercept and trend parameters are not included in ADF and PP testing.

¹⁶ Banks' capital surplus is such variable.

¹⁷ Banks' capital surplus, NPL ratio and inflation rate are such variables.

¹⁸ The results are not presented in order to save space.

The endogeneity arises from the mutual interaction of the variables considered in the regression (1). Namely, higher single-name concentration risk stimulates the banks to increase or decrease the capital surplus as prudent or imprudent behavior, and moreover, higher capital surplus provides a base for undertaking higher concentration risk. Additionally, this technique provides long-run equilibrium coefficients and the error correction mechanism (ECM) which presents the speed of adjustment of short-run disequilibrium towards long-run equilibrium.

Therefore, the below given regression (1) was constructed and the long-run coefficients¹⁹ were estimated.

Table 2: Correlation matrix between the variables

	Banks' capital surplus	Single-name concentration risk	Return on equity (ROE)	Nonperforming loans (NPL) ratio	Inflation rate	Real Gross Domestic Product (Real GDP)
Banks' capital surplus	1.00	0.77	0.24	0.39	0.12	-0.57
Single-name concentration risk	0.77	1.00	0.09	0.41	-0.06	-0.41
Return on equity (ROE)	0.24	0.09	1.00	-0.58	0.11	0.20
Nonperforming loans (NPL) ratio	0.39	0.41	-0.58	1.00	-0.15	-0.44
Inflation rate	0.12	-0.06	0.11	-0.15	1.00	-0.37
Real Gross Domestic Product (Real GDP)	-0.57	-0.41	0.20	-0.44	-0.37	1.00

Source: Author's calculations.

The correlation matrix indicates that multicollinearity is not an issue of concern between the regressors as it is low. Also, the correlation between the dependent variable (Banks' capital surplus) and the main independent variable (Single-name concentration risk) is relatively high, but below the threshold of 0.8 and could not be considered as a threat to the results.

19 The dummy variable for the global financial crisis and subsequent European sovereign debt crisis is not contained here because it is taken as an exogenous variable to account for the unexpected effects of the mentioned crisis.

6. Estimation results

The regression (1) was developed in 7 sub-regressions by combining various independent variables to consider whether the coefficient in front of the single-name concentration risk changes its effect. Table 2 below contains the estimated long-run coefficients in front of the independent variables for the 7 sub-regressions (I-VII) developed from the regression (1) and ECM term, for each sub-regression separately.

Table 3: Estimated long-run coefficients for the regression (1) by employing VECM method, banks' capital surplus is the dependent variables (normalization of banks' capital surplus = -1)

Dependent variable: Banks' capital surplus							
	I	II	III	IV	V	VI	VII
Single-name concentration risk	0.69*	0.80*	0.65***	0.88*	1.56*	1.10*	2.20*
ROE		-0.16				0.51***	0.80*
NPL ratio			-0.91				
Inflation rate				0.62		0.37	
Real GDP					0.34		-0.62**
ECM	-0.25*	-0.26*	-0.22*	-0.32*	-0.14**	-0.34*	0.06
No serial correlation in the first order (probability) ***	0.16	0.12	0.39	0.03	0.01	0.02	0.18
*, ** and *** indicate statistically significant coefficient at 1%, 5% and 10% level of significance (H0: coefficient=0); *** a figure higher than 0.01 indicates non rejection at 1% statistical level of the following null hypothesis: (1) no serial correlation in the residuals at the first order.							

Source: Author's calculations.

The results presented in Table 2 for the sub-regressions I-VII arising from the regression (1), are indicating prudent behaviour of the Macedonian banking sector relative to the single-name concentration risk. The sub-regressions I - VII yielded a positive coefficient ranging from 0.65 to 2.20. The meaning of this coefficient is that an increase of the single-name concentration risk by 1 percentage point (p.p.) affects positively the banks' capital surplus within the interval from 0.65 p.p. to 2.20 p.p., ceteris paribus. Thus, these sub-regressions imply that the Macedonian banking sector accounts for the eventual unfavourable effects of the single-name concentration risk and accordingly, it increases the capital surplus to cover eventual unexpected losses. The effect is positive across all estimated sub-regressions.

In order to have a monetary insight of the estimated coefficient, a calculation was made with an aim of obtaining the minimum amount of additional capital surplus in millions of euros.

Namely, by taking the minimum value of the coefficient of 0.65 p.p. and applying to the last number of the banks' capital surplus of 87.56%²⁰, as of 2018q4, it indicates that the banks would be prudent if they increase the regulatory capital by the minimum amount of 3.1 million of euros²¹, in order to obtain the capital surplus of 88.21% ($87.56\% + 0.65 \text{ p.p.} = 88.21\%$), under the assumption of rise of the single-name concentration risk by 1 p.p. which is by 53.7 millions of euros²². Hence, a future increase of the banking sector's single-name concentration risk by 53.7 million of euros compared to the number obtained as of 2018q4, would require an increase of the banking sector's capital surplus by minimum amount of 3.1 million of euros, under the assumption of not changing both the total gross loans and the minimum capital requirement, compared to 2018q4. This minimum amount (3.1 million of euros) could serve as a benchmark for assessing the capital surcharge for the single-name concentration risk provided by each bank. Also, the minimum amount is more appropriate for using a benchmark as there are large, medium and small banks each with different capital sizes, profitability and opportunity for increasing the regulatory capital.

Finally, the ECM term is mostly negative suggesting the correction of the disequilibrium towards equilibrium, with the exception to the sub-regression VII, but it is statistically insignificant. The diagnostic tests for the serial correlation do not indicate large problems in the residuals.

The results regarding the other variables are in line with the expectations except for the statistically insignificant effect of the NPL ratio and inflation rate. The ROE variable has a positive effect of 0.51 p.p. and 0.80 p.p., *ceteris paribus*, and it is logical having in mind that profitability is very important source for increasing the regulatory capital. Furthermore, the real GDP has a negative effect of 0.62 p.p., *ceteris paribus*, implying that banks lend in good times at the expense of the capital surplus.

20 Minimum capital requirement for the Macedonian banking sector is 478.2 millions of euros (RWA of 5,978 millions of euros times 8%=478.2) and Tier 1 regulatory capital (896.9 millions of euros). Thus, $((896.9 - 478.2) / 478.2) * 100 = 87.56\%$.

21 Tier 1 regulatory capital of 896.9 millions of euros increased by 3.1 million of euros yields to Tier 1 regulatory capital of 900 millions of euros. Moreover, $((900 - 478.2) / 478.2) * 100 = 88.21\%$ i.e. banks' capital surplus of 88.21% which is by 0.65 p.p. higher compared to the 87.56% as of 2018q4.

22 Value of large exposures (10% and above 10% from the regulatory capital (own funds)) is 2,154.6 millions of euros and total gross loans are 5,368.9 millions of euros, yielding to single-name concentration risk of $(2,154.6 / 5,368.9) * 100 = 40.13\%$, as of 2018q4. The single-name concentration risk ratio of 41.13% ($40.13\% + 1 \text{ p.p.}$), is obtained by an increase of the value of the large exposures by 53.7 millions of euros $((2,154.6 + 53.7) / 5,368.9) * 100 = 41.13\%$.

7. CONCLUSION

This study aims to investigate the relationship between the concentration risk and capital surplus for the Macedonian banks. The concentration risk is considered as the single-name credit risk exposure or more concretely, it measures the total value of large loans approved to individual borrowers as a percentage of the total gross loan portfolio. Vector Error Correction Model (VECM) or known as the Johansen cointegration technique was applied for investigating the mentioned relationship throughout the period from 2006q1 to 2018q4.

Therefore, the single-name concentration risk has to be taken seriously for the case of North Macedonia due to the very high potential for causing loss to the banks and the fact that the banking sector's regulatory capital is not sufficient to fully cover the eventual realization of this risk. Therefore, assessing the relationship between the banks' capital surplus and this type of concentration risk is of particular importance for the Macedonian banks as it would provide insight into the capital practice to cover this risk and whether the banks prudentially address this issue.

The results suggest that the Macedonian banking sector is prudent and increases the capital surplus from 0.65 p.p. to 2.20 p.p. as the single-name concentration risk rises. Thus, this investigation finds a direct-proportionate relationship between the two variables and moreover, it assesses the average increase of the capital that the Macedonian banking sector sets aside as a response to the increase of the single-name concentration risk. The minimum amount by which the Macedonian banking sector should increase the capital surplus is 3.1 million of euros (0.65 p.p. of the minimum capital requirement as of 2018q4) as a response to the increase of the large exposures by 53.7 millions of euros (1 p.p. of the total gross loans as of 2018q4), as indicated by this study and under the assumption of not changing both the total gross loans and the minimum capital requirement (compared to 2018q4).

Therefore, with this study, the domestic policymakers get an insight into the banks' average capital increase in order to cover the eventual unfavourable effects of the concentration risk. The best defence from all risks, including the concentration risk, is solid banking risk management unlike building up a large capital base that captures funds that could not be used for lending. However, the banking risk management could not always be perfect for minimizing the losses and thus the banks will be rational if they continue with such prudent practice and increase the capital surplus by the minimum amount of 3.1 million of euros, in order to cover the single-name concentration risk accordingly. Having in mind the mentioned estimated effect, the domestic policymakers now have a clear benchmark for assessing the proper size of the capital surcharge for the single-name concentration risk, when making on-site and off-site supervision to each bank in North Macedonia.

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ISTRAŽIVANJE ODNOSA IZMEĐU RIZIKA KONCENTRACIJE I VIŠKA KAPITALA: EVIDENCIJA BANKARSKOG SEKTORA U MAKEDONIJI

SAŽETAK

Banke pozajmljuju velika sredstva velikim klijentima i izložene su riziku koncentracije. Rizik koncentracije je neizravna izloženost banaka kreditnom riziku i može uzrokovati velike gubitke u slučaju neizvršenja obaveza velikih klijenata. Stoga bi prudentne banke povećale kapitalni višak s rastom izloženosti koncentracije kako bi očuvale svoju stabilnost protiv pogoršanja performansi velikih klijenata. Tako se u ovom radu istražuje utjecaj rizika koncentracije od individualnih klijenata na višak kapitala u makedonskom bankarskom sektoru. Analiza je urađena primjenom Vector Error Correction Model na kvartalnim podacima 2006q1 do 2018q4. Rezultati sugeriraju da je makedonski bankarski sektor prudentan i povećava kapitalni višak sa 0,65 postotnih bodova (pp) na 2,20 pp, budući da se rizik koncentracije individualnih klijenata povećava za 1 pp. Konkretnije, budući porast velikih izloženosti u bankarskom sektoru za 53,7 miliona eura (1 pp od ukupnih bruto kredita u 2018q4), zahtijevalo bi povećanje kapitalnog viška za minimalni iznos od 3,1 milion eura (0,65 pp minimalne kapitalne potrebe od 2018q4), pod pretpostavkom da se ne mijenjaju ni ukupni bruto kredite ni minimalni kapitalni zahtjev, u odnosu na 2018q4.

Ključne riječi: višak kapitala, rizik koncentracije, bankarski sektor Makedonije

JEL: C32, G21, G32