National Bank of the Republic of Macedonia

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The Risk-Taking Channel of Monetary Policy in Macedonia: Evidence from Credit Registry Data

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Abstract

The last global crisis brought the monetary policy risk-taking channel to the fore, arguing that lingering low interest rates might affect not only the quantity, but the quality of credits extended as well. In line with this debate, this paper is the first effort to empirically investigate the potential existence of the monetary policy risk-taking channel in Macedonia. For this purpose, we use a rather unique database of corporate loans, taken from the Credit Registry of the National Bank of the Republic of Macedonia (NBRM), which is complemented with data from banks' balance sheets. By using pooled OLS on semi-annual data for the 2010-2017 period, our study points to an inverse relationship between the policy rate and the ex-ante risk rating assigned by the banks, a finding that is supportive to the existence of the risk-taking channel, although the effect is relatively small. The results prove to be robust after controlling for several bank-, loan- and time-specific variables. We also test for possible difference in the risk-taking by banks conditioned on the capitalization level, but the results do not confirm the difference in the reaction. The findings of the study are policy-relevant, as they confirm the need for policy makers to be mindful of financial stability impact when making monetary decisions.

JEL: E43, E44, E52, G21
Keywords: Monetary policy, risk-taking, ex-ante credit risk, leverage, POLS.

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1. Introduction

The latest global crisis revisited many of the previously conventional economic paradigms, including those related to monetary policy transmission. The main "novelty" in this area was the increased focus on the link between policy rates and the quality of the credits extended by banks, and hence the risk undertaken. It was triggered by the arguments of a large number of scholars, policy makers, and market agents that the seed of the "Great Recession" was sawn by the low rates prior to the emergence of the crisis. In a low interest rate environment, the banks' incentive to take more risks in their balance sheets increases. They lax their lending standards or start a yield searching path, thus shifting from safe to riskier assets. If this prolonged low interest rate period is followed by a subsequent recession or monetary policy tightening, then given the previous engagement in higher-risk projects, the quality of the banks' balance sheet might deteriorate. The issue is even more topical, given the prolonged low interest rate environment after the global crisis, additionally strengthened by the use of unconventional monetary policy measures.

Borio and Zhu (2008) noted that prior to the crisis, not sufficient emphasis was placed on understanding the link "between monetary policy and perceptions and pricing of risk by economic agents", what they mark as monetary policy "risk-taking channel". They argue that the central bank through the changes in its policy reaction can affect risk-taking, by changing risk perceptions and risk tolerance. Although, we should not perceive it as the most important transmission channel, yet the authors argue that having a better understanding of it, would improve the knowledge of the monetary transmission, particularly given the intensive financial liberalization and innovation, and changes in the prudential framework.

This paper attempts to explore the risk-taking channel of monetary policy in Macedonia. For this purpose, we employ microdata on individual corporate loans, utilizing the database from the Credit Registry of the central bank. We study the linkage between the effective interest rate of the central bank and the so-called ex-ante risk-taking by the banks, while controlling for several loan-, bank- and time-specific variables. To our best knowledge, this is a first attempt to estimate the monetary policy risk-taking channel for Macedonia, and a first attempt to use the rich data set from the Credit Registry for a more comprehensive econometric empirical investigation. Hence, the paper has two important contributions, the first one related to the

specifics of the topic, which has not been explored before, and the second related to the first-time utilization of a unique database.

The paper is organized as follows. Section 1 briefly discusses the literature on the monetary policy risk-taking channel, with focus on the empirical literature on the issue, only. Section 2 refers to the model specification. Section 3 explains the data used and presents some brief stylized facts. Section 4 refers to the selected empirical methodology and discusses the main findings. Section 5 concludes.

2. Related literature

Despite the increasing policy interest in the risk-taking channel, the empirical literature on the issue is rather new and scant. It does not come as surprise, given the fact that the discussion on the monetary policy risk-taking channel, particularly came to the fore after the outburst of the global crisis. In addition, the estimate of this channel often requires granular micro, or survey data, which has not been easily and readily available across countries.

Gaggl et al. (2010) explored the risk-taking channel in Austria, using a unique dataset that matches lenders and borrowers, accounting for a major part of Austrian business lending. Data is taken from the annual balance sheets and income statements of companies, as well as from the Credit Registry in the Austrian central bank. The data from the balance sheets and income statement are used to estimate probability of default for each of the firm in the sample, and hence assign each firm different risk rating. Further, a different empirical approach is taken to assess the impact of lower rates in the risk-taking. The authors explore whether different levels of interest rates affect the probability of default. The research does support the risk-taking channel for the Austrian case.

López et al. (2010) estimate the monetary policy risk-taking channel on the case of Colombia, using database, with a quarterly frequency, for more than two million loans for the period 2000-2008. By using a duration model, they find a statistically significant link between low interest rates and banks' risk-taking based on evidence from Colombia. Lower interest rates increase the probability of default on new loans, but reduce that on outstanding loans. Furthermore, this policy transmission channel depends on some bank, loan and borrower characteristics, as well as on macroeconomic conditions such as the rate of growth of the economy.

Dell'Ariccia et al. (2013), to whom our paper is closely related, study the link between the short-term interest rate and risk-taking, using confidential data on individual U.S. banks' loan rating from the Federal Reserve's Survey of Terms of Business Lending. In the paper, the authors explore the link between the ex-ante risk rating of the banks and the short-term policy rate. They employ panel estimate on a loan level data, on a stratified sample of about 400 banks, over the 1997-2011 period, with a quarterly frequency. They reveal a negative relation between the risk rating and the interest rate, providing strong evidence that low short-term interest rate environment increases bank risk-taking. They also provide evidence that this effect is strongly dependent on the level of bank's capitalization, with the effect of risk-taking being more pronounced for well capitalized banks. They also find that the risk-taking effect is more visible in non-crisis time and during periods when interest rates are not raised for prolonged periods of time.

Bonfim and Soares (2013) use the data on loans to non-financial corporations from the Portuguese Credit Register for the 1999-2007 period. The authors choose 2007 as an end year, given the changes in the monetary policy transmission mechanism after the emergence of the global crisis. Therefore, their aim was to test the existence of the risk-taking channel in "normal" context. Credit registry data is used, and firm-bank relationship in a given quarter is the main unit of observation. The authors use several modalities for the dependent variable, all of which related to the borrowers credit quality. Several bank, borrower and loan specifics are used as control variables. The authors use discrete choice models to assess the probability of loans being granted to borrowers with bad credit history or no credit history at all. The approach also allows to test whether banks grant more loans to risky borrowers, when interest rates are lower. Within borrowers, regressions are also conducted, to test how prone banks with different size are to risk-taking in low interest rate environment. At the end, a survival analysis is employed, to see whether loans granted in periods of lower policy rates, show higher future default probabilities. The results from the discrete choice models show that lower interest rates increase the probability of a bank granting a loan to a borrower with recent bad credit history, and the risk-taking is more evident in smaller banks. While ex-ante risk is higher, the survival analysis does not confirm the increase in risk-taking ex-post, i.e. over the life of the loan.

Jiménez et al. (2014) explore the existence of the monetary policy risk-taking in Spain by using a comprehensive database from the credit registry of Spain. They use a unique, comprehensive bank firm-level dataset on loan application and outcomes. The authors assess the monthly information on loan applications made to banks by firms, from 2002 until 2009, matched with the resulting granted loans and the main bank and firm-level information. They use a two-stage model, in which they explain the monthly granting in the first stage and the actual outcome in the second stage, while controlling for both observed and unobserved, time varying, firm and bank heterogeneity. They infer that a lower overnight interest rate induces banks that are less capitalized to grant more loans to ex-ante risky firms and to extend larger loan volumes with less collateral, but with a higher ex-post probability of default.

Ioannidou et al. (2014) empirically assess whether the level of the monetary policy rate affects bank loan risk-taking. They use microdata from the public credit registry of Bolivia for the 1999 -2003 period and construct several risk measures. The first one is the ex-ante risk measure at the moment of the loan approval, while the second one is the ex-post risk default measure estimated with a simple probit model. They assess how the monetary policy rate at loan origination and repayment (or default), affects the probability of default. Using the probit estimates, and the information on some loan characteristics the authors estimate the ex-ante expected default probability. At the end, they use fully specified duration model, to assess the time to default as a dynamic risk measure. Given the fixed exchange rate of the local currency to the US dollar and the extremely high level of dollarization, as a measure of the monetary policy stance, the paper uses US federal funds rate, thus resolving the possible endogeneity problem. Using the probit and simple OLS estimates, the authors of the paper conclude that lower policy rate supports granting of riskier loans, to borrowers with worse credit history, higher ex-ante risk and weaker ex-post performance.

Karapetyan A. (2016) explores the risk-taking channel in Norway, by using a unique dataset of corporate borrowers. The model uses data on newly extended loans or the change in the total credit exposure between the bank and the firm as dependant variable, while the risk rating of the firm, policy rate and several bank-specific and macro variables are employed as control variables. The paper finds that a lower benchmark interest rate induces the bank to grant more loans to risky firms. It also goes further, by assessing the impact of the bank's balance sheet on the risk-taking channel, concluding that less capitalized banks are more prone to increase loan

volumes to ex-ante risky firms. The model also controls for several additional bank-specific variables, the liquidity level, the share of foreign funding, as well as the size of the bank.

Özşuca and Akbostancı (2016) examine the existence of the monetary policy risk-taking channel in Turkey for the 2002-2012 period. They use an unbalanced panel dataset, with quarterly frequency, covering deposit banks and development and investment banks, operating in Turkey during the selected period. Within their empirical strategy, they perform a series of dynamic panel regressions to assess the risk-taking channel. They do not use microdata on individual loans, but rather bank-specific variables as proxy for the risk-taking (non-performing loans, Z-index, standard deviation of banks, return on assets). Each risk indicator is regressed, on the three-month interest rate, the natural interest rate gap and the nominal GDP growth. Additional control variables are employed, like the concentration of the banking system, its size, liquidity and capitalization. The authors find evidence that low interest rates encourage risk-taking behavior for all the risk measures. More specifically, they find that the change in the short-term rate is positively related to the banks' risk, while the impact of the policy rate below the benchmark rate negatively affects the banks' risk behavior.

3. Model specification

The paper follows the model of Dell'Ariccia et al. which is a simple model assuming banks operating under limited liability and with asymmetric information about the borrower quality. The authors argue that the policy rate affects banks' deposit rates and bank motivation for risk-taking through two different channels. First, the so-called pass-through effect exists, when the increase in the policy rate affects deposit rates, and then lending rates. Hence, if the bank is successful at managing the credit portfolio, the reward for the success is higher. Therefore, it is highly motivated to monitor the quality of credit portfolio closely and to maximize the return on it. The second channel is the classical risk-shifting, when due to the increase in the policy rate, funding costs increase as well, reducing banks' profit margins (other thing equal) in case of success and hence reduces its incentive to monitor its portfolio. They also emphasize that the relative size of the two channels is conditional on the bank leverage, or in other words on bank's capitalization. The risk-shifting effect is high for fully leveraged banks, and it reduces to zero for a bank fully funded with capital (as the limited liability for this type of bank is not important). In the model that they use, and we follow as well, the first effect prevails, and the

main expected outcome of the model is to find a negative relationship between the banks' risk-taking and the policy rate of the central bank. When the policy rate is low or declining, banks take more ex-ante credit risk, and vice versa. Another important, but a very strong assumption in the model is that monetary policy changes, that is changes in the policy rate are fully exogenous to the banks' risk-taking. Interpreted in another way, this would in general imply that monetary policy does not take explicitly into account financial stability considerations. Interest rate decisions considered financial stability issues implicitly, but the explicit reaction to some potential financial vulnerabilities was usually in the form of targeted and specific macro-prudential measures.

Following Dell'Ariccia et al., our main empirical model specification takes the following form:

$$\boldsymbol{LRR_{kit} = \lambda_i + \beta r_t + \eta K_{it} + \mu L_{kit} + \Omega B_{it} + \varepsilon_{kit}}$$

where, LRR_{kit} is the loan risk rating of loan k, extended by bank i during the semester t, and this is the measure used in the model specification to gauge the ex-ante risk rating that the bank assigns to the specific loan party, λ_i are bank-specific effects, r_t is the central bank's effective interest rate, K_{it} refers to a measure of bank's capitalization at the end of time t, L_{kit} embeds a set of loan-specific variables (size, maturity, indicator of collateral backing), and B_{it} refers to a set of bank-specific variables at the end of time, other than capitalization (in essence, it includes total assets, as a measure of the bank's size). The main coefficient of interest, which is the essence of our research question, is the β coefficient, which is expected to be negative and hence, indicative of a presence of risk-taking channel in Macedonia. Yet, it should be pinpointed that the model does not have an ambition to provide an evidence whether the risk-taking is excessive, or to provide us with the level of interest rate at which the risk-taking becomes excessive.

Furthermore, we proceed with the second block of estimation, where an interaction term between the policy rate and the capitalization measure is employed. The inclusion of the interaction term aims to test the hypothesis that low interest rates do increase the banks' risk-taking, especially for banks with relatively high capital, i.e. low leverage. To support this notion, the expected sign of the coefficient ν in front of the interaction term is expected to be negative.

$$\boldsymbol{LRR_{kit} = \lambda_i + \beta r_t + \eta K_{it} + \nu K_{it} r_t + \mu L_{kit} + \Omega B_{it} + \varepsilon_{kit}}$$

4. Data and some stylized facts

4.1. Credit Registry of the National Bank of the Republic of Macedonia

Given the Credit Registry of the National Bank of the Republic of Macedonia (NBRM) as the main data source, the paper provides a separate section on its main features. The NBRM is legally obliged to establish and maintain a Credit Registry of domestically founded banks' and saving houses' credit exposures to legal entities and natural persons. This Credit Registry constitutes an electronic base of data and information on the credit exposures of deposit-taking financial institutions[3] to their clients, the main purpose of which is to contribute to improvement in the loan quality and the maintenance of the stability of the banking system. Hence, banks and savings houses may use the Credit Registry data for the credit risk management purposes, while the NBRM employs this data for performing its supervisory function, for maintaining the financial stability of the country, as well as for analytical purposes.

The Credit Registry of the NBRM was established in 1998. At the beginning, the Registry was used solely for supervisory purposes. After a while, the access to Credit Registry data expanded to banks and saving houses, considering the extreme usefulness of this data in the credit risk underwriting/assessing process, as well as for monitoring purposes during the entire life cycle of credit exposures established with clients. Ever since its establishment, the Credit Registry has undergone several changes, with some more substantial improvements taking place in 2008/2009. Hence, when performing any data-series analysis, 2009/2010 is usually taken as a starting point, as for consistency of data employed to be ensured. Since 2009, deposit-taking financial institutions have been obliged to submit data to the Credit Registry for any individual contract made with clients (legal entities and natural persons), that is (even potentially[4]) generating exposure to credit risk, with a monthly frequency. Some minimum thresholds in the amount of individual credit contracts are imposed when submitting data to the Credit Registry. The information provided for individual credit contracts is rather rich and extensive. A comprehensive list of the input data in the Credit Registry is given in Annex 2.

[3] Banks and savings houses are the only functional (and allowed by Law) deposit-taking financial institutions in the Republic of Macedonia.
[4] Off-balance sheet activities, e.g. irrevocable credit commitments and overdrafts, uncovered guarantees and letters of credit, etc.

4.2. Datasets and variable definition

The dataset used in our empirical model covers the seven largest banks in the country (out of 15[5]), that are rather active on the corporate credit market as well. Their market share in the total assets of the banking system is around 83-84% in the time period covered, with even higher market shares of the corporate segment, varying between 87-89%. We use data with a semi-annual frequency over the period 2010H1-2017H1[6]. Within the chosen time frame, the economy was hit by several shocks - sovereign debt crisis in the euro area and the ensuing structural weaknesses of the Greek economy, as well as the domestic political crisis in 2016. Yet, their impact was short-lived and not of a profound nature.

Loan-specific variables

We use data on individual new loans[7] extended to non-financial companies during each half-year of the time period covered. New loans extended in a process of restructuring of previously approved loans (when replacing an old loan with a new one) are also included in the study. Due to the huge number of loans extended at relatively small amounts, we have reduced our sample, focusing only on loans with individual amounts exceeding the mean value calculated for each analyzed period. As mentioned above, our Credit Registry enables us to match the newly extended loans with the lenders, as well as to consider a relatively broad list of characteristics of each loan.

[5] 18 banks operated in 2010.

[6] The semi-annual frequency was chosen because of the importance to examine how the banks assess ex-ante the creditworthiness of their clients in Macedonia. In our case, the risk categorization of loans at the moment of approval usually is A or B, implying that the loans initially are considered to be of very high quality. However, if in some reasonable period (for example after six months) there is a worsening of the creditworthiness, this would imply that the initial risk categorization was too optimistic. Given that the Credit Registry provides the data at the moment of retrieval, we can take account of this by extracting the data on a semi-annual basis, which means that for all approved loans in one semester, we will obtain the credit ratings not a the date of approval, but at the moment of data extraction. This allows us to obtain rating variability of the matured portfolio of loans during the semester, which is crucial for our analysis.

[7] For the sake of simplicity, we will be using the term "loan" throughout the remainder of the paper. However, besides classical loan agreements, data on newly concluded leasing contracts and factoring and forfaiting agreements concluded with banks' clients are covered as well (although having negligibly small amounts), as such data is also reported by our banks. In addition, off-balance sheet activities with non-financial companies, which could potentially pose credit risk to the bank, are also taken into account.

Risk rating is the risk category assigned[8] by the bank to a given loan, as reported in the Credit Registry of the National Bank of the Republic of Macedonia. According to the regulation, when classifying any credit exposure in a certain risk category, the bank should take into account the creditworthiness of the client, their regularity in debts repayment and the collateral provided for the particular credit exposure. Thus, the loan is classified in one of the five risk categories, as prescribed in the regulation, from A (having the lowest level of riskiness) up to E (having the highest level of riskiness). For the purpose of our study, the risk categories are translated into corresponding numerical values, thus obtaining a discrete index that increases with higher perceived risk (A=1, B=2, C=3, D=4 and E=5)[9]. The risk categories assigned to loans extended in each half-year period covered in the analysis refer to loan classification made as of the end of the respective half-year period. As such, these risk categories might be considered as proper ex-ante risk ratings assigned by the bank to a given new loan.

The model considers several control variables, pertaining to some of the basic loan characteristics: the size of the loan (measured in logs), the original maturity of the loan (in number of years), and dummy variable on whether or not the loan is secured by collateral (takes value 1 for secured loans, and 0 otherwise). For the purpose of our study, loans with co-credit borrower or where endorser is appointed and/or are secured by a bill of exchange only (and none of the other types of collateral) are considered as unsecured.

Bank-specific variables

We complement data from the Credit Registry with balance sheet information[10] on banks' total assets (measured in logs) and their capital positions. As for the latter, regulatory capital ratio is employed (the Tier 1 ratio), calculated as a share of banks' Tier 1 regulatory capital in risk-

[8] More precisely, banks do not report the risk category of a particular loan, but the percentage of impairment losses determined for that particular loan. Depending on the reported percentage of impairment losses, the risk category of each particular loan can be obtained (from A to E), as prescribed in the regulation on credit risk management.

[9] According to our regulation, loans classified in D and E are considered as non-performing, as well as loans classified in risk category C, which, on any basis, have not been collected in more than 90 days from the date of maturity. Potentially useful information with reference to our study is the fact that banks are obliged to classify restructured loans, at least, in risk category C, or even higher (D or E). The regulation on credit risk management provides a list of criteria upon which, individual credit exposures should be classified by banks, in the respective risk category (Decision on credit risk management, available at: http://www.nbrm.mk/ns-newsarticle-decision_credit_risk_2013.nspx.

[10] As reported by banks according to the Decision on submitting data on the accounts balances and value entries in banks' general ledger and financial statements (Official Gazette of the Republic of Macedonia No. 126/11), available at (in Macedonian only): http://www.nbrm.mk/ns-newsarticle-odluka_za_dostavuvanjie_podatotsi_za_sostojbata_i_promietot_na_smietkitie_od_smietkovniot_plan_na_bankitie_i_finansiskitie_izvieshtai.nspx.

weighted assets[11]. Alternatively, in some of the specifications, the capitalization ratio is used - calculated as a share of banks' equity and reserves in total assets.

Time-specific variables

Within the study, the main policy rate of the central bank should be used as a relevant short-term rate in the economy. In the Macedonian case, the interest rate on the one-month Central Bank bills (CB bills) is the key rate, which reflects the monetary policy stance. Yet, in April 2012, the portfolio of monetary instruments was enriched with the introduction of both the overnight deposits and the seven-day deposits that are also relevant to banks' decisions. Hence, for the purpose of the study, until April 2012 we do use the CB bills interest rate, but starting from April 2012, we calculate an effective interest rate. It is a volume-weighted average of the interest rates on all three instruments. In terms of the choice of the policy rate, one might argue that being a small and open economy, with de facto fixed exchange rate against the Euro, does not leave much space for autonomous monetary policy. Hence, the ECB rate might be an optional interest rate that we can use in assessing the risk-taking channel. Yet, given some idiosyncratic shocks that the domestic economy was faced with in the period under consideration, which required opposite monetary policy stance compared to that of the ECB, we would argue that the domestic interest rate is the optimal choice for the research question that we address in the paper.

In some of the specifications, we also try to control for the specifics of the economy, throughout the time horizon used in the estimates. For this purpose, we use a variable which should broadly capture these effects, i.e. the real GDP growth.

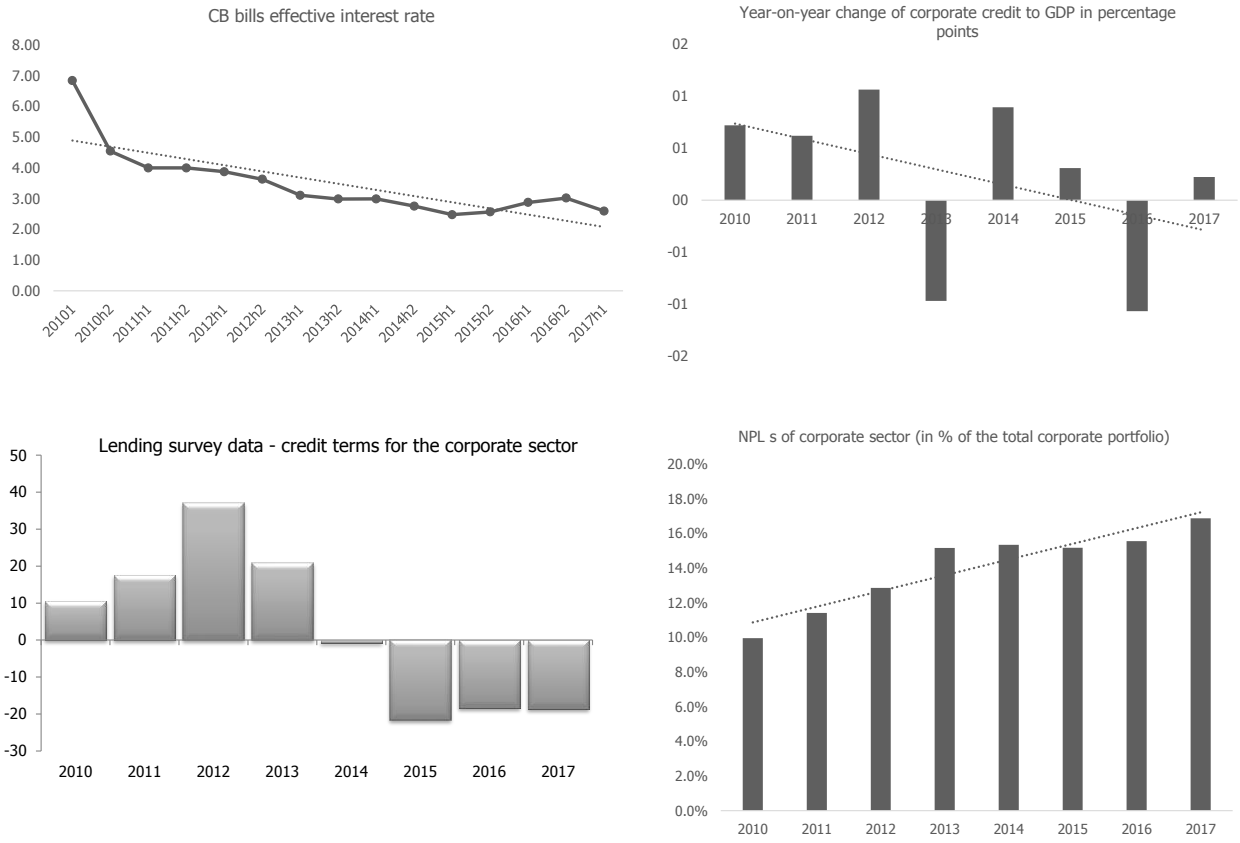
4.3. Stylized facts

The monetary policy stance during the period considered in the paper was in accommodative mode. Given the ultra-relaxed stance of the ECB as anchoring central bank, the strong fundamentals of the domestic economy, and the absence of any considerable pressures on the exchange rate, the effective interest rate of the central bank was generally declining. The only exception was the middle of 2016, when the central bank increased the interest rate in

[11] As reported by banks according to the Decision on the methodology for determining capital adequacy (Official Gazette of the Republic of Macedonia No. 47/12, 50/13, 71/14, 223/15, 218/16), available at: http://www.nbrm.mk/ns-newsarticle-decision_capital_adequacy_2012.nspx.

response to banking and currency pressures, on the backdrop of the turbulent domestic political context. It was a short-lived event, and monetary policy was normalized soon thereafter. Given the lax monetary stance, and the banking system with no liquidity or capital constraints, after the initial tightening at the beginning of the crisis, credit conditions for the corporate sector were eased as well. Lending to the corporate sector, though slower after the global crisis, continued to grow. As expected in the post-crisis mode, the ex-post quality of the corporate credit portfolio deteriorated.

Chart 1

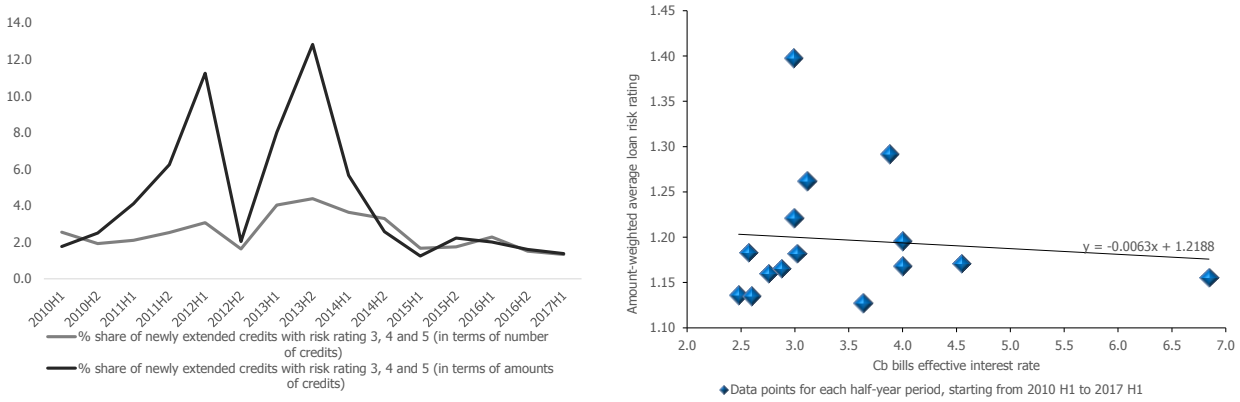


Source: National Bank of the Republic of Macedonia. Note: in the lending survey data, credit conditions are relaxed when negative, and vice versa.

If we do observe the ex-ante risk rating of individual loans, assigned by the banks in the sample, a trend of mild deterioration was also noticeable in certain periods, both through the share of the number of loans approved in a riskier category (clusters of rating 3, 4 and 5), and through the share of the amounts approved in these categories in the total amount extended. Despite the mild rising trend, yet the share of the loans classified in these risk categories,

remained modest, and the amount-weighted average loan rating equaled 1.2. Hence, the simple data inspection would suggest that during the period of declining interest rate, banks took somewhat higher ex-ante credit risk. Yet, of course without more rigorous empirical investigation, the relationship between the two cannot be confirmed.

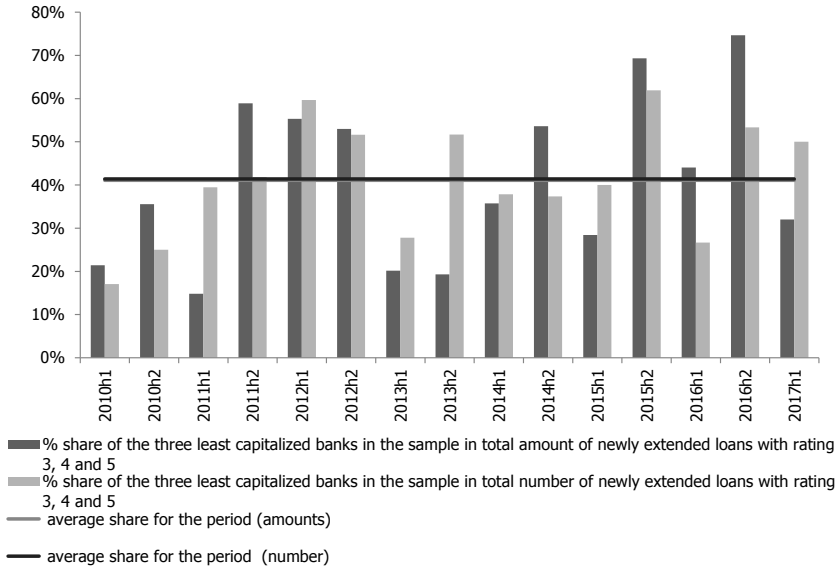
Chart 2



Source: National Bank of the Republic of Macedonia. Data on the ex-ante credit risk refer to the sample of seven banks used in the empirical estimation.

Given the intention of this research to also test for the presence of risk-taking, while controlling for banks' leverage level, we also scrutinize the behavior in this context of banks with different leverage. The data from our sample indicated that the ex-ante risk-taking is more prevalent in banks with higher leverage, i.e. with lower capitalization level.

Chart 3



5. Methodology and empirical results

This section presents the methodology used for the estimation and the empirical findings from the estimated model. Our main interest is focused on the reaction of the ex-ante credit rating of newly granted loans to the changes in the key policy rate. This will allow us to draw conclusions on whether a new risk-taking channel of monetary policy exists in Macedonia, apart from the more traditional channels.

In the search for the appropriate estimator, we have to take into account the specifics of our sample. Namely, as previously mentioned, we are dealing with a dataset which consists of time-specific, bank-specific and loan-specific variables. Although the time- and bank-specific variables can be dynamically monitored, this is not the case with the loan-specific variables (including most importantly the dependent variable) because each new loan occurs only once, at the date of approval and is not monitored afterwards. By construction, this means that there are many loans per period, per bank, which makes our dataset non-longitudinal, so typical panel analysis exploiting the time dimension cannot be carried out. However, given that the research question that we try to address does not require use of any time series operators or autoregressive panel models, we can still use static panel models even on the series of cross-sections in our sample. The reason why we opt to follow this approach is in order to control for the bank-level fixed effects and thus to alleviate the potential omitted variable bias. Namely, it is presumable that there are some fixed effects, specific to each individual bank that affect the bank's risk behavior, and which are not captured in the fully unrestricted model. For example, the ownership, management or clients of the banks, which could be argued to remain fairly constant over time, could affect the bank's attitude towards risks. This is also known as unobserved heterogeneity, which is one of the many sources of endogeneity. However, by applying this estimator, diagnostic tests show that the model suffers from considerable heteroscedasticity which affects the inference. Due to the fact that our number of clusters is very small (in our case we have only 7 banks and 15 separate time periods), we cannot use cluster-robust standard errors to correct for the problem of heteroscedasticity of the error structure. Namely, in the case of few clusters, cluster-robust standard errors are no longer valid, as their derivation relies on asymptotic results. Not just that this would not be an improvement over the non-robust standard errors, in fact it might make matters worse. For that reason, we opt to use the pooled OLS (POLS) estimator as an alternative approach, with heteroscedasticity-consistent standard errors. In addition, mimicking the fixed effects estimator,

a full set of bank dummy variables is also included in the model to control for the unobserved bank-level heterogeneity. We expect this to capture some of the effects from omitted variables that vary across banks, but not time. The inclusion of bank dummy variables is also supported by the joint significance of the fixed effects in the standard fixed effects model and by the significance of the general F-test in the OLS regressions.

Table 1 summarizes the results from the OLS regressions of loan risk ratings on the CB bills interest rate and other control variables from the first semester of 2010 to the first semester of 2017.

Table 1: Loan risk ratings, the CB bills interest rate and bank and loan characteristics
Dependent variable - risk rating of individual loans

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CB bills interest rate	-0.015***	-0.012***	-0.012***	-0.012***	-0.012***	-0.013***	-0.011**
	[0.002]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Tier 1 capital ratio		0.266**	0.264**	0.264**	0.253**	0.246**	0.316**
		[0.123]	[0.123]	[0.123]	[0.123]	[0.123]	[0.127]
Bank size		0.014	0.014	0.014	0.013	0.011	0.023
		[0.023]	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]
Loan size			0.003			-0.002	-0.002
			[0.003]			[0.003]	[0.003]
Dummy for loans with collateral				-0.004		-0.012**	-0.011*
				[0.006]		[0.006]	[0.006]
Loan maturity					0.010***	0.010***	0.010***
					[0.001]	[0.001]	[0.001]
GDP growth							0.007***
							[0.001]
Constant	1.185***	0.874**	0.865**	0.894**	0.888**	0.957**	0.693
	[0.010]	[0.438]	[0.438]	[0.437]	[0.439]	[0.437]	[0.448]
Observations	29,074	29,074	29,074	29,074	29,074	29,074	29,074
Number of banks	7	7	7	7	7	7	7
Bank dummy variables	YES	YES	YES	YES	YES	YES	YES
R-squared	0.137	0.137	0.137	0.137	0.140	0.140	0.140

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

In line with the expectations, the results show that the short-term interest rate, as proxied by the central banks' effective interest rate, has a negative and significant effect on the ex-ante bank risk-taking, which is a finding akin to studies in other countries (Dell'Ariccia et al. (2013), Ioannidou et al. (2014), Jimenez et al. (2014)). This provides evidence of a potential risk-taking channel of the monetary policy in Macedonia, indicating that monetary policy actions may affect

not only the quantity, but also the quality of banks' lending. As can be seen from the table, the interest rate maintains its significant negative effect even after controlling for bank-specific (column 2) and loan-specific variables (columns 3-6). Moreover, the coefficient on the interest rate is fairly stable in magnitude and varies between -0.011 and -0.015. The estimation results in column 2, where we control for the different bank characteristics suggest that a reduction in the interest rate of one standard deviation (1.025) is associated with an increase in the loan risk ratings of 0.012. However, compared with the standard deviation of loan risk ratings of 0.46, albeit statistically significant, this appears to be a very small economic effect.

In order to extend the analysis of the relationship between monetary policy and bank risk-taking, in columns 3-6 we control for the distinct loan characteristics that are most likely to affect risk ratings, such as loan amount, maturity and collateral, by including them first successively, and then jointly in the estimation. The results show that the economic and statistical significance of the interest rate in the specification using the full set of independent variables (column 6) is very similar to the estimation which controlled only for the bank-specific variables. The effect of the other bank-specific variables on the risk rating is also similar. Namely, we find that the coefficient on Tier 1 capital ratio is positive and significant in all regressions, implying that the increase in the level of banks' capitalization leads to an increase in their risk appetite. The literature offers contradictory results as to the effects of bank capital on banks' risk appetite. On the one hand, some authors find that better capitalized banks are safer and have a lower risk exposure (Dell'Ariccia et al., 2013), while other authors report opposite results (Ioannidou et al., 2014, Bonfim and Soares, 2013). Our results are consistent with the latter line of research. One explanation might be that banks with higher capital might tolerate higher losses, and therefore take higher risk. In addition, the effect of bank size is also positive, but it is statistically insignificant. Regarding the loan-specific variables, we find that although the amount of the loan has no significant implications for the credit rating, there is a positive and significant relationship between the rating and the loan maturity, meaning that loans with longer maturity tend to have poorer ex-ante credit ratings. Similarly, whether a loan is secured by collateral or not also plays a significant role for the ex-ante credit rating. However, this relationship is negative, with collateralized loans reducing banks' risk-taking, since ex ante they are assigned better credit ratings on average than non-collateralized loans. Also, when we include GDP growth in order to control for the effects of the macroeconomic environment on the demand for loans that might be related to the dependent variable, results remain broadly

unaltered (column 7). Moreover, the relationship between GDP growth and risk-taking is positive, indicating a certain pro-cyclicality in the banks' risk behavior. The explanation might be that higher growth rates lead to an increase in banks' optimism and risk tolerance which, in turn, results in approval of ex-ante riskier loans.

Next, we test whether the strength of the interest rate effect on banks' risk-taking depends on their levels of capitalization. This hypothesis is developed in the simple model of Dell'Ariccia et al. (2013), according to which low interest rates increase banks' risk-taking, especially for banks with relatively high capital (low leverage). For that reason, in specification (2) of Table 2 we include the interaction term between the CB bills interest rate and the Tier 1 capital ratio, among the other regressors[12]. It is expected a priori the coefficient on the interaction term to be negative, which would indicate a stronger effect of interest rate cuts on risk-taking of highly capitalized banks (Dell'Ariccia et al., 2013).

Table 2: Loan risk ratings and the interaction between the CB bills interest rate and the bank capital

Dependent variable – risk rating of individual loans

VARIABLES	(1)	(2)	(3)
CB bills interest rate	-0.013***	-0.027***	-0.035***
	[0.004]	[0.007]	[0.008]
Tier 1 capital ratio	0.246**	-0.177	
	[0.123]	[0.240]	
Tier 1 capital ratio x CB bills interest rate		0.116***	
		[0.044]	
Equity-assets ratio			-0.220
			[0.384]
Equity-assets ratio x CB bills interest rate			0.277***
			[0.073]
Bank size	0.011	0.019	0.049**
	[0.023]	[0.022]	[0.021]
Loan size	-0.002	-0.002	-0.002
	[0.003]	[0.003]	[0.003]
Dummy for loans with collateral	-0.012**	-0.012**	-0.012*
	[0.006]	[0.006]	[0.006]
Loan maturity	0.010***	0.010***	0.010***
	[0.001]	[0.001]	[0.001]
Constant	0.957**	0.867**	0.283
	[0.437]	[0.431]	[0.407]

[12] Similar estimation is also made by including the interaction term between the bank assets and the interest rate, to investigate whether there is a differential effect of the bank size on the link between the interest rate and the risk-taking. However, the results show that both the bank size and the interaction term are not statistically significant and for the sake of brevity they are not reported.

Observations	29,074	29,074	29,074
Number of banks	7	7	7
Bank dummy variables	YES	YES	YES
R-squared	0.140	0.140	0.141

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

The results from this specification confirm in general the ones excluding the interaction term[13]. As can be seen, we again obtain a statistically significant, negative coefficient on the short-term interest rate, which appears to be somewhat larger in magnitude. However, opposite to the theoretical suggestions in Dell'Ariccia et al. (2013), we find that the coefficient on the interaction term between the bank capital and the interest rate is positive and significant. Given the negative coefficient on the interest rate, the interpretation in the model with the interaction term is not straightforward, and requires an additional calculation of the marginal effect of the interest rate on risk-rating, while holding the capital ratio constant at representative values. Indeed, the calculation points to a negative marginal effect, but with minimal economic significance. Namely, based on the estimation results presented in column 2 of Table 2, when evaluated at one standard deviation below the mean of the Tier 1 capital ratio, a one standard deviation reduction in interest rates results in worsening of loan risk ratings by 0.02, which is a small effect taking into account that the standard deviation of the risk rating variable equals 0.46. The effect of a one standard deviation decrease in interest rates is even smaller when we hold the capital ratio constant at one standard deviation above the mean, amounting to only 0.01. This finding suggests that interest rate cuts encourage marginally larger risk-taking for banks with lower capital ratios, while the negative relationship seems to be slightly weaker for better capitalized banks, given that the internal loan risk ratings assigned by these banks tend to worsen by a bit less than those assigned by lower capitalized banks. This goes against the aforementioned proposition that the effect of lower interest rates on bank risk-taking should be stronger for well-capitalized banks, compared to lower capitalized banks. However, similar result is also found in the research of Ioannidou et al. (2014) for the case of Bolivia, Jimenez et al. (2014) for the case of Spain, Özşuca and Akbostancı (2016) for the case of Turkey and Lopez et al. (2010) for the case of Colombia. The results in column 3, where we use a different proxy for bank capitalization, i.e. the equity-assets ratio, also broadly support these conclusions, albeit

[13] Note that in this case the coefficient on Tier 1 capital ratio changes signs and becomes statistically insignificant. However, the tests of the main effects in this model do not test the same hypotheses that they make when carried out in the model without interaction. Instead, when we test for the overall significance of Tier 1 ratio in the interaction model, we find that it is statistically significant. This means that the main effects of the variables that are used to compute the interaction terms should still be included in the model, even if they are not significant. Otherwise, both the main effects and the interaction effects can get confounded.

the economic relevance becomes even smaller, and the statistical significance actually disappears when evaluated at one standard deviation above the mean.

Table 3 reports the estimation results obtained by splitting the sample by bank capital. Column 1 presents the results for the sample of banks above the median Tier 1 capital ratio, whereas column 2 shows the results for the sample below the median. The evidence suggests that the interest rate has a similar encouraging effect on risk-taking, regardless whether we analyze separately the banks with capital ratios higher or lower than the median.

Table 3: Subsampling by bank capital
Dependent variable – bank loan risk ratings

VARIABLES	(1) Banks with Tier 1 capital ratio above median	(2) Banks with Tier 1 capital ratio below median
CB bills interest rate	-0.016**	-0.010*
	[0.007]	[0.005]
Tier 1 capital ratio	-0.002	0.033***
	[0.001]	[0.004]
Bank size	-0.061**	0.093***
	[0.029]	[0.036]
Loan size	-0.007*	0.006
	[0.004]	[0.005]
Dummy for loans with collateral	0.024***	-0.049***
	[0.009]	[0.009]
Loan maturity	-0.004***	0.023***
	[0.001]	[0.002]
Constant	2.373***	-0.852
	[0.559]	[0.700]
Observations	14,299	14,775
Number of banks	7	7
Bank dummy variables	YES	YES
R-squared	0.015	0.213

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

6. Robustness checks

Table A in Annex 1 presents the results from the estimation when splitting the sample by different loan characteristics. In this case, the results are mixed. For example, we continue to find a negative and significant relationship between the interest rate and the risk rating only for

the loans with maturity longer than the median and the loans that are secured by collateral. Opposite to this, the coefficient on the interest rate becomes positive in the subsamples of shorter-term and non-secured loans. This implies that in these cases other factors might be at play in the banks' decisions to undertake risk.

Table B in Annex 1 presents an alternative specification, which includes time dummy variables in the model[14]. These variables should capture changes in economy-wide conditions, such as GDP growth, inflation, and other overall shocks to the economy, that are not captured by the interest rate. In this case, the interest rate variable is dropped because it varies over time, but not across banks, and will therefore be captured with the time dummies. This will enable us to check the robustness of the estimated interaction between the interest rate and the banks' capitalization levels. The comparison shows that the coefficients on the interaction term between the two proxies for bank capitalization and the interest rate are similar, which lends support to the robustness of the results in our main specification.

As an additional robustness check, we include an interaction between the CB bills interest rate and the real GDP growth in the model, in order to control directly for the potential dependence of risk ratings on the economy-wide conditions. As shown in Table C in the Annex, the results again support the conclusion that there is an increasing effect of lower interest rates on bank risk-taking. Furthermore, the coefficients on the interactions between the capital ratios and the short-term interest rate do not change very much in this specification of the model.

Finally, in order to examine the effect of past interest rate decisions on credit risk on the date of loan origination, we use the six-month lag of the interest rate as an explanatory variable. This might also help us to tackle the possible problem of reversed causality between interest rates and risk-taking. As shown in Table D in Annex 1, the results do not change the conclusions drawn so far in our analysis.

7. Conclusion

The monetary policy risk-taking channel became particularly topical issue after the outburst of the global financial crisis. The conventional knowledge suggests that accommodative monetary policy impacts banks to grant larger quantity of credits. The risk-taking approach, on the other

[14] The results from the F-test show that the time dummies are strongly statistically significant. However, in order to save space, we do not report them in the table.

hand, suggests that it impacts not only the quantity, but the quality of credits, as well, through its effect on banks' perceptions and risk-taking.

The paper made an effort to empirically test the presence of the risk-taking channel in the Macedonian case. For this purpose, we followed an approach, commonly employed in the empirical literature on this matter, using micro, or individual data on newly extended loans. The database is extracted from the Credit Registry of the NBRM, and covers the seven largest banks, and their newly extended loans in the corporate credit portfolio for the 2010-2017 period. We used the pooled OLS estimation to test the linkage between the policy rate and the ex-ante risk rating assigned by banks to each individual loan. Our study reveals inverse relationship between the two, supporting the existence of the risk-taking channel in Macedonia. The results prove to be robust after controlling for several bank-, loan- and time-specific variables. Yet, the magnitude of the coefficient is rather small, indicative of small economic significance.

Following Dell'Ariccia et al. (2013), the paper also puts a special emphasis on testing the impact of banks' leverage on the risk-taking behavior. Contrary to their finding, we find a marginally lower risk-taking for better capitalized banks, suggesting that banks with high capital and low leverage are more risk averse and prudent in the risk assessment, regardless of the interest rate level and of their larger capacity for loss absorption. Yet, again the difference between the two groups is rather small, and does not support the thesis on significant impact of the leverage level on the risk-taking channel.

The findings of the paper are policy-relevant, as they are indicative of the presence of the monetary policy risk-taking channel in Macedonia and the need to take into account financial stability consideration and banks' risk-taking when deciding on the policy rate, and/or on the need to complement it with targeted macro-prudential measures. The paper is also meaningful from the pure research perspective, as to our best knowledge, it is the first effort to estimate this alternative monetary policy channel for the region, and the first effort to use the Credit Registry database for econometric research purposes. Future research in this area might try to tackle more thoroughly the definition of the ex-ante risk rating, by compiling alternative indicators, and testing whether the risk-taking channel exists after controlling for the different risk measures. In addition, the risk-taking channel could be assessed on the household credit portfolio, as well.

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ANNEX 1

Descriptive statistics

Variable	Observations	Mean	Standard deviation
Risk rating	29074	1.171	0.456
NBRM effective interest rate (%)	29074	3.410	1.025
Loan size (denars)	29074	20242	43430
Loan maturity (years)	29074	2.193	2.546
Dummy for loans with collateral	29074	0.796	0.403
Tier 1 capital ratio	29074	0.130	0.036
Equity-assets ratio	29074	0.103	0.027
Bank total assets (million denars)	29074	55700	28100
GDP growth (%)	29074	2.536	1.766

Table A: Subsampling by loan characteristics

Dependent variable – bank loan risk ratings

VARIABLES	(1) Loans with maturity longer than median	(2) Loans with maturity shorter than median	(3) Loans secured by collateral	(4) Loans not secured by collateral
CB bills interest rate	-0.037***	0.010*	-0.025***	0.016*
	[0.006]	[0.006]	[0.005]	[0.009]
Tier 1 capital ratio	-0.005***	0.011***	0.003**	0.001
	[0.002]	[0.002]	[0.001]	[0.003]
Bank size	-0.154***	0.180***	-0.023	0.091*
	[0.031]	[0.033]	[0.025]	[0.049]
Constant	4.080***	-2.310***	1.601***	-0.609
	[0.592]	[0.640]	[0.481]	[0.941]
Observations	12,827	16,247	23,141	5,933
Number of banks	7	7	7	7
Bank dummy variables	YES	YES	YES	YES
R-squared	0.177	0.114	0.144	0.115

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table B: Regressions including time dummy variables
Dependent variable – bank loan risk ratings

VARIABLES	(1)	(2)
Tier 1 capital ratio	-0.882***	
	[0.260]	
Tier 1 capital ratio x CB bills interest rate	0.158***	
	[0.046]	
Equity-assets ratio		-1.403***
		[0.411]
Equity-assets ratio x CB bills interest rate		0.352***
		[0.077]
Bank size	-0.118***	-0.059
	[0.044]	[0.038]
Loan size	-0.003	-0.003
	[0.003]	[0.003]
Dummy for loans with collateral	-0.015**	-0.013**
	[0.006]	[0.006]
Loan maturity	0.010***	0.010***
	[0.001]	[0.001]
Constant	3.236***	2.096***
	[0.810]	[0.702]
Observations	29,074	29,074
Number of banks	7	7
Bank dummy variables	YES	YES
Time dummy variables	YES	YES
R-squared	0.144	0.144

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table C: Loan risk ratings, the CB bills interest rate, bank capital and GDP
Dependent variable – bank loan risk ratings

VARIABLES	(1)	(2)	(3)
CB bills interest rate	-0.038***	-0.056***	-0.063***
	[0.009]	[0.011]	[0.011]
CB bills interest rate x GDP growth	0.007***	0.007***	0.007***
	[0.002]	[0.002]	[0.002]
Tier 1 capital ratio	0.258**	-0.310	
	[0.126]	[0.239]	
Tier 1 capital ratio x CB bills interest rate		0.156***	
		[0.045]	
Equity-assets ratio			-0.406
			[0.382]
Equity-assets ratio x CB bills interest rate			0.327***

			[0.074]
Bank size	-0.000	0.010	0.040*
	[0.024]	[0.024]	[0.021]
Loan size	-0.002	-0.002	-0.002
	[0.003]	[0.003]	[0.003]
Dummy for loans with collateral	-0.010	-0.010	-0.010
	[0.006]	[0.006]	[0.006]
Loan maturity	0.010***	0.010***	0.010***
	[0.001]	[0.001]	[0.001]
GDP growth	-0.016**	-0.016**	-0.014**
	[0.007]	[0.007]	[0.007]
Constant	1.221***	1.098**	0.522
	[0.466]	[0.461]	[0.424]
Observations	29,074	29,074	29,074
Number of banks	7	7	7
Bank dummy variables	YES	YES	YES
R-squared	0.141	0.141	0.142

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table D: Regressions with the lag of the CB bills interest rate

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CB bills interest rate (t-1)	-0.009***	-0.007***	-0.007***	-0.007***	-0.007***	-0.008***	-0.007***
	[0.002]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Tier 1 capital ratio		0.275**	0.274**	0.272**	0.262**	0.255**	0.300**
		[0.129]	[0.129]	[0.129]	[0.129]	[0.129]	[0.131]
Bank size		0.018	0.017	0.017	0.017	0.015	0.021
		[0.023]	[0.023]	[0.023]	[0.023]	[0.023]	[0.024]
Loan size			0.003			-0.002	-0.002
			[0.003]			[0.003]	[0.003]
Dummy for loans with collateral				-0.004		-0.012*	-0.011*
				[0.006]		[0.006]	[0.006]
Loan maturity					0.010***	0.010***	0.010***
					[0.001]	[0.001]	[0.001]
GDP growth							0.007***
							[0.001]
Constant	1.170***	0.796*	0.784*	0.813*	0.806*	0.874*	0.736
	[0.008]	[0.449]	[0.448]	[0.448]	[0.449]	[0.448]	[0.453]
Observations	29,074	29,074	29,074	29,074	29,074	29,074	29,074
Number of banks	7	7	7	7	7	7	7
Bank dummy variables	YES	YES	YES	YES	YES	YES	YES
R-squared	0.137	0.137	0.137	0.137	0.140	0.140	0.141

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

ANNEX 2

List of input data in the Credit Registry of the National Bank of the Republic of Macedonia

No.	Data on clients identification and characteristics	Data on maturity and other dates related to the agreement	Data on the amounts of credit exposure	Data on the collateral (if any) provided by the client	Data on other characteristics of the credit agreement	Other data on the credit quality	Data on written-off claims
1.	Type of client (legal entity, individual, retailer, bank, etc.)	Date of the first cash outflow on the basis of the credit agreement	Total approved exposure amount	Type of collateral (residential or commercial real estate, automobile, guarantees, securities, endorser, co-borrower, etc.)	Number of credit agreement (according to bank own format)	Amount and percentage (as share in total credit exposure) of impairment losses and/or special reserves determined by the bank	Outstanding amount of written-off principal
2.	Residency status and name of country	Final maturity date of the credit agreement	Amount of undue principal of the credit agreement as of the end of the reporting month	Amount of collateral	Type of debt repayment (in annuities, bullet loans or credit cards/overdrafts)	Scope of the impairment losses determined by the bank (calculated for individual credit exposure or for group of exposures on aggregate basis)	Outstanding amount of written-off interest
3.	Code for unique identification in Macedonia	Date of first maturity of the credit agreement principal	Amount of due principal of the credit agreement as of the end of the reporting month	Lien over collateral (primary, secondary, etc.)	Interest rate type (fixed, variable or adjustable according to decision of authorized body in the bank)	Identification of credit agreements where restructuring or extension of the final maturity date was made	Outstanding amount of the other written-off claims
4.	Title of the legal entity and tax number for legal entities - residents	Date of restructuring or extension (if any) of the final maturity date	Amount of interest as of the end of the reporting month	Endorser/co-borrower information: - national ID - tax number - title of the legal entity - name of surname of the individual	Currency (EUR, USD, MKD, etc.)*	Number of restructurings / extensions of the final maturing date (if any)	
5.	Name and surname of the individual	New exposure maturity date (due to restructuring or extension of final maturity date)	Amount of non-performing principal of the credit agreement as of the end of the reporting month		Purpose of the foreign currency credit	Identification of credit agreements that are repayed by endorser or another entity due to default of original borrower	
6.	Municipality for residents from Macedonia		Amount of non-performing interest as of the end of the reporting month		Purpose of the credit approved to individuals (consumer loan, mortgage loan, automobile loans, etc.)	Maximum noted delay in repayment over entire duration of the agreement (in number of days)	
7.	Prevailing activity of legal entities		Amount of other claims according to the agreement as of the end of the reporting month		Agreed annual nominal interest rate	Amount to which the maximum noted delay in repayment pertains	
8.	Client with matched foreign currency position		Amount of off-balance sheet items (if any related to the agreement) as of the end of the reporting month				
9.			Total credit exposure deriving from the credit agreement as of the end of the reporting month				
10.			Annuity amount				
11.			Amount approved in the restructuring or extension (if any) of the final maturity date				

* Agreements in Denars with FX clause are separately identified by reporting the currency of the FX clause.

Source: Instructions for implementation of the Decision on the contents and the manner of functioning of the Credit Registry (Official Gazette of the Republic of Macedonia No. 14/14, 83/15 and 225/15), available at: http://www.nbrm.mk/ns-newsarticle-instructions_credit_registry_n.nspx