National Bank of the Republic of Macedonia

DETERMINANTS OF LENDING RATES AND INTEREST RATE SPREADS IN MACEDONIA

Ljupka Georgievska; Rilind Kabashi;
Nora Manova - Trajkovska; Ana Mitreska; Mihajlo Vaskov*

ABSTRACT

This paper focuses on investigating the determinants of lending rates and interest rate spreads in Macedonia. In order to quantify the effect of various factors on lending rates and interest rate spreads during the 2001-2009 period, we use panel estimation techniques on a sample of commercial banks in Macedonia. Our results indicate that lending rates are mostly influenced by bank size and market share, and to a somewhat lesser extent by deposit rates and non-performing loans. In addition, policy variables such as the domestic policy rate and the foreign interest rate also appear to be quite important. Furthermore, bank size and market share, as well as the differential between domestic and foreign rates, are the most important factors affecting interest rate spreads, while the effect of other factors is less clear-cut.

JEL Classification Numbers**: C23, E43, G21**

Keywords: **interest rates, banking system, panel estimation, Macedonia**

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1. Introduction

The banking system, and the financial system more generally, is a key pillar in any economy, bearing in mind its basic function to reallocate funds from agents with a surplus to those with a deficit. By solving the problem of information asymmetry among agents and by diversifying risks, banks manage to decrease the costs of the exchange of financial funds and enable their efficient allocation within the economy. Therefore, the financial system is one of the most important sources of financing of economic decisions related to consumption and investment, and hence of the financing of capital accumulation and technological innovations, aimed at medium-term productivity growth and more dynamic and sustainable rates of economic growth. Consequently, the price of financing through bank loans (i.e. lending rates) and the efficiency of the banking system (as measured by interest rate spreads) are essential for the possibility of allocation of additional financial potential in the economy, and thus for the acceleration or sustainability of economic growth.

The price of loans and the interest rate spread in Macedonia were relatively high for a long period, thus limiting access to capital and inhibiting economic growth. Although there has been a trend towards lower lending rates and narrower spreads in recent years, they are still relatively high. Until now, the factors that determine lending rates and interest rate spreads in Macedonia were usually analysed with economic intuition, through expert opinions and by analysing the dynamics of certain categories, which are usually considered to influence the interest rate policy of the banks. These factors included the low level of savings and consequently the low supply of loans, insufficient competition in the banking system, the inefficiency and low profitability of banks, uncertainty in the economic environment, the inherited low quality of loan portfolios, institutional limitations, etc.

This study is the first empirical analysis of the determinants of lending rates and interest rate spreads in Macedonia. The main methodology used in the paper is that of a panel estimation of a sample of 17 banks in Macedonia, for the period from 2001 to the first half of 2009. The goal of this research is the empirical estimation of the main factors that influence lending rates and interest rate spreads, so that certain conclusions can be drawn regarding policy measures that could lead to lower lending rates and narrower interest rate spreads. In addition, it is interesting to compare the results of this research with previous qualitative analysis regarding the main factors that influence banks' interest rate policy. Certainly, bearing in mind the fact that this is the first attempt at empirical quantification of these issues, a certain amount of caution is necessary when interpreting the results.

The paper is structured as follows: the literature review in the second section is followed in the third by a brief description of developments in interest rates and general developments in the banking system in Macedonia in the recent years. The fourth section contains an explanation of data and methodology used, and the econometric results are presented in the fifth section. The sixth section presents the results of the decomposition of the interest rate spread, as an alternative method of evaluating the factors that determine interest rate spreads. The final section concludes and suggests policy recommendations from this research.

2. Literature review

Interest rates and interest rate spreads are the subject of numerous empirical analyses, both for developed and developing countries. Depending on the goals of the research, the available data and the specific characteristics of particular banking systems, these issues are treated in various manners, ranging from simple accounting identities, through regression techniques to more sophisticated econometric models.

One part of the literature is based on the influential dealer model, introduced by Ho and Saunders (1981), which uses a two-stage procedure for econometric estimation of the relative influence of particular micro- and macro-factors on the formation of banks' interest rate spreads.[1] Brock and Rojas-Suarez (2000) apply this method to a sample of five Latin American countries. They conclude that interest rate spreads in the 1990s were dominated by liquidity and capital adequacy developments at the micro-level and interest rate volatility, inflation and growth at the macro-level, with some variation in the results across countries. The research by Saunders and Schumacher (2000), on a sample of seven OECD-countries for the 1988-1995 period, concludes that bank capitalisation, market structure and interest rate volatility are the main determinants of interest rate spreads, whereas, according to Afanasieff at al. (2002), macroeconomic variables appear to be the most important factors in the case of Brazil.

The second alternative approach in the research in this area is more eclectic, based on a single-stage regression technique. It is oriented towards the specification of a behaviourist model of banks through the inclusion of various potential determinants of interest rate spreads. For instance, using panel estimation, Demirgüç-Kunt and Huizinga (1999) examine the determinants of interest rate spreads in 80 countries in the 1988-1995 period. Based on a set of variables related to bank specifics, macroeconomic indicators, explicit and implicit taxes, the entire financial structure and regulatory and institutional factors, they find that banks' net-interest rate spreads react positively to the growth of bank capitalisation, the share of loans in total assets, the foreign ownership of the bank, bank size defined using total assets, operating costs, inflation and the short-term money market real interest rate. By contrast, they find a negative effect from non-interest-bearing assets, whereas the rate of economic growth has no effect on interest rate spreads. Similar to this is the research on Tunisia for the 1980-2000 period by Naceur (2003), which has comparable results. Furthermore, Randall (1998) finds a dominant influence of operating costs on high interest rate spreads in the East-Caribbean region. According to this study, operating costs account for 23% of the interest rate spread in the 1991-1996 period.

Our research is mainly based on Čihák (2004), who analyses determinants of lending rates and interest rate spreads in Croatia between 1999 and 2003. In his paper, they are a function of: the deposit rate, total assets, market share, the share of non-performing loans in total loans, liquidity, capital adequacy, dummy variables for privatised and green-field banks, as well as the Treasury bill rate and the EURIBOR

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[1]The first step includes an estimation of the pure interest spread by regressing the spreads on a set of variables related to the specifics of particular banks (mainly CAMEL indicators). The pure spread estimated in this way is then explained from the point of view of basic macroeconomic indicators, as well as of variables related to the market structure in which banks operate.
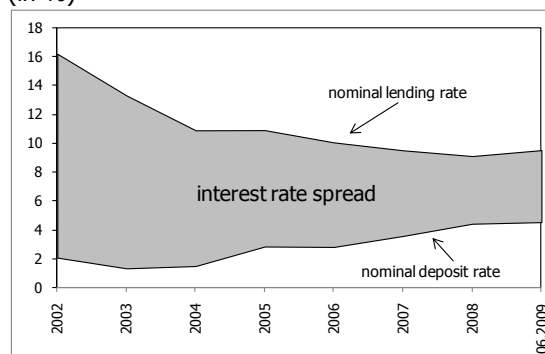
as general factors. The results of this panel estimation show an inverse relation between lending rates and interest rate spreads, on the one hand, and bank size (total assets), liquidity and foreign ownership, on the other. In addition, he finds that market share, non-performing loans, deposit rates and money market rates have a positive effect on lending rates and interest rate spreads. Capital adequacy has a different effect on lending rates from the one on spreads. According to the author, "banks with higher capital adequacy have lower lending rates, but they have even lower deposit rates, so that their spreads are higher than in banks with lower capital adequacy" (Čihák (2004), page 20).

In the literature there are also attempts to quantify the effects of institutional and regulatory changes on the behaviour of banks in financial intermediation. In this context, Claeys and Vennet (2003) carry out a systematic comparative analysis of the determinants of interest rate spreads of banks in Central and Eastern European countries and in Western European countries. According to their results, concentration levels, operative efficiency, capital adequacy and risk management are important determinants of interest rate spreads in both groups of countries. Institutional reforms initially cause risky bank behaviour, which is manifested in higher interest rate spreads. However, later on, as institutional reforms advance, they result in narrower spreads as a result of greater competitive pressure. These results contrast with the research by Barajas et al. (1999) on the effects of financial liberalisation measures in Colombia in the early 1990s. They find that liberalisation has no direct impact towards narrower interest rate spreads. They conclude that the effects are mainly related to the change of the level of significance of particular factors which affect the interest rate spread.

3. Brief review of the developments in the banking system in Macedonia

In the 2000-2008 period, there was a continuous decrease in lending rates and a narrowing of interest rate spreads in the banking system in the Republic of Macedonia. This trend is a result of several developments that occurred in recent years, such as the rise in the efficiency and profitability of the banking system, greater competition, a widening of the spectrum and quality of the financial services offered by the banks, a rise in deposits, a decrease in the riskiness of banks' loan portfolios, as well as permanent growth in the volume of banks' activities and an improvement in the quality of their performance. In the last few years, banks' interest rate policy has contributed towards a gradual approaching of the lending rates and interest rate spreads to those in the more developed countries in the region (Figure 1).

Figure 1

Interest rates in Macedonia (in %)	Comparison of interest rate spreads by countries (in percentage points)
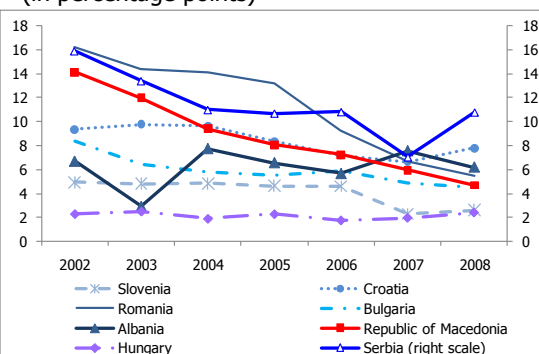
Source: NBRM and EBRD

The trend towards a narrowing of interest rate spreads was interrupted in the first half of 2009, when lending rates in the Macedonian banking system increased, which consequently caused a widening of interest rate spreads. The increase in lending rates is only one dimension of the tightening of banks' credit policy in the first half of 2009 (a gradual tightening of banks' credit policy started in the second half of 2008), which is mainly a result of worsening perceptions by banks of the risks they are taking, in circumstances characterised by a domestic contraction in economic activity. However, it is also a result of the measures taken by NBRM as a prudential response to the consequences of the global economic crisis.

Banks' profitability and efficiency are often considered as the main factors that determine interest rates and interest rate spreads. The continuous trend of expanding bank activities in recent years, as well as the reallocation of low-interest-bearing assets into high-interest-bearing assets, had a direct positive impact on the improvement of banks' profitability and efficiency. However, this trend of a continuous improvement in bank profitability and efficiency was interrupted in 2008, when profits were 6.6% lower than in 2007. In addition, banks' profits were four times lower in the first half of 2009 compared to the same period in 2008.

The narrowing of interest rate spreads in the previous period is also related to higher bank efficiency. In particular, the more dynamic growth of net-interest income, compared to the growth in operating costs, results in a higher degree of coverage (Figure 2). For instance, in 2001, the net-interest income, as an income from regular activities, covered only half of operating costs, while in the 2006-2008 period it completely covered operating costs. However, in 2008, the coverage of operating costs by banks' net-interest income declined by 1.6 percentage points, and, in the first half of 2009, by an additional 9.2 percentage points. This probably reflects a worsening of the efficiency of the banking system during the period between the end of 2007 and the first half of 2009. However, it is difficult to reach a clear-cut conclusion on the reasons for the fall in coverage, since it might also reflect the effects of the crisis.

Therefore, it could be concluded that the recent worsening in banks' profitability and efficiency is one of the main factors that caused wider interest rate spreads in Macedonia in the first half of 2009.

Figure 2
Coverage of operating costs by net-interest income and their share in average assets
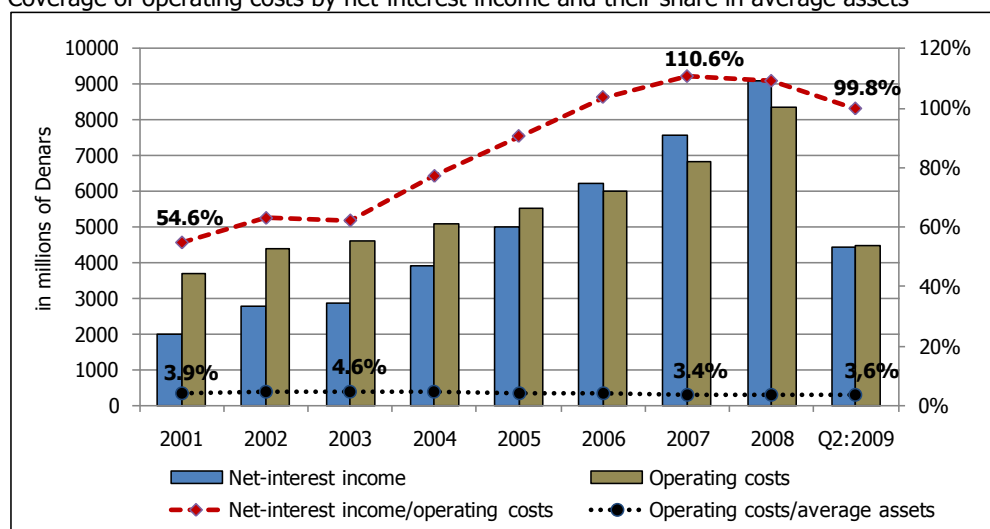
Source: NBRM

The degree of competition in the banking system is also considered a very important factor which impacts on banks' interest rate policy. As of 30.06.2009, there were eighteen banks in the Republic of Macedonia, of which seventeen perform universal banking activities. The banking system of the Republic of Macedonia is characterised by a relatively high, but acceptable level of concentration, which has been declining over the past several years, with the exception of the first half of 2009 (Figure 3). The highest level of concentration is present in bank deposit activity, as measured by the Herfindahl index[2], equalled 1,865 as of 30.06.2009. This index equalled 1,784 for banks' credit activity and 1,591 for banks' assets. The high level of concentration in banks' deposit activity can also be seen through the CR3[3] indicator, which is around 70% during the period analysed. The concentration in banks' total loans and assets has been strengthening throughout the period, and at the end of the first half of 2009 reached levels of 70.3% and 66.3%, respectively. The high level of concentration in the three largest banks[4] points towards their dominant market position and theoretically it is an opportunity for maintaining high interest rates, which brings high profits. However, practice indicates that competition within the oligopoly structure of banking in Macedonia causes lending rates to decline (a trend

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[2] The Herfindahl index is calculated according to the formula $HI = \sum_{j=1}^{n}(S)^2_j$, where S denotes each bank's share in the total amount of the analysed category (e.g. total assets, total deposits, etc.), while n denotes the total number of banks in the system. When the index ranges between 1,000 and 1,800, the level of concentration in the banking system is generally considered acceptable.

[3] The CR3 indicator represents the share of assets (i.e. the category that is analysed) of the three credit institutions with largest assets (i.e. category that is analysed) in total assets (i.e. category that is analysed) of the banking system.

[4] For the purposes of this paper, banks are classified in two groups, according to the size of their assets: large banks and other banks. The group of large banks consists of the three banks with the largest absolute amount of assets, whereas all the other banks belong to the second group.

which other banks have started to follow), which consequently narrows the interest rate spreads.

Figure 3

Herfindahl index	CR3 for the Macedonian banking system
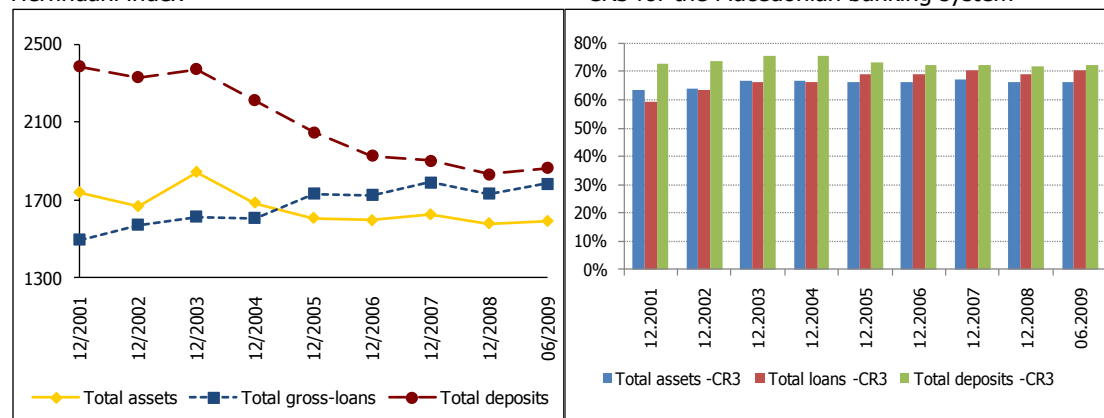
Source: NBRM

The continuous strengthening of confidence in the banking system and the high propensity to save have contributed to continuous deposit growth (Figure 4). For instance, deposits of non-financial entities had an annual growth rate of 31.9% in 2007, which is the highest rate in the period, with the exception of deposit growth in 2001 due to the introduction of the euro. Deposit growth has enabled a strong increase in banks' credit activity, which reached the highest annual growth rate of 39.1% in 2007, thus contributing towards continuous strengthening of the degree of financial intermediation. However, as a consequence of the general deceleration in domestic economic activity, deposits experienced slower growth in 2008 (by only 9.5%), whereas during the first half of 2009 they had a negative annual growth rate of 0.1% (in comparison to 30.06.2008). The decrease in the deposit core, the tightened lending conditions by commercial banks and the macro-prudential measures taken by the NBRM have resulted in a significant deceleration of credit growth. For instance, gross loans to non-financial entities increased by 34.4% in 2008, whereas in the period 30.06.2008-30.06.2009 they increased by only 14.4%. Despite the increase in the degree of financial intermediation in the past ten years, this indicator measured through the share of banks' assets in GDP is still lower in comparison to the banking systems of other European countries[5]. Therefore, the insufficient degree of financial intermediation in the Macedonian banking system can be considered as one of the factors contributing to relatively high levels of lending rates and wide interest rate spreads.
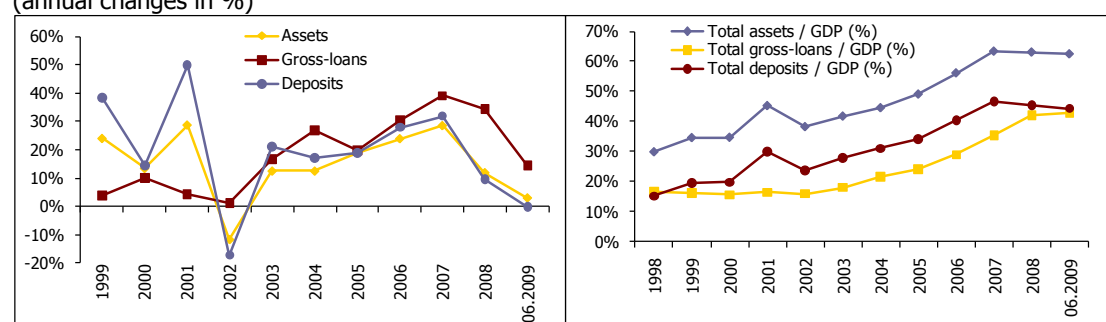
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[5] At the end of 2008, the degree of financial intermediation, measured as a share of banks' assets in GDP, by countries, was as follows: 63.7% in Serbia, 79.6% in Poland, 91.1% in Slovakia, 93.5% in Bulgaria and 136.7% in Slovenia. (Source: ECB (2009) and web-pages of central banks).

Figure 4
Assets, gross loans and deposits   Degree of financial intermediation
(annual changes in %)

Source: NBRM.
Note: Indicators for financial intermediation at the end of the first half of 2009 are calculated according to estimated data on GDP for 2008.

In the past ten years, there was a decrease in the riskiness of banks' loan portfolios (Figure 5). For instance, at the end of June 2009, the share of non-performing credit exposure[6] in total credit exposure equalled 7.6%. In comparison with the peak share of 41.3% at the end of 1999, this is a substantial improvement in the quality of banks' loan portfolio[7]. This indicator shows that only 7.6% of the collected domestic savings are inefficiently allocated, in contrast to 41.3% in the past. These positive developments in the riskiness level of loan portfolio point out the improvement in banks' credit policies and procedures for credit risk management, as well as better financial discipline. However, the riskiness of banks' loan portfolio increased slightly during 2008 and the first half of 2009. The transformation of the financial crisis into a real sector crisis inevitably causes worsening balance sheets for domestic borrowers, thus worsening the quality of credit exposure. Besides, the share of non-performing credit exposure in total credit exposure, compared with other countries[8], indicates that this share is still relatively high. This holds even if the comparison is made for the end-2007, when the banking system's loan portfolio was characterized as having the lowest riskiness of the period. This is considered as one of the main reasons for maintaining relatively high lending rates and wide interest rate spreads in Macedonia. The recent increase in the riskiness of banks' loan portfolio and the worsening prospects for the direction of future movements in riskiness narrow the possibility for any significant decrease in banks' lending rates.

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[6]For the purpose of this paper, the term non-performing credit exposure is related to the credit exposure classified in categories of risk C, D and E.

[7]However, this improvement is partially a result of the changed methodology since March 2002. The decline in the indicators' level at the end of 2002, compared to the end of 2001, is largely a result of the changed methodology for classification of on-balance sheet and off-balance sheet items, which contributed towards a wider scope of banks' total credit exposure.

[8]In comparison, as of 31.12.2008, the share of non-performing loans in total loans by countries is as follows: 1.6% in Slovenia, 2.9% in Hungary, 3.1% in Czech Republic, 4.4% in Poland and 5.3% in Serbia. (Source: IMF, 2009).

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Figure 5
Indicators of the riskiness level of banks' loan portfolios

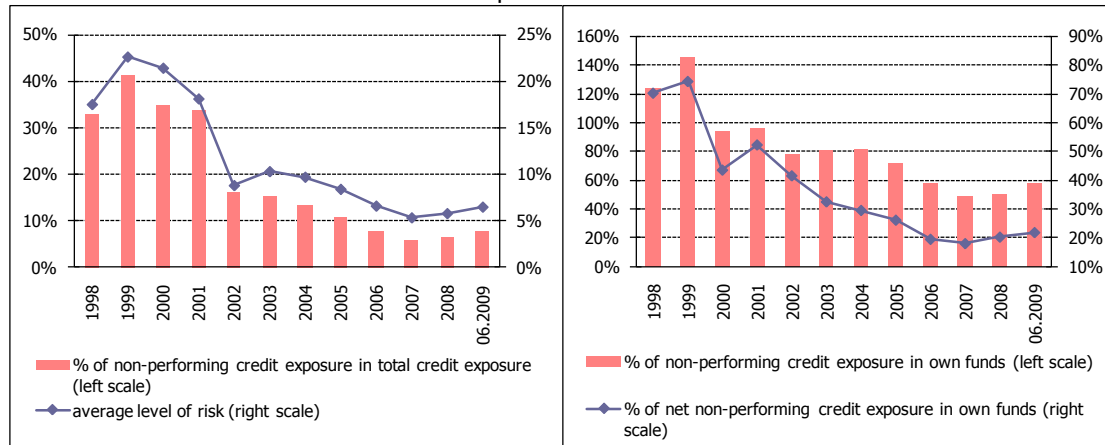Source: NBRM
Note: Net non-performing credit exposure is related to the credit exposure classified in categories of risk C, D and E, decreased by the respective impairment losses. The average level of riskiness is calculated as a share of impairment losses in total credit exposure.

Developments in the banking system in the period are in a direction that would lead to higher profitability, more efficiency and greater stability in a more competitive environment. This can be considered as a combination of changes that have contributed towards a decrease in lending rates and a narrowing of interest rate spreads. However, the analysis of particular indicators shows that there is still room for improvement in banks' operations, and consequently, for positive developments in banks' interest rate policy. Moreover, and mostly as a result of the indirect effects of the global economic and financial crisis on the domestic banking system, Macedonian banks had poorer performances over most activities in the past year and a half (31.12.2007-30.06.2009), which narrows the possibilities for any significant decrease in banks' lending rates and a narrowing of interest rate spreads in the short term. One of the key long-term challenges for Macedonian banks is the gradual return to the previous paths of continuous improvement in profitability and efficiency (without deterioration in the soundness and stability of banks' operations), through widening the base for income generation, while at the same time controlling the most important cost components. The increase in banks' profitability and efficiency would ensure an increase in their capital base, as well as an increase in their total activities, which would inevitably lead to a greater degree of competition in the banking system, a decrease in lending rates and a narrowing of interest rate spreads.

4. Data and methodology

As one of the most frequently used approaches for this goal, we use panel estimation in order to analyse the factors that determine lending rates and interest rate spreads in the banking system in Macedonia. The data used here are primarily determined by the theoretical and empirical consideration of the literature. The dataset used in our research is also affected by data availability for particular variables.

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The panel consists of commercial banks in Macedonia. We use quarterly data in order to maximise the number of observations, but this is also affected by the frequency of data collection.[9] The database of the National Bank of the Republic of Macedonia is the source of all the data, with the exception of EURIBOR data, which are taken from the Deutche Bundesbank.

The entire data base covers the first quarter of 2001 to the second quarter of 2009, as the maximum possible sample, which is determined primarily by the availability of data on interest rates by banks, as well as of some other data. For this period, data exist for 27 banks, which have been functioning throughout the entire period or in some parts of the period. However, there is a lack of data for a few banks, which are established later than 2001, merged with or were acquired by other banks, went bankrupt in the meantime or did not perform typical banking activities. That is, several of these banks have functioned over a relatively short time period and are relatively unimportant from the point of view of the entire banking system. Therefore, we decided to exclude these banks from the analysis, while at the same time trying not to reduce the representativeness of the sample by doing so[10].

Table 1
Indicators of the banking system and the banks in the sample

	Date	Number of banks	Total assets (in mil. denars)	Total deposits (in mil. denars)	Equity (in mil. denars)	Total loans (in mil. denars)	Highly liquid assets (in mil. denars)	Number of employees
Entire banking system	31.03.2001	22	74,922	40,064	19,153	37,288	9,351	3,813
Banks in the sample	31.03.2001	14	65,773	37,190	15,083	31,433	8,379	3,404
Coverage of the sample (%)		63.6	87.8	92.8	78.7	84.3	89.6	89.3
Entire banking system	30.06.2009	18	248,345	176,555	30,735	170,698	38,267	6,094
Banks in the sample	30.06.2009	16	239,206	172,388	28,259	166,591	36,942	5,830
Coverage of the sample (%)		88.9	96.3	97.6	91.9	97.6	96.5	95.7

After the transformation, the sample is unbalanced, and consists of 17 commercial banks for the period from the first quarter of 2001 until the second quarter of 2009 (14 banks at the beginning and 16 at the end of the period), or a total of 558 available observations. Within the sample, 13 banks are covered during the entire period, whereas 4 banks are covered only during one part of the period. The banks in the sample are representative of the entire banking system from the point of view of the main variables, both at the start and at the end of the period (Table 1). In addition, the banks included in the sample also enable a good coverage of the banking system in Macedonia from the point of view of the market share of banks according to total assets (Table 2).

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[9] When the original frequency of the data is monthly (e.g. interest rates), quarterly data are calculated as an average of monthly data.
[10] If the goal was to analyse the reasons why banks merge or go bankrupt, the exclusion of these banks from the sample would be methodologically wrong.

Table 2
Size of banks in the banking system and in the sample (market share according to total assets)

	Date	Number of banks	Total market share by bank assets (%)	Banks with market share above 10%	Banks with market share between 2% and 10%	Banks with market share below 10%
Entire banking system	31.03.2001	22	100	2	9	11
Banks in the sample	31.03.2001	14	87.8	2	7	5
Entire banking system	30.06.2009	18	100	3	8	7
Banks in the sample	30.06.2009	16	96.3	3	7	6

The choice of variables in our study was mostly affected by the approach in other empirical studies, as well as by determinants suggested by the literature. Bearing in mind the goal of the study, we use the lending rate and the interest rate spread as dependent variables. The independent variables include the deposit rate (as a main cost of banks), and other variables which are bank-specific: total assets, market share according to total assets, non-performing loans, liquidity, capital adequacy, return on assets, operating costs and the share of foreign capital. Changes in the macroeconomic environment are captured by the interest rate on NBRM central bank bills and 3-month EURIBOR. A dummy variable was also added to capture the change in the methodology of calculating interest rates in 2005. (Appendix 1 contains a detailed description of the construction of variables).

One of the advantages of panel estimation is the possibility of using data with variation both in the cross-section and in the time dimension. This enables better performance during estimation since this variation eliminates part of the disadvantages of simple time series or cross-section analyses. The variation in the entire sample can be seen in Table 3, whereas Appendix 3 contains basic statistics by groups of banks according to their size. Certain differences can be noticed in bank size and in the characteristics of particular variables by bank, which means that we might expect heteroskedasticity in the econometric estimation.

Table 3
Basic statistics for the entire banking system (by banks)

	lend_rate	depos_rate	spread	assets	share	npl	liquidity	capital_ad	roa	policy	euribor	operating	foreign
mean	0.138	0.039	0.100	8,493	0.06	0.14	0.56	0.46	0.00	0.08	0.03	84.3	0.54
median	0.126	0.033	0.090	2,753	0.02	0.10	0.35	0.35	0.01	0.07	0.03	34.6	0.58
minimum	0.060	0.007	0.027	348	0.00	0.00	0.06	0.10	-0.64	0.05	0.01	5.8	0.00
maximum	0.300	0.177	0.259	64,012	0.34	0.84	9.27	3.43	0.18	0.17	0.05	485	1.00
standard deviation	0.047	0.026	0.042	13,120	0.08	0.15	0.90	0.38	0.06	0.03	0.01	110	0.41
nr. of observations	558	558	558	557	557	557	557	557	557	578	578	557	557

The methodology used in our study is in accordance with the dominant approaches in the literature regarding panel estimation. We use fixed effects as our main approach[11]. This method takes into account differences between cross-sections (banks) by allowing the constant term to differ by banks, whereas the coefficients on

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[11] Robust standard errors are used in the estimation.

the explanatory variables are the same for all banks, and it assumes that independent variables are correlated with the unobserved effects. Fixed effects are theoretically preferred for these types of samples, since the sample is not a random draw from a wider population, but is pre-determined. In addition, in order to enrich the analysis, we also tried random effects estimation. We use feasible GLS, which assumes heteroskedasticity, without correlation between cross-sections[12]. It is assumed that there is an AR(1) autocorrelation within cross-sections and that the coefficient of this auto-regressive process is common across all cross-sections.

Besides the theoretical preference for fixed effects, the Hausman specification test also rejects the use of random effects. Therefore, the discussion of the results focuses mainly on fixed effects results. However, there are no big differences among results according to the two methods, except for the significance of some of the variables, which indirectly indicates that the results are fairly stable.

5. Empirical results

The results from the panel estimation of lending rates and interest rate spreads in the banking system in Macedonia generally confirm the previous non-quantitative assessments of the main factors that caused relatively high lending rates and wide interest rate spreads for a longer time period. The sensitivity of the results for some variables to a change in the estimation method or to a change in the combination of variables included in the estimation indicates that one needs to be careful when interpreting the intensity of the influence of particular factors on lending rates and interest rate spreads. However, in general, the results are fairly stable and they are mostly in accordance with expectations. Therefore, this study could be used as an indicator of the direction of influence of certain factors. In addition, its results could help draw some conclusions regarding the necessary changes in the banking system, which would potentially cause lower rates and narrower spreads, that is better access to financing through banks and greater efficiency in banking operations.

5.1 Factors that determine lending rates

The factors affecting lending rates were initially examined by defining a set of variables which are directly related to bank balance sheets and bank characteristics, and which are expected to have a strong influence on lending rates, such as: deposit rates, bank assets, market share, the share of non-performing loans in total credit exposure, bank liquidity, capital adequacy, operating costs and the share of foreign capital. All the variables enter the regressions with one lag, which is recommended both from the statistical (avoiding endogeneity problems) and from the economic point of view (the existence of a certain delay in the occurrence of effects of a particular change).

Bearing in mind the history of high share of non-performing loans in the balance sheet of banks in Macedonia, they were usually treated as one of the main determinants of high lending rates. Therefore, after initially finding an insignificant

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[12] The panel would have to be balanced in order to be able to take into account the contemporaneous correlation between cross-sections.

effect of this variable[13], we modified the specification in order to analyse the probable prolonged transmission of the costs of bad loan portfolio to the interest rates. The new specification includes this variable with up to 4 time lags (Specification 1 in Table 4), which could be explained by the slower adaptation of banks' interest rate policy to changes in this variable. Formal statistical tests for the joint significance of these coefficients indicate that the lags are jointly significant and positive. Therefore, the time lags were maintained in the following specifications as well, when the coefficients are again jointly significant.

The inclusion of the effects of monetary policy and of structural and macroeconomic factors is done with two additional groups of variables. The first group includes the central bank policy rate and the foreign interest rate (specification 2), which causes a certain worsening of the results. Then, the effect of the methodological change of the calculation of interest rates in 2005 was analysed by adding a dummy variable (specification 3). This is the preferred specification, since it includes the variables that are recommended in the literature, and the results are mostly in accordance with expectations. The results of feasible GLS estimation are shown in the last specification, which corresponds to the preferred version with fixed effects. As noted before, FGLS estimation assumes heteroskedasticity and AR(1) autocorrelation within cross-sections, with a common auto-regressive coefficient for all cross-sections.

In all the specifications, statistical tests show that the variables used are jointly very significant (the p-value of the F-test, that is the χ^2 test, is less than 0,001). In addition, in all the specifications with fixed effects, R^2 adjusted shows that the independent variables explain most of the changes of lending rates.

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[13] This specification is not showed in the results.

Table 4
Results of the panel estimation of lending rates (dependent variable - lending rates; standard errors are given in brackets)

	1 fixed effects	2 fixed effects	3 fixed effects	4 GLS
deposit rate (-1)	0.585***	0.322***	0.314***	0.200***
	(0.069)	(0.079)	(0.072)	(0.041)
logarithm of total bank assets (-1)	-0.049***	-0.035***	-0.018***	-0.027***
	(0.006)	(0.006)	(0.006)	(0.003)
market share (-1)	0.588***	0.482***	0.314***	0.213***
	(0.100)	(0.089)	(0.085)	(0.040)
non-performing loans (-1)	-0.042	-0.007	-0.001	-0.025
	(0.031)	(0.028)	(0.026)	(0.015)
non-performing loans (-2)	0.010	0.009	0.009	0.023*
	(0.039)	(0.036)	(0.035)	(0.014)
non-performing loans (-3)	0.002	-0.005	-0.005	0.014
	(0.041)	(0.035)	(0.035)	(0.013)
non-performing loans (-4)	0.082***	0.055**	0.048**	0.045***
	(0.031)	(0.027)	(0.024)	(0.012)
liquidity (-1)	0.001	0.002	0.005*	0.000
	(0.003)	(0.003)	(0.003)	(0.002)
capital adequacy (-1)	-0.003	-0.021***	-0.032***	-0.011**
	(0.008)	(0.007)	(0.007)	(0.005)
rate of return on average assets (-1)	0.099***	0.108***	0.111***	0.036**
	(0.023)	(0.021)	(0.021)	(0.014)
logarithm of operating costs (-1)	0.004	0.000	-0.002	0.001
	(0.006)	(0.006)	(0.005)	(0.002)
share of foreign ownership(-1)	-0.021***	-0.011*	-0.005	0.001
	(0.007)	(0.007)	(0.006)	(0.004)
policy rate of NBRM (-1)		0.494***	0.420***	0.209***
		(0.056)	(0.052)	(0.026)
3-month EURIBOR (-1)		0.221	0.209*	0.201**
		(0.135)	(0.123)	(0.088)
dummy variable 2005			-0.026***	-0.012***
			(0.003)	(0.002)
constant term	0.469***	0.339***	0.241***	0.306***
	(0.033)	(0.034)	(0.034)	(0.025)
Observations	531	531	531	531
Number of banks	17	17	17	17
R-squared adjusted	0.569	0.645	0.696	
F	57.38	65.43	74.89	
Prob>F	0.00	0.00	0.00	
chi2				621.0
Prob>chi2				0.00
ll	1211	1264	1306	1584
rho	0.515	0.545	0.627	0.693
corr	-0.443	-0.203	-0.163	
sigma_u	0.0262	0.0252	0.0277	
sigma_e	0.0254	0.0231	0.0213	

*Significance level of 10%, ** Significance level of 5%, *** Significance level of 1%.

The deposit rate, as a cost of the basic sources of financing of bank activities, is statistically very significant in explaining lending rates, regardless of the method and

independent variables used. However, the intensity of its effect is considerably less than what was expected, which would be close to 1; instead it ranges between 0.2 and 0.6. According to the preferred version, an increase in the deposit rate of 1 percentage point causes an increase in the lending rate of 0.3 percentage points. The incomplete transmission of deposit rates into lending rates could be partially explained by the degree of competition. Thus, the increase in deposit rates often reflects the strategy of a bank to maintain or increase its market share regarding deposits. Due to the need to maintain its position in the market for credit, the change in deposit rates is only incompletely transmitted to lending rates. The incomplete transmission could also be explained by the compensation of the rise of costs through the adaptation of other categories of bank balance sheets. On the other hand, the low coefficient of the deposit rate as a cost for banks could also reflect the fact that they are not the only source of bank financing. This explanation is based on the results which show a relatively strong influence of central bank bills as opportunity costs, as well as the somewhat weaker influence of the foreign interest rate as an indicator of financing from abroad.

Total assets or bank size should in principle reflect "economies of scale", and hence a rise in bank assets should contribute towards lower lending rates. At the same time, the increase in assets could also mean higher competition and potentially higher bank efficiency, which would contribute towards a downward adjustment of interest rates. The results follow this economic logic. The coefficient of bank assets is negative and shows that a doubling of assets causes a fall in the lending rate of 1.2 percentage points (in the preferred specification). The coefficient on total assets is negative and statistically very significant in all specifications, and the effect is even bigger than in the preferred specification.

Market share is an indicator of the market power of the bank and its ability to achieve higher income by maintaining higher lending rates. The panel estimation of lending rates confirms this is true in the case of Macedonia. Results show that the coefficient of market share is always positive and statistically very significant. According to the preferred specification, an increase in market share of 1 percentage point would cause an increase in lending rates by 0.3 percentage points, ranging from 0.2 to 0.6 percentage points in the various specifications. These results suggest that the further increase in concentration in the banking sector in Macedonia would cause the cost of credit to rise.

Non-performing loans, defined as the share of credit exposure classified in categories of risk C, D and E in the total credit exposure, were expected to have a strong influence on the process of formulation of lending rates ex ante. Namely, the recognition of impairment losses on the basis of a relatively high share of non-performing loans in the total loan portfolio means higher costs for banks. Consequently, it is expected that they would be included in the interest rates. On the basis of coefficients in the preferred specification, the cumulative effect of this variable indicates that, in the long term, an increase in the share of "bad loans" in the total loan portfolio of 1 percentage point would result in an increase in lending rates of 0.05 percentage points. The fact that in all the specifications the coefficients are statistically significant and positive only at the fourth lag confirms the prolonged effect of this factor on lending rates, in the expected direction. In order to analyse whether the behaviour of big banks regarding "bad loans" differs from the behaviour of the other banks in the sample, an interaction variable was included, constructed

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as the product of "bad loans" and a dummy variable for the three big banks. However, the coefficient of the interaction variable proved insignificant, and therefore these results are not shown.

Contrary to expectations of an inverse relationship between *bank liquidity* and lending rates, liquidity was insignificant in almost all specifications. It is statistically significant only in the preferred specification, but the coefficient is positive, and hence does not correspond to previous expectations, whereas the size of the coefficient is almost negligible. One of the possible explanations for this relationship is the low return on highly liquid assets. That is, banks with higher amounts of highly liquid assets try to compensate for the lower return from this through higher interest income. On the other hand, if liquidity is disaggregated into the liquidity of big banks and of other banks (Appendix 3), it can be seen that big banks have a considerably lower share of liquid assets in total deposits, which suggests that the effect of liquidity on interest rates might be partially related to bank size.

Capital adequacy is generally expected to be inversely related to lending rates, as banks with higher capital adequacy have the possibility of maintaining an interest rate policy with lower lending rates. In other words, it is possible that the higher capital adequacy is a result of the lower size of bank assets, whose growth could be achieved with lower lending rates, that is with being more competitive in the credit market. The higher capital adequacy also means potential possession of additional sources of financing the increase in credit activity, and thus a possibility for lower price of loans. In our case, the results on capital adequacy are in accordance with these interpretations. This variable has an expected negative effect and is statistically very significant in all the specifications (except in the first one). However, the effect of capital adequacy is relatively low (between -0.03 and -0.01). According to the preferred specification, an increase in capital adequacy of 1 percentage point would result in a decrease in the lending rate of 0.03 percentage points.

As part of the variables directly related to the balance sheets of the banks, we also used the *rate of return on average assets (ROAA)* as an indicator of bank profitability[14]. Its coefficient was statistically significant in all the specifications, but the direction of the effect does not correspond to expectations. It is expected that an increase in bank profitability would create the potential for a lower price of loans and thus for a further increase in the volume of activities, that is higher market share in the credit market. However, our estimates indicate a positive influence of ROAA on lending rates, with the size of the effect being in the range of 0.04 to 0.1. Therefore, this deviation of results from the economic intuition requires careful interpretation. A possible cause of this relationship would be the lack of competition in the banking system, with banks being able to increase their lending rates even in circumstances of rising profitability.

We also analysed the effect of *operating costs,* which are expected to play an important role in the interest rate policy of banks. Nevertheless, operating costs were

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[14] It was pointed out to us that including profitability in regressions might introduce endogeneity. However, there is a negligible change of results if profitability is removed (both in the estimation of lending rates and interest rate spreads). We believe that this reaction indicates that there are no serious consequences arising from potential endogeneity on these grounds. In addition, in some parts of the period analysed, a considerable part of bank profitability in Macedonia was a result of factors not related to interest rates (i.e. non-interest income). Therefore, we decided to keep profitability in our estimations.

insignificant in all the specifications, which is contrary to theoretical expectations. In addition, we tried to assess the effect of the *share of foreign ownership* on lending rates, which was expected to be negative, under the hypothesis that foreign banks operate more efficiently. This assumption is confirmed only in the first two specifications, whereas in the remaining ones, including the preferred specification, the effect of foreign ownership is statistically insignificant.

The pass-through effect, that is the transmission of the effect of the change in the central bank policy rate to bank interest rates is usually analysed through other econometric techniques, such as VAR and VECM. However, in order to analyse the effect of variables related to macroeconomic management, we decided to include the *policy rate of the National Bank of the Republic of Macedonia (central bank bills' rate)* in the estimation. The policy rate also captures the macroeconomic environment, which affects its determination. Furthermore, in circumstances of a fixed exchange rate regime and a relatively liberalised regime of capital mobility, it is expected that the foreign interest rate will have a considerable effect. This is particularly due to the fact that, as part of the loan portfolio of banks in Macedonia, there is a high share of loans with a foreign exchange clause and loans in foreign currency, whose price should mostly depend on changes in the foreign interest rate. Therefore, in order to better capture the effect of macroeconomic factors, besides the interest rate of central bank bills, we also use the *3-month EURIBOR* as a proxy for foreign interest rates.[15] The coefficient of the NBRM policy rate is very significant in all the specifications where it is included, and shows a relatively strong influence ranging between 0.2 and 0.5. This means that the increase in the interest rate on central bank bills for 1 percentage point causes an increase in lending rates of 0.4 percentage points in the following quarter (according to the preferred specification). This effect is in the same direction with expectations, but its intensity is considerably stronger than what is usually considered to be the case in Macedonia. The results for the 3-month EURIBOR are somewhat unstable, with statistical significance being sensitive to the estimation method and the combination of variables. In the preferred specification, the coefficient is statistically significant, and shows that an increase in the EURIBOR of 1 percentage point causes an increase in the lending rate of 0.2 percentage points, which is in accordance with expectations.

We also tried to correct for the effect of the *change in the methodology of calculating interest rates in 2005* through the introduction of a dummy variable. The dummy is significant in both specifications in which it is included, and shows that the lending rate is somewhat lower after 2005 due to the methodological change. Furthermore, in order to analyse the possible effect of other factors, which are not explicitly included, we also included *year dummies.* Nevertheless, they were statistically insignificant, with a relatively limited effect on the results for other variables, so this specification is not shown.

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[15] In theory, the monetary policy of a country with a fixed exchange rate regime should follow the monetary policy in the anchor-country. Therefore, it was initially expected that the domestic policy rate would be highly correlated with the foreign interest rate. However, in practice the correlation between them is very low, which enables the inclusion of both variables in the estimation.

5.2 Factors determining interest rate spreads

The next step in the research was the panel estimation of interest rate spreads, defined as the difference between lending and deposit rates, that is as an ex ante spread. Spreads could be defined in two ways: ex ante spreads (the difference between contracted lending and deposit rates) and ex post spreads (the difference between realised interest income and interest costs). Both approaches have their advantages and disadvantages, but we decided to use the ex ante spread because we were aiming to analyse the factors that influence the interest rate policy of the banks. The estimation method and the specification of variables included in the panel estimation of the interest rate spread are in essence the same as those used in the estimation of lending rates (Table 5), with the exception of two elements: a) the deposit rate is no longer used as an independent variable, since it is an input in the calculation of the interest rate spread, and b) it is not expected that the central bank bills' rate and the foreign rate would directly affect the spread, bearing in mind the fact that they should affect both lending and deposit rates, that is, the interest rate spread should not reflect monetary effects. Therefore, a new variable was constructed as the difference between the central bank policy rate and the EURIBOR rate (hereinafter denoted as the interest rate differential). In order to facilitate better comparison, the same specifications used for lending rates will be presented, and the third specification is again the preferred one. It can be noticed that most of the variables are now insignificant, particularly with GLS estimation. The variables are again jointly significant in all the specifications (p-value lower than 0.001), whereas the adjusted R^2 shows that the variables used in the fixed effects specifications explain most of the variations of the interest rate spread.

Table 5
Results of the panel estimation of interest rate spreads (dependent variable - interest rate spreads; standard errors are given in brackets)

	1	2	3	4
	fixed effects	**fixed effects**	**fixed effects**	**GLS**
logarithm of total bank assets (-1)	-0.046***	-0.030***	-0.013*	-0.014***
	(0.007)	(0.006)	(0.007)	(0.004)
market share (-1)	0.506***	0.367***	0.202**	0.031
	(0.118)	(0.097)	(0.092)	(0.050)
non-performing loans (-1)	-0.072**	-0.051*	-0.048	-0.026
	(0.033)	(0.030)	(0.030)	(0.018)
non-performing loans (-2)	0.011	0.010	0.010	0.014
	(0.043)	(0.039)	(0.039)	(0.017)
non-performing loans (-3)	0.020	0.023	0.022	0.028*
	(0.045)	(0.043)	(0.043)	(0.017)
non-performing loans (-4)	0.060*	0.033	0.023	0.004
	(0.033)	(0.031)	(0.029)	(0.015)
liquidity (-1)	0.001	0.004	0.007**	0.004*
	(0.003)	(0.003)	(0.003)	(0.003)
capital adequacy (-1)	0.004	-0.004	-0.017**	0.006
	(0.008)	(0.008)	(0.009)	(0.006)
rate of return on average assets (-1)	0.075***	0.087***	0.087***	0.017
	(0.027)	(0.024)	(0.024)	(0.019)
logarithm of operating costs (-1)	0.003	0.001	-0.000	0.006*
	(0.007)	(0.007)	(0.007)	(0.003)
share of foreign ownership(-1)	-0.031***	-0.021***	-0.014*	0.000
	(0.008)	(0.008)	(0.007)	(0.005)
interest rate differential (-1)		0.439***	0.375***	0.164***
		(0.051)	(0.049)	(0.032)
dummy variable 2005			-0.028***	-0.020***
			(0.003)	(0.003)
constant term	0.448***	0.302***	0.197***	0.177***
	(0.036)	(0.036)	(0.038)	(0.032)
Observations	545	545	545	545
Number of bank	17	17	17	17
R-squared adjusted	0.391	0.492	0.560	
F	39.31	47.66	58.91	
Prob>F				
chi2				201.7
Prob>chi2				
ll	1178	1228	1268	1511
rho	0.458	0.431	0.513	0.695
corr	-0.506	-0.230	-0.173	
sigma_u	0.0263	0.0227	0.0249	
sigma_e	0.0286	0.0261	0.0243	

*Significance level of 10%, ** Significance level of 5%, *** Significance level of 1%.

Bank assets again have a stable effect, and are statistically significant in all specifications. The coefficient on this variable has the expected sign, indicating that higher assets cause a narrowing of the interest rate spread, so banks with higher growth can become more competitive. According to the preferred specification, the doubling of assets causes a decrease in the interest rate spread of 0.9 percentage points. *Market share* is statistically significant in all the specifications with fixed

effects, with the expected sign. An increase in the market share of 1 percentage point causes an increase in the spread of between 0.2 and 0.5 percentage points. Further, *liquidity, capital adequacy* and *operating costs* are significant only in some of the specifications, and their effect is in any case relatively small. Unlike the case of lending rates, the effect of *non-performing loans* on the interest rate spread is insignificant, and this is also true for the joint effect of time lags. The relation between ROAA as an indicator of *bank profitability* and the interest rate spread is positive, and shows that profitable banks increase their spreads, which could again be interpreted as an indicator of insufficient competition in the banking system. Further, the effect of the *share of foreign capital* indicates that spreads fall as foreign ownership rises, which is in line with what would be expected. However, the effect of this variable is relatively weak. In the preferred specification, an increase in the share of foreign capital of 10 percentage points causes a narrowing of the spread by 0.1 percentage points. The *interest rate differential* appears to be an important element in determining the interest rate spread. Its coefficient was statistically significant and positive in all specifications and methods, showing that the increase of the differential causes wider interest rate spreads. In the preferred specification, an increase in the differential between the domestic the foreign rate of 1 percentage point causes an increase in the interest rate spread of 0.4 percentage points. The economic interpretation of these results is not straightforward, because of the various possible scenarios. One scenario would be that the differential increases because of the increase of the domestic policy rate, which stimulates investment in central bank bills and thus causes higher lending rates and higher spreads and lowers the supply of credit. On the other hand, the widening of the differential because of a fall in foreign interest rates could mean that there is a larger effect on the lowering of deposit rates relative to the possible fall of lending rates, which again widens the interest rate spread. Despite the various channels of transmission, the research shows that the interest rate differential has a very important role in the formulation of banks' interest rate policy. Finally, similar to the lending rates, *the methodological change in 2005* has a statistically significant influence on the interest rate spread.

6. Decomposition of the interest rate spread

Besides the panel estimation of interest rate spreads, we also carried out a decomposition of the interest rate spread into its components. This is a relatively simple method of identifying the factors that determine the interest rate spread. The decomposition is carried out by disaggregating the spread into its cost components in order to measure their relative contribution to the interest rate spread. The following formula is used for the decomposition:

$$i^l - i^d = o + l + i^d r/(1-r) + d + p + \tau \left[p - o - l - i^d r/(1-r) - d \right] \tag{1}$$

where,

i^l - lending rate;
i^p - deposit rate;

o - the relation between operating costs and total gross loans (operating costs are weighted with the share of total gross loans in total assets);
l - the relation between total impairment losses and total gross loans;
r - reserve requirement rate;
d - relation between insurance premiums on deposits and total gross loans;
τ - profit tax rate;
p - profit margin of the banks' credit activity (calculated as a residual after the calculation of the other components).

The analysis of the results (Table 6) shows that, in the first half of 2008 and 2009, the interest rate spread is not sufficient to cover the cost components, implying a negative profit margin on the banks' credit activity. The negative profit margin on the banks' credit activity is a result of several related factors: 1) growth of operating costs; 2) decelerating credit activity; 3) worsening loan portfolio quality, i.e. the increased impairment losses. Despite the higher lending rates, these factors cause a narrowing of the interest rate spread in the last year (30.06.2008-30.06.2009) to be accounted for by the fall in the profit margin of the banks' credit activity.

Table 6
Decomposition of the interest rate spreads in Macedonia, for the first half of 2008 and of 2009

Decomposition of the interest rate spread	30.06.08		30.06.09	
	in percentage points	Percentage share of the components in the interest rate	in percentage points	Percentage share of the components in the interest rate spread
Interest rate spread	**5.18**	**100.0%**	**4.77**	**100.0%**
Cost components (factors)	**5.53**	**106.7%**	**5.77**	**121.0%**
Operating costs	3.22	62.0%	3.40	71.2%
Impairment losses	1.39	26.8%	1.50	31.5%
Deposit insurance premium	0.49	9.5%	0.37	7.8%
Reserve requirements	0.43	8.3%	0.50	10.6%
Profit margin of the banks' credit activity, before taxation	**-0.34**	**-6.7%**	**-1.00**	**-21.0%**
Profit taxes	0.00	0.0%	0.00	0.0%
Profit margin of the banks' credit activity	-0.34	-6.7%	-1.00	-21.0%

Source: NBRM

As far as cost components are concerned, the largest component of the interest rate spread is operating costs, followed by impairment losses. When compared on an annual basis, the share of operating costs and impairment losses in the interest rate spread has increased by 0.2 and 0.1 percentage points, respectively. The comparison of the contribution of operating costs and impairment losses to the interest rate spread in other countries (Figure 6) shows that the Republic of Macedonia is among the countries which have a high share of these two cost components in the creation of the interest rate spread.

Figure 6
Operating costs/gross loans (left) and Impairment losses/gross loans (right)
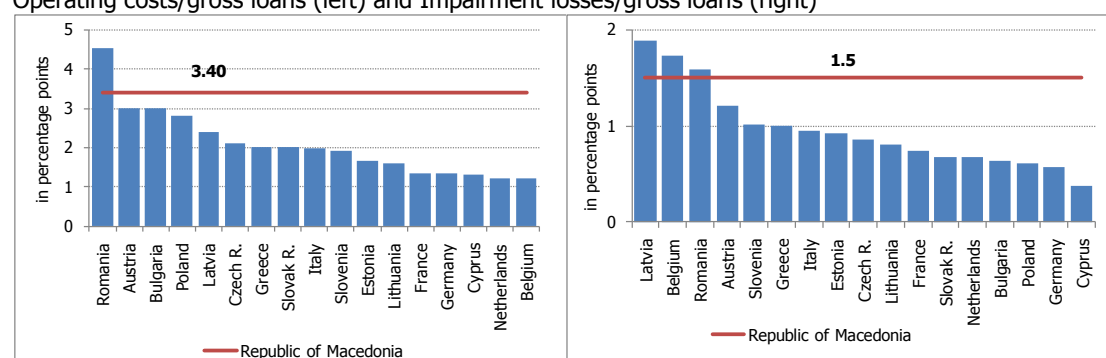
Source: NBRM calculations based on data from banks and ECB (2009).
Note: The data for all countries are calculated for 2008, with exception of data for the Republic of Macedonia, which are calculated for the first half of 2009.

7. Conclusion

The interest rate policy of banks in Macedonia was for a long time assessed as a policy of high and non-flexible interest rates. The identification of the causes of the maintenance of high lending rates and wide interest rate spreads was so far based on qualitative assessments. This took the form of following the dynamics of particular categories, which were generally considered to have an effect on interest rates, and thus were used to draw more general conclusions. The factors most frequently mentioned as reasons for high interest rates were the low level of savings and consequently the low supply of loans, insufficient competition in the banking system, the unsatisfactory efficiency and profitability of commercial banks, uncertainty in the economic environment, the inherited low quality of loan portfolios and institutional constraints. The trend decrease in the price of loans and the narrowing of interest rate spreads in recent years indicate a gradual elimination of the constraining influence of these factors. In addition, it emphasised the need for a more quantitative approach in the research of factors that influence the interest rate policy of the banks.

The main conclusion of this study is related to the results regarding the size of bank assets and market share, which indicate a considerable use of market power by banks in determining their lending rates and interest rate spreads. These variables could be treated as key variables, which have the most important effect, and whose results are very stable across various specifications. According to the results, an increase in bank size and a decrease in the market share of certain banks (i.e. higher competition) are factors which could cause further falls in lending rates and a narrowing of interest rate spreads. Bearing in mind the current structure of the banking system, that is the relatively high concentration and the relatively large number of banks, the results point towards the need for consolidation of the banking system through mergers between and/or acquisitions of smaller banks. This would contribute towards the creation of bigger banks, which would increase competition and would contribute towards lower interest rates and narrower interest rate spreads.

The decrease in the costs of financing (deposit rates) would certainly cause a decrease in the price of loans, although this factor has a relatively weaker influence than what would be expected. In addition, the rise in the central bank bill rate and EURIBOR (as both an opportunity cost and a real cost, respectively) has a considerable effect in the direction of higher lending rates, which is mainly in accordance with expectations. In addition, in accordance with previous research, an improvement in the quality of the loan portfolio also proved to be a relevant factor influencing banks' interest rate policy. Capital adequacy as an additional indicator of the quality of banks' balance sheets also enables a more aggressive interest rate policy of banks, that is lower lending rates and narrower interest rate spreads.

On the other hand, the results show no effect of operating costs on lending rates and interest rate spreads. These results run contrary to previous research, but also contrary to the decomposition of interest rate spreads, which indicates that cost elements are their main components. This indicates that there is a considerable space in future research for the introduction of alternative cost indicators, which would provide a better explanation for interest rates and interest rate spreads.

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Appendices

Appendix 1

Description and construction of variables (All variables are in percents, unless noted otherwise)

lend_rate	**lending rate** - quarterly average of monthly interest rates, by banks. In accordance with available data for particular periods, the calculation of the lending rate is carried out in the following way: • the interest rate on denar loans is used for 2001; • for the 2002-2004 period, the aggregate interest rate is used, calculated as a weighted average of the available interest rates on denar loans (enterprises and households) and interest rates on total foreign exchange loans (all maturities and sectors); and • for the 2005-2009 period, the data used are in accordance with the New Methodology of NBRM for the Calculation of Banks' Interest Rates, i.e. the interest rate data are related to all currencies, maturities and sectors.
depos_rate	**deposit rate** - quarterly average of monthly interest rates, by banks. In accordance with available data for particular periods, the calculation of the deposit rate is carried out in the following way: • the interest rate on denar deposits is used for 2001; • for the 2002-2004 period, the aggregate interest rate is used, calculated as a weighted average of interest rates on denar time deposits of households with a maturity of 1-3 months without a foreign exchange clause and interest rates on total foreign currency deposits of households; and • for the 2005-2009 period, the data used are in accordance with the New Methodology of NBRM for the Calculation of Banks' Interest Rates, i.e. the interest rate data are related to all currencies, maturities and sectors.
spread	**interest rate spread** - the difference between the lending and the deposit rate in the quarter
assets	natural logarithm of **total assets** of the bank
share	**market share** according to total assets - total assets of the bank divided by total assets of the entire banking system
npl	**non-performing loans** - share of credit exposure classified in categories of risk C, D and E in total credit exposure. Credit exposure is consisted of: regular loans, non-performing loans, regular interest, other claims and off-balance sheet items
liquidity	**share of highly liquid assets in total deposits of non-financial entities**. The highly liquid assets are a sum of: cash and balances with NBRM, NBRM central bank bills, short-term placements in government securities and correspondent accounts with foreign banks. Total deposits of non-financial entities are a sum of: deposits of enterprises, households, government and other clients (including non-profit institutions serving households and non-residents - non-financial entities), without deposits from banks
capital_ad	**coefficient of capital adequacy** - own funds divided by risk-weighted assets, which include credit risk - weighted assets and other risks - weighted assets

roa	**rate of return on average assets (ROAA)** - calculated on quarterly basis as profit (or loss) divided by average assets. The profit (or loss) is a cumulative flow during one year. Average assets are an arithmetic mean of the size of assets on the date for which the rate is being calculated and the size of assets at the end of the previous year. In order to get the rate on the annual level, the quarterly rate is multiplied by four and divided by the number of past quarters in the year. That is, on 31.03 it is multiplied by 4; on 30.06 it is multiplied by 2; on 30.09 it is multiplied by 1.333 (4/3) and on 31.12 it is multiplied by 1.
policy	**average quarterly interest rate of central bank bills** - calculated as a weighted average of monthly interest rates of central bank bills for all maturities
euribor	**average quarterly 3-month EURIBOR** - calculated as an average of average monthly rates of 3-month EURIBOR
pol_eur	**interest rate differential** - calculated as a difference between the interest rate on central bank bills and the 3-month EURIBOR in the quarter
operating	natural logarithm of **operating costs** (which are consisted of: costs of employees, depreciation, material costs, costs for services, costs for representation and business trips, deposit insurance premiums)
foreign	**share of foreign ownership** (foreign shareholders) in the total number of issued shares
dum2005	**dummy variable** for the introduction of the new Methodology of NBRM for the Calculation of Banks' Interest Rates in 2005 (dum2005=1 since 2005, 0 otherwise)

Appendix 2

Correlation matrix of variables in the panel estimation

	lend_rate	depos_rate	spread	assets	share	npl	liquidity	capital_ad	roa	operating	policy	euribor	foreign
lend_rate	1												
depos_rate	0.46	1											
spread	**0.83**	-0.11	1										
assets	-0.47	-0.14	-0.44	1									
share	-0.21	-0.09	-0.17	**0.85**	1								
npl	0.55	0.50	0.30	-0.33		1							
liquidity	0.22		0.27	-0.42	-0.24	0.17	1						
capital_ad	0.28		0.32	**-0.62**	-0.42	0.18	0.44	1					
roa	-0.17	-0.11	-0.13	0.24	0.11	-0.49	-0.15		1				
operating	-0.33		-0.32	**0.92**	**0.85**	-0.14	-0.30	**-0.63**		1			
policy	0.53	0.34	0.38	-0.17		0.30		0.23		-0.17	1		
euribor		0.35	-0.21				0.12					1	
foreign	-0.17	-0.25				-0.31	0.21	0.26		0.09	-0.16		1

*Only the correlation coefficients with a significance level of less than 0.05 are shown. Coefficients higher than 0.6 are shown in **bold**.

Appendix 3
Summary statistics of variables by groups of banks (all banks, group of 3 biggest banks, and the group of other banks)

All banks

	lend_rate	depos_rate	spread	assets	share	npl	liquidity	capital_ad	roa	policy	euribor	operating	foreign
mean	0.138	0.039	0.100	8,493	0.06	0.14	0.56	0.46	0.00	0.08	0.03	84.3	0.54
median	0.126	0.033	0.090	2,753	0.02	0.10	0.35	0.35	0.01	0.07	0.03	34.6	0.58
minimum	0.060	0.007	0.027	348	0.00	0.00	0.06	0.10	-0.64	0.05	0.01	5.8	0.00
maximum	0.300	0.177	0.259	64,012	0.34	0.84	9.27	3.43	0.18	0.17	0.05	485	1.00
standard deviation	0.047	0.026	0.042	13,120	0.08	0.15	0.90	0.38	0.06	0.03	0.01	110	0.41
nr. of observations	558	558	558	557	557	557	557	557	557	578	578	557	557

3 biggest banks

	lend_rate	depos_rate	spread	assets	share	npl	liquidity	capital_ad	roa	policy	euribor	operating	foreign
mean	0.119	0.034	0.084	32,107	0.22	0.13	0.20	0.17	0.01	0.08	0.03	282	0.64
median	0.101	0.028	0.079	29,870	0.24	0.10	0.16	0.15	0.02	0.07	0.03	317	0.73
minimum	0.080	0.012	0.033	5,679	0.08	0.03	0.06	0.10	-0.07	0.05	0.01	41.4	0.06
maximum	0.265	0.115	0.170	64,012	0.34	0.68	0.77	0.32	0.04	0.17	0.05	485	0.94
standard deviation	0.039	0.025	0.034	14,970	0.06	0.12	0.14	0.05	0.02	0.03	0.01	114	0.32
nr. of observations	102	102	102	102	102	102	102	102	102	102	102	102	102

Other banks

	lend_rate	depos_rate	spread	assets	share	npl	liquidity	capital_ad	roa	policy	euribor	operating	foreign
mean	0.143	0.040	0.103	3,199	0.02	0.15	0.64	0.52	-0.01	0.08	0.03	40	0.52
median	0.131	0.035	0.094	2,064	0.02	0.10	0.39	0.39	0.01	0.07	0.03	28.2	0.43
minimum	0.060	0.007	0.027	348	0.00	0.00	0.08	0.11	-0.64	0.05	0.01	5.8	0.00
maximum	0.300	0.177	0.259	14,659	0.06	0.84	9.27	3.43	0.18	0.17	0.05	209	1.00
standard deviation	0.047	0.027	0.043	2,755	0.01	0.15	0.98	0.39	0.07	0.03	0.01	34.5	0.42
nr. of observations	456	456	456	455	455	455	455	455	455	476	476	455	455