Bank Specific Determinants of Credit Risk - An Empirical Study on the Banking Sector of Bosnia and Herzegovina

by
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Abstract. The main aim of this paper is to examine the influence of bank specific determinants on realization of credit risk in the portfolio of commercial banks in Bosnia and Herzegovina (B&H). This study comprises a sample of seventeen out of twenty eight planned banks that are analyzed over the period of 2002 to 2012. The effect of variations in the determinants of bank credit risk exposure is based on using a multivariate panel regression model. Our empirical results suggest that a significant relationship exists between credit risk and the following variables:[Inefficiency (IE), profitability (ROE), Credit growth (CG) and Deposit rate (DR) while variables Solvency (SR), Loans to deposit ratio (LTD), Market power (MP), profitability (ROA) and Reserve ratio (RR)] are not statistically significant in terms of credit risk.

Key words: credit risk, banking sector, Non-performing Loans (NPLs), Indicators of quality assets, Bank specific determinants.

JEL classification: C33, G21

1 Introduction

On the international scene, conducting banking business has become ever more risky, as well as the actions by monetary authorities that are more onerous than ever before. This is understandable because of the negative experiences and particularly large negative repercussions of the banking crisis on individual national economies. As banks play a dominant role in most of the financial system, as the main source of financing and payment management system, financial collapse can have serious macro-economic consequences on the national economy. During credit boom, credit growth has recorded significant rates while such loans have a higher risk of default than loans to prime borrowers.

High exposure to credit risk from this period reflects the current level of NPLs in some banks. After the peak of the cyclical upturn, borrowers' profitability worsens reflection of the delays in debt-servicing, unfavorable financial condition of borrowers. In the early stages of the transition operating environment for banking business was inadequate. The progress in liberalization of foreign investment restrictions allowed B&H to open its doors to foreign institutional investor and entry banking groups, mainly from Austria, Slovenia and Croatian. The presence of foreign banks in the domestic banking industry is often considered in the context of their significant benefits for the domestic banking sector. This primarily refers to the transfer of technology and managerial skills, which increased the operational capacity of local banks as well as better risk management practice, enhance financial stability and convergence with international prudential standards.

The absence of competitive financial instruments and other financial services leads to less productive forms of banking operations where banks have relied entirely on traditional banking functions. As a result, the quality of the assets as a whole depended on the extent of the credit risks involved in their operations. A very important aspect in the analysis of indicators of asset quality is the quantification of certain indicators. They are indicators such as the participation of non-performing assets (NPAs) to total assets, the provision of low-quality assets in relation to the initial capital and the provision of low-quality assets. Among other things, asset quality indicators show that the percentage of NPAs in the total assets in the

same reference period is reduced, although the annual rate of credit growth on average per annum amounted to over 25%. As confirmation of the above the relationship can be seen between the share of NPAs to total assets and NPAs net of provisions to Tier 1 shown in Figure 1.

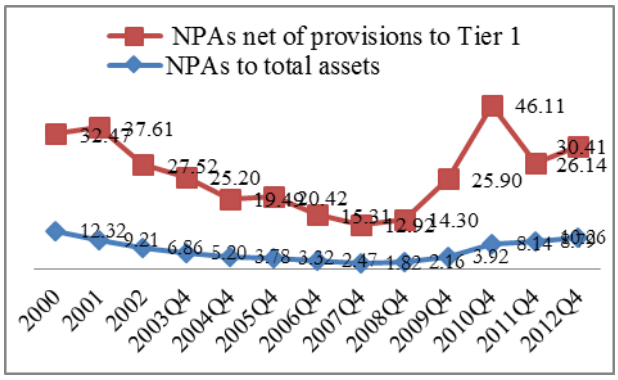

Figure 1 Indicators of quality assets in B&H
Source: the authors' elaborations on CB of B&H data

Over the years, improvement of the institutional framework of the banking sector in B&H enabled reduction of its credit risk exposure ensuring an adequate supply of credit to economically important sectors in B&H. In addition, the growth of production and income influenced the increase in demand for loans. This stimulated a further increase in demand for loans.

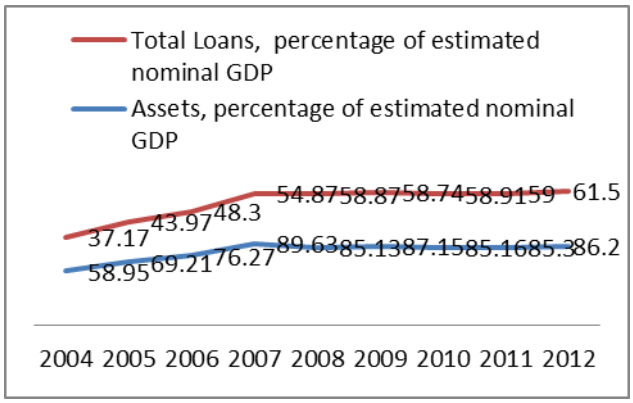

Figure 2. Assets/ GDP, total loans/GDP: 2004-2012
Source: the author's elaborations on CB of B&H data

As it is shown in figure 2 and figure 3 banking sector recorded a positive growth in the period from 2004 to 2007. The ratio of domestic credit provided by the banking sector to GDP and ratio of total assets of banking sector to GDP indicates credit expansion of commercial banks.

During the period of time covered in Figure 3, GDP growth rates did not follow a very high annual rate of credit expansion.

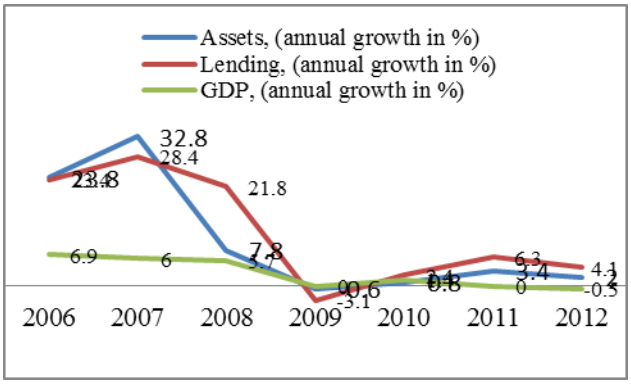

Figure 3 Selected indicators in banking sector of B&H
Source: the author's elaborations on CB of B&H data

During the period of time covered in Figure 3, GDP growth rates did not follow a very high annual rate of credit expansion. In addition, a loan supply was below the loan demand as the interest rates have been kept at a high level. It is evident that the expansion of credit was pronounced by the end of 2007 after which credit activities have had a weak impact on GDP growth. However, the average annual growth rate for banks' assets and loans in 2009 had a declining trend as a result of the global financial crisis and as a consequence the amount of credit available is decreased. In addition, there were no other financial institutions to supply long-term finance to B&H economy. As an interesting indicator of the quality of assets can be used as well as also the ratio of NPLs to total loans (figure 4). During the years under review the ratio of the risk ratio of NPLs to total loans shows that it starts with one of the greatest values of 21.22% (2000) in order to be reduced to relatively low level two years later (2002) to 2.11%. Significant stabilization of this indicator is related to the period between 2006 and 2009. In 2012 recorded deterioration in the loan portfolio of the banking sector and NPL ratio had begun to climb again to 11.80%.

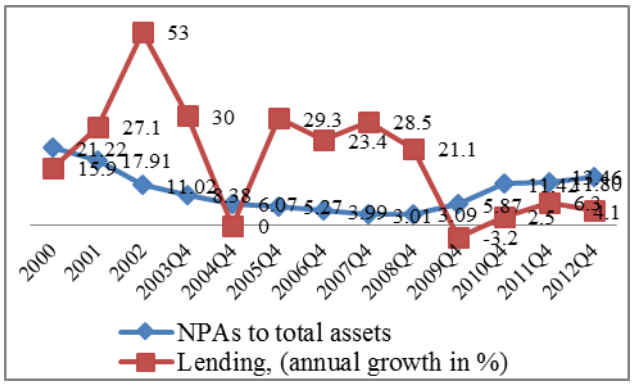

Figure 4. NPLs to total loans vs. Lending rate
Source: the author's elaborations on CB of B&H data

2. Literature Review

Recently available literature on credit risk shows that there are at least two sets of factors relevant for the examination of the credit risk of banks. Specifically, it is the macroeconomic and microeconomic factors. With point of individual countries micro-economic factors play a crucial role in shaping decisions made by banks. However, when comparing the performance of banks that operate in different countries and regions there were significant differences which are mainly macroeconomic character. Earlier research workers have examined anti-cyclical behavior of the NPLs.

The general explanation is that higher real GDP growth usually translates into more income which improves the debt servicing capacity of borrowers. In their study Salas and Saurina (2002) examined the effect of macroeconomic and individual bank level variables of problem loans in Spanish commercial and savings banks over the period 1985–1997. The main focuses in their research was given on the importance of individual bank factors such as growth policies and managerial incentives. The GDP growth rate, firms, and family indebtedness, rapid past credit or branch expansion, inefficiency, portfolio composition, size (total assets), net interest margin, capital ratio, and market power are variables that explain credit risk. Jimenez and Saurina (2006) investigated the Spanish banking sector over the period 1984 to 2003. Their findings revealed strong empirical support of a positive, although quite lagged, relationship between rapid credit growth and loan losses. Also, they provided some evidence that NPLs are determined by GDP growth, high real interest rates and lenient credit terms. Berger and DeYoung (1997) conducted a study with the aim to examine the relationship between NPLs, cost and capitalization of U.S. commercial banks for the period 1985-1994. Their study showed a two-way causal influence between cost efficiency and NPLs. In fact during their research they are presumed causality between NPLs and cost efficiency incurred as a result of deteriorating macroeconomic conditions. Their research was based on the following hypotheses.

The first hypothesis of "bad management" claims to be the low cost efficiency indicator of poor management practices at banks and that as a result of poor loan underwriting, monitoring and control participation of NPLs to total loans increased. Using a simultaneous equations approach Kwan and Eisenbis (1996) examined tradeoffs between risk, capitalization and measured inefficiencies in a sample of 254 banks in the period between 1986 and 1991. Their findings suggest that those inefficient banks are more prone to risk-taking. The main argument is that less efficient banks tended to be less well capitalized, as result differences in management quality. An alternative hypothesis "Skimping" associated high level of cost efficiency and NPLs through insufficient resources allocated to monitoring credit risk leads to an increase in NPLs in the future.

Recent work by Gonzalez-Hermosillo et al. (1997) suggests that the higher share of NPLs to total loans leads to the greater probability of banking failure. They used an econometric model to predict bank failures using data for the banking sector of Mexican over the period of 1991 to 1995. As analyzed in Cooper et al. (2003) variations in credit risks would lead to variations in the health of banks' loan portfolio which in turn affect bank performance. Fawad and Taqadus (2013) used panel data of Pakistan banking sector over the period between 2006 and 2011 in order test the validity of 10 banks specific hypotheses. Their findings reject the validity of both bad management hypothesis and skimping hypothesis in case of Pakistani banking sector. Miller and Noulas (1997) conducted a research in the United States during

1980s in order to determine the factors that have affected the profitability of banks, using both cross-sectional and pooled time-series cross-sectional regressions. They indicate that there is a negative relationship between credit risk and profitability, and that large commercial banks achieved poor results because of the declining quality of the loan portfolio.

Third hypothesis "moral hazard" offered by Berger and De Young (1997) linked low levels of capital in banks with the delivery of higher risk, resulting in a higher level of NPLs in the future. About this hypothesis previously discussed Keeton and Morris (1987). Their study examined causes of credit losses using a sample of nearly 2.500 banks in the Tenth Federal Reserve District States. According to their findings a significant portion of the variation in credit losses in the sample is due to the difference in their economic environment and weak indicators of specific industries such as agriculture and energy sector. It further concluded that the greater variation in loan losses among banks suggests that the banks become less vulnerable to the approved loans to a wider geographical area in which industry operates profitable.

The study conducted by Louzis et al. (2010) exploring the banking specific variables affect on credit risk (measured by NPLs to total loans) over the period between 2003 and 2009. Their study is based on panel data set including the 9 largest Greek banks (approximately 90% of Greece's banking sector). It concludes that the estimated coefficients for the bank-specific explanatory variables suggest that profitability indicators (ROE and ROA) are found to be significant and negatively related to the NPLs for mortgages and consumer loans while they are not significant for business loans. Furthermore, the solvency and loans-to-deposit ratio does not seem to have explanatory power over NPLs for all types of loans while market power indicators have a significant impact only for business loans' NPLs. The excess lending hypothesis represents a continuation of the previous hypotheses that goes to the bank to assume greater risk possibly absorb larger losses (as a share of the loan/asset and loan-to-asset ratio). Both sets of determinants, suggest us intertwined impact of real and financial sectors of the movement NPL loans.

The effect on the real economy NPL is mainly explained by the weakening borrower's ability to repay outstanding debts while the reverse effect of NPL in the real sector often identified by offering loans (Klein, 2013). In addition, weak bank lending and continued uncertainty due to the return and management of NPLs (higher costs) impact on equity due to increased costs of provision. A study conducted by Fofack (2005) in CFA and non-CFA countries shows a negative association between NPLs and most banking variables, including return on asset and equity, total deposit, net interest margin and net income.

3 Methodology and Data

The data for the empirical analysis has been sourced from the secondary sources. These are the financial statements of commercial banks in B&H, and also from the published annual audited accounts of individual banks submitted to Federal Banking Agency and Banking Agency of Republika Srpska. In this paper, several variables were taken to analyze relationships between bank specific variables [Inefficiency (IE), Solvency (SR), Loans to deposit ratio (LTD), Market power (MP), profitability (ROA and ROE), Credit growth (CG), and Deposit rate (DR) and Reserve ratio (RR)] and a dependent variable which is Credit risk (CR). For needs of our analysis panel data is used on seventeen commercial banks which makes 60.7% of the total sample (or 76.26 % of total banking assets) in the period between 2002 and 2012.

It is necessary to note that it was not possible to collect data for all banks, given that they have not disclosed the required information. Accordingly sample for the study included 17 out of the 28 banks operating in B&H. In order to identify determinants of credit risk of commercial banks in B&H, the panel data regression analysis was used. If the probability was less than or equal from the level of significance of 0.05 the null hypothesis will be rejected. In that case the result is considered to be statistically significant.

In Table 1 a list of selected variables for regression analysis has been shown.

Table 1. Summary of variables used in regression model

Variable	Notation	Measurement	Expected sign
Inefficiency	IE	As the ratio measured as the ratio Operating Expenses to Operating Income for bank i in year t.	+
Solvency Ratio	SR	As the ratio of total equity to total assets for bank i in year t.	-
Loans to deposit ratio	LTD	As the ratio of the loans to deposit ratio for bank i in year t.	+
Market power	MP	As the ratio of Loan to Total loans of all banks for bank i in year t."	+
Return on Assets	ROA	As the ratio of net income to total assets for bank i in year t.	-
Return on Equity	ROE	As the ratio of net income to total equity for bank i in year t.	+/-
Credit growth	CG	As the ratio of the credit growth for bank i in year t.	+
Deposits rate	DR	As the ratio of Interest expenses to total deposits for bank i in year t.	-
Reserve ratio	RR	As the ratio of nonearning assets to total deposits for bank i in year t.	-

In testing the relationship between credit risk, and its determinants our multivariate regression model for the study is written as follows.

Yit = f (IE, SR, LTD, MP, ROA, ROE, CG, DR, RR)
(1)

Yit = β0 + β1IEit + β2 SR it + β3 MP it + β4ROA it + β5 ROE it + β6CG it + β8DR it + β9RR it + + εit
(2)

Where is β0, β1, β2, β3, β3, β4, β5, β6, β7, β8 and β9 are parameters (coefficients)

Yit – dependent variable, = Credit Risk i,t (As the share of non-performing loans on total volume of loans for bank i in year t.)

"i" is the cross section units (17 banks)

"t" is the time period (2002 to 2012); εit – error term

Goal and Hypothesis: The main aim and objective of this paper is to contribute to current research and to explore the impact of the bank-specific determinants on banks' exposure to credit risk.

Ho: Hypothesis for each variable is that the Bank specific determinants have no significant impact on credit risk of commercial banks in B&H.

4. Results and Discussion

Goodness of fit test is performed by determining whether data set can be viewed as a random sample from a population that has a certain distribution. Accordingly, it is necessary to determine whether the selected variables are normally distributed or not. To address this issue, this paper conducted a Kolmogorov-Smirnov goodness of fit test to determine whether a test is parametric or non-parametric test. The results of the Kolmogorov-Smirnov goodness of fit test showed that all variables greater than 0.05 and that all variables' values normally distributed. The correlation analysis was done for all the independent variables and the dependent variable in the study (table 2). It has been done in order to determine whether there were serial correlations between the independent variables. Among selected variables in the model, it is evident that only variable ROA, ROE, and CG negatively and significantly correlated with credit risk. This significant effect was determined at 1% level of confidence. The values of correlation coefficients in the table 2 indicate a low level of correlation between the independent variables.

Table 2. Correlation matrix of bank specific variables

Correlations											
		IE	SR	LDR	MP	ROA	ROE	CG	DR	RR	CR
IE	Pearson Correlation	1	0.029	-0.029	0.032	-.214**	-.225**	-0.045	0.055	-0.133	-0.115
	Sig. (2-tailed)		0.697	0.698	0.668	0.003	0	0.539	0.454	0.069	0.116
	N	187	187	187	187	187	187	187	187	187	187
SR	Pearson Correlation	0.029	1	0.056	-.459**	0.034	-0.07	.146*	-0.04	.452**	0.049

	Sig. (2-tailed)	0.697		0.446	0	0.641	0.32	0.047	0.619	0	0.505
	N	187	187	187	187	187	187	187	187	187	187
LDR	Pearson Correlation	-0.029	0.056	1	-.158*	0.109	-0.01	0.044	-0.08	0.14	0.023
	Sig. (2-tailed)	0.698	0.446		0.031	0.138	0.84	0.547	0.298	0.057	0.756
	N	187	187	187	187	187	187	187	187	187	187
MP	Pearson Correlation	0.032	-.459**	-.158*	1	-0.064	0.06	-0.004	.225**	-.403**	-0.063
	Sig. (2-tailed)	0.668	0	0.031		0.384	0.39	0.961	0.002	0	0.388
	N	187	187	187	187	187	187	187	187	187	187
ROA	Pearson Correlation	-.214**	0.034	0.109	-0.064	1	.684**	-0.095	-0.01	0.076	-.194**
	Sig. (2-tailed)	0.003	0.641	0.138	0.384		0	0.195	0.934	0.302	0.008
	N	187	187	187	187	187	187	187	187	187	187
ROE	Pearson Correlation	-.225**	-0.074	-0.014	0.063	.684**	1	0.036	0.023	-0.004	-.293**
	Sig. (2-tailed)	0.002	0.315	0.844	0.393	0		0.627	0.759	0.955	0
	N	187	187	187	187	187	187	187	187	187	187
CG	Pearson Correlation	-0.045	.146*	0.044	-0.004	-0.095	0.04	1	-0.03	0.117	-.245**
	Sig. (2-tailed)	0.539	0.047	0.547	0.961	0.195	0.63		0.723	0.11	0.001
	N	187	187	187	187	187	187	187	187	187	187
DR	Pearson Correlation	0.055	-0.037	-0.076	.225**	-0.006	0.02	-0.026	1	-0.064	0.113
	Sig. (2-tailed)	0.454	0.619	0.298	0.002	0.934	0.76	0.723		0.387	0.124
	N	187	187	187	187	187	187	187	187	187	187
RR	Pearson Correlation	-0.133	.452**	0.14	-.403**	0.076	-0	0.117	-0.06	1	-0.005
	Sig. (2-tailed)	0.069	0	0.057	0	0.302	0.96	0.11	0.387		0.941
	N	187	187	187	187	187	187	187	187	187	187
NPL	Pearson Correlation	-0.115	0.049	0.023	-0.063	-.194**	-.293**	-.245**	0.113	-0.005	1
	Sig. (2-tailed)	0.116	0.505	0.756	0.388	0.008	0	0.001	0.124	0.941	
	N	187	187	187	187	187	187	187	187	187	187

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Author's calculation

None of the bank specific variables are highly correlated, no multicollinearity amongst these variables exist. Correlation between independent variables is below 0.8. (Guajarati, 2003). Pearson correlation coefficients show a positive but not significant correlation between SR and credit risk, between the DR and the credit risk as well as between the credit risks of the LDR. In contrast, the Pearson correlation coefficients show a negative correlation between IE and credit risk as well as between RR and credit risk.

Table 3: Common effect model results of bank specific variables (Determinants of credit risk)

Dependent variable	Unstandardized Coefficients		Standardized Coefficients				
Variable	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
C	0.05847	0.011		5.099	0		
IE	-0.00831	0.003	-0.178	-2.625	0.009	0.949	1.053
SR	0.07911	0.05	0.13	1.57	0.118	0.63	1.588
LTD	0.00314	0.006	0.033	0.492	0.623	0.956	1.046
MP	-0.05703	0.045	-0.1	-1.256	0.211	0.681	1.469
ROA	-0.12921	0.189	-0.06	-0.685	0.494	0.558	1.793
ROE	0.13844	0.031	0.39	4.454	.000	0.567	1.764
CG	-0.01507	0.004	-0.244	-3.619	.000	0.952	1.05
DR	0.05375	0.026	0.138	2.029	0.044	0.938	1.066
RR	-0.00016	0.009	-0.015	-0.189	0.85	0.69	1.448
R Square	0.2318		Durbin-Watson	1.753			
Adjusted R Square	0.1927		Observation	187			
Std. Error of the Estimate	0.02747		F statistic	5.933			
Sum of Squares Regression	0.907		Prob (F-stat)	0.000			
Sum of Squares Residual	0.134			Chi2: 9.44			
Wald chi 2	52.30		Hausman test	Prob. 0.3974			

Source: Author's calculations

Additionally we have also examined the problem of multicollinearity, using the variance inflation factor (VIF). In our model there is no serious problem of multicollinearity. The results of the VIF test all VIF values are identified less than 2 (the highest VIF has value of 1.793). It shows that the presence of multicollinearity is minimal. In order to examine the problem of heteroscedasticity in the model Durbin-Watson (DW) test was used. Examining the heteroscedasticity in table 3 shows that the observed positive autocorrelation is 1.753 for credit risk. Endogenous in the model was tested by Hausman test. This test simultaneously examines the justification for the use of instrumental variables as possible solutions to the problem of endogeneity. The Hausman test based on Chi- squared statistic (9.44, df.6 with prob. 0.3974) indicate that corresponding effects are statistically insignificant, so the null hypothesis is accepted and random effect model is preferred. LM test is performed that helps to decide between a random effects regression and a simple OLS regression. There is significant difference across units and the results were in favor of Random effect (Chi-squared = 43.16 with prob. 0.0000).

The evaluation of model adequacy in terms of the significance of all the independent variables taken together was examined using the F-test (5% significance). As it can be seen from the table 3 the probability of the F statistic (5.933) for the overall regression relationship is <0.005. It implies that our Model is a good fit. It can be concluded that we reject the null hypothesis that all coefficients are simultaneously zero and accept that the regression is significant overall.

Furthermore, individual t-tests show that four variables in our Model (Inefficiency, ROE, and credit growth and deposit ratio) found to be statistically significant at the empirical significance level of less than 5%. Linear combination of explanatory variables formed the regression function in our model that

provides R Square coefficient of determination of 23.18 %. The regression results are given in table 3. The R-Squared statistic indicates that all these 9 predictor variables combined explain 23.18% of the variance in credit risk. The remaining nearly 76.82% of the variations in Credit risk can be explained by factors that are not included in our model. The adjusted R-squared statistic, which is more suitable for comparing models with different numbers of independent variables, is 19.27%. The standard error of the estimate shows the standard deviation of the residuals to be .02747. When assessing the impact of independent variables on credit risk variable ROE has the most influence whose regression standardized coefficient (beta) is 0.39, followed by a variable CG (beta is -0.244) , variable IE (beta is -0.178), as well as variable DR (0.138). As it can be observed from the summary of regression output all other regression coefficients were not statistically significant because the p-value is larger than 0.05. Moreover, the results of the regression also revealed that only four variables have significant impact on the model. Some of bank specific variables in our Model as IE (-0.00831), MP (-0.05703), ROA (-0.12921), CG (-0.12921) and RR (-0.00016) have inverse relationship with the CR. It means that when each of these variables increases it leads to lower CR. On the other hand, positive relationships with CR have the following variables: SR (0.07911), LTD (0.00314), ROE (0.13844) and DR (0.05375).

5 Conclusion

This study used the method of panel data to examine the determinants of credit risk in the banking sector in B&H. The findings of this study showed that banking credit risk is significantly negatively affected by IE and Credit growth. It means that with the growth credit risk the banks cost efficiency and lending of the banks declines. Moreover, the negative statistically significant value of IE and CG suggests that the both variables have a substantial impact on credit risk. Further, a negative coefficient of IE (-0.00831) implies that increase in efficiency leads to decrease of credit risk as well as with credit growth (-0.01507). It is according to the findings provided by Kwan and Eisenbis (1996) in the case of IE as well as with credit growth (Jimenez and Saurian, 2006).

Similarly, DR has coefficient of 0.05375. It implies that any increase in this variable leads to increased in credit risk. The ROE has a positive coefficient of 0.13844 and it means that increase in ROE leads credit risk. Moreover, the results of the study demonstrate that ROA and LTD the coefficients estimate is positive however statistically not significant. The low coefficient of LTD (0.00314) suggests that LTD has weak impact on the credit risk. It shows that there is no any significant relationship between SR and credit risk as well as LTD and credit risk. The findings of this study are consistent with the findings of Louzis et al. (2010).

Accordingly, first hypothesis that GDP is negatively related to the credit risk is not accepted. Credit risk has a negative and insignificant relationship with MP. It implies that with loans share of individual bank increases in total loans of banking sector Credit risk decrease. It is in according with findings of Fofack (2005) who found no any relationship between money supply and credit risk. Our findings also reveal that RR was found to be negative and not statistically significant to the credit risk. The relationship between the credit risk a bank and its ROE is not only positive but also significant. Lastly, MP, SR and and ROA also no any significant relationship with credit risk. In accordance with the use of econometric methods in this paper it can be confirmed hypothesis in the case of B&H that the highest importance in explaining the variability of credit risk in banks have the following variables: Inefficiency (IE), profitability (ROE), Credit growth (CG) and Deposit rate (DR) while variables Solvency (SR), Loans to deposit ratio (LTD), Market power (MP), profitability (ROA) and Reserve ratio (RR)] are not statistically significant in terms of credit risk.

Table 4: Summary of Hypothesis Testing

	Sign	**Reject H0**
IE	-	Yes
SR	+	No

LTD	+	No
MP	-	No
ROA	-	No
ROE	+	Yes
CG	-	Yes
DR	+	Yes
RR	-	No

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