VOL. 5, NO. 1, February 2016 ISSN 2307-2466
International Journal of Economics, Finance and Management

http://www.ejournalofscience.org

Explanatory Factors of Credit Risk: Empirical Evidence from Tunisian Banks

Ines Ghazouani Ben Ameur
Institut Supérieur de Gestion de Sousse, Tunisia
inesghazouani@hotmail.com

ABSTRACT

In this paper we attempt to identify factors explaining Tunisian credit risk taking behaviour. Using GMM estimator technique as described by Bundell and Bond (1998) and retaining the main 10 commercial Tunisian banks during 2000-2013 periods, this paper examines bank specific, industry specific and macroeconomic factors that may influence bank credit risk. Results suggest that credit risk in Tunisian banks is significantly influenced by capital adequacy and operational efficiency. Indeed, banks with adequate capital and efficient management seem to hold low credit risk level. On the other hand, competitiveness among banks pushes risk-taking behaviour through developing risky activities to compensate the loss of revenues. Finally, we found that Tunisian bank credit risk-taking decisions are essentially determined by macroeconomic factors.

Keywords: *Bank credit risk, capital regulation, macroeconomic, GMM system, Tunisia*

1. INTRODUCTION

For years, the health of the financial sector is a major concern of policy, especially in developing countries where failure in financial intermediation can disturb the development process. It is proved that the major economic upheavals are the result of banking crisis.

The events that took a place in Asia, during the second half of the 1990s, represent a good illustration that a weak financial system associated with inadequate macroeconomic policies resulted in the outbreak of a crisis. There was also evidence that the problems faced by Asia's banking systems were the legacy of years of bad lending practices in an environment characterized by inadequate supervision and regulation that led to rapid lending growth and excessive risk taking (Lindgren *et al*., 1996; Caprio and Klingebiel, 2003). However, there is limited work of operational relevance for improving the functioning of financial sector and minimizing risk taking behavior in developing countries.

Without a doubt, holding an effective risk management procedure is crucial for banking business. Indeed, in unpredictable and explosive atmosphere all banks are exposed to colossal risks like liquidity risk, operational risk, market risk, foreign exchange risk, interest rate risk and credit risk, which may affect the successes and survival of banks (Ali,Akhtar and Sadaqat,2011 and Al-Tamimi and Al- Mazrooei,2007).

Credit risk management is considered as the major complex task in the financial business because of the changeable nature of the macroeconomic factors coupled with banking industry or specific to particular bank factors.

Defined by Greuning and Bratonovic (2004), credit risk is the probability that the borrower fail to honour the terms of loan agreement. Banks try to maximise their profits, which requires a correct pricing of the risk contained in their assets portfolios. However, given the weight of loans on banks assets, some bank firms default while others do not. Zribi and Younes (2011), suggest that credit risk in emerging economy banks is higher than that in developed ones and that risk is influenced by a bigger number of bank-specific factors in developing economies compared to their counterparts in developed ones.

Thus, the main motivation behind this study is to improve understanding of credit risk modelling at the micro and macro levels. We are mainly interested by the Tunisian banks case because they suffer from high credit risk levels and low profitability and liquidity. While it has been proved that the credit risk is the key risk facing the Tunisian banks over the last years, the factors affecting risk taking behaviour have not been identified.

Section 2 of this paper provides the review of the extant literature on credit risk determinants. Section 3 presents data, retained variables, econometric approaches and major empirical results. Finally section 4 concludes.

2. LITERATURE REVIEW AND HYPOTHESIS

According to Rose and Hudgins (2008) credit risk is the probability that financial institution's loans, will decline in value and possibly become worthless.

Saunders and Cornet (2008) and Al-Smadi and Ahmed, (2009) define Credit risk as the probability that the main or the interests from loans granted by financial institutions not be paid in full. Credit risk is the most important cause of bank failures, and the most important risk facing banks' managers (Gup et al, 2007).

Several studies have examined factors that may affect banks' credit risk in various countries around the world. While some researchers focus on the understanding of credit risk taking behaviour in a particular and single country, others ones give attention in their studies to a

panel of countries. A closer review of previous literature allows us to identify three types of credit risk determinants; macroeconomic, industry-specific and bank-specific variables. Gross Domestic Product and Inflation are the most pertinent macroeconomic factors investigated. Industry specific factors mainly mentioned in the earlier literature are financial sector development and competition. While, bank ownership, management efficiency, lagged profitability, bank size and capital adequacy are the principal bank specific factors affecting bank credit risk.

2.1 Macroeconomic Factors

According to Figlewski, Frydman and Linag (2012) macroeconomic factors are seemed to explain the greatest impact on firms' credit importance. Jimenez and Saurina (2006) observe that banks' lending mistakes are widespread during recovery than in the midst of recession.

Similarly, Al-Smadi and Ahmed (2009) reveal that conditions associated with favorable economic periods contribute in diminishing the banks' credit risk exposure.

GDP growth rate is a macro factor explaining banks performance and credit risk. On economic booms, incomes are high and portfolio at risk is minimal. On recession's period, incomes are low and borrowers priorities on basic expenses at the expense of their credit obligations. An increase in per capita GDP signals increase in the economy and productivity (Demirguc-Kunt and Huizinga, 1999). A higher GDP per capita is an indication of raise in purchasing power and the ability of borrowers to honor their loans. It also reflects the improvement of the capacity of savings. So, GDP per capita is supposed to be negatively associated to credit risk. According to Vazquez, Tabak and Sauto (2012), there exists an inverse relationship between GDP and NPL.

In opposition, to the above impact on GDP, researches show a positive relationship of inflation, unemployment and interest rate on NPL. High tendencies of credit risk go along with high inflation, unemployment and interest rates. Derbali (2011) suggests that these variables limit the borrower's ability to borrow and increase the cost of borrowing. Demirguc-Kunt and Huizinga (1999) and Athanasoglou et al. (2010) suggest that a widely used proxy for the macroeconomic environment effect on bank profitability and risk taking is inflation. And they find a positive relationship between inflation and bank profitability, in their respective works.

On the other hand, Voridis (1993) claims that uncertainty in the economy enhances banks to ration credit and leads to disequilibrium in credit markets. Al-Smadi and Ahmed (2009) relate high inflation to decrease in credit risk.

2.2 Industry-Specific Factors

Two industry-specific factors have been used in the major empirical literature: competition and financial sector development.

The debate on the competition impact on banks' risk taking is not conclusive. A large number of empirical studies deal with the nature of relationship between risk taking and competition, but i provide a series of divergent results. According to Demirguc-Kunt and Huizinga (1999), Rose and Hudgins (2008) and Anginer et al. (2014), competition is excellent for the banking sector.

Indeed, greater competition may encourage banks to diversify their risk, making them less fragile.

Conversely, Caminal and Matutes (2002), show that strong competition reduces credit rationing and increase the distribution of credits. So, banks may be engaged in riskier operations to increase their profitability. Mishkin (1999) shows that a more concentrated banking structure is rewarded by government, which can create moral hazard problems and encourages banks to take more risk, and consequently increasing bank fragility.

Tennant and Folawewo (2008) exploit two indicators to represent financial sector development: the ratios of M2+ to GDP and bank total asset to GDP.

According to these authors, the two ratios reflect the level of banking system development and the level of competition in well-developed banking sectors. A raise of any of these ratios indicates improvement in the development financial sector. Ngugi (2001) suggests that an inefficient intermediation process reveals a repressed financial system. This is because selective credit policies engage considerable administrative costs and interest rates to reflect the true cost of capital.

2.3 Bank's Specific Factors

Bank credit risk may also arise due to internal weaknesses in a financial institution. Existing literature identifies numerous bank-specific factors that may impact credit risk: bank profitability, bank size, efficiency of management, bank ownership structure, deposit composition and quality, asset quality, capital and bank reserve requirement.

Theoretically there is a negative relationship between bank size and credit risk taking. Such a relationship can be justified by the fact that larger banks have the capability of holding more diversifiable portfolios. Then larger banks are expected to have lower risks. Natural logarithm of total assets has been used as an indicator of bank size in a large body of literature. Considering this last proxy, major studies report a negative relationship between bank size and credit risk.

Saunders et al. (1990), Chen et al. (1998), Cebenoyan et al. (1999), Megginson (2005), Salas and

Saurina (2002) and Hu et al (2006) illustrate the inverse relationship. Their finding means that large banks have better risk management strategies that usually turn into more superior loan portfolios. However, Rajan and Dhal (2003) provide evidence of a positive relationship between bank size and NPL.

Regarding operating efficiency, Berger and De Young (1997) argue that inefficient management of the banking institutions affects granting loans' process.

Indeed, inefficient management in the banking firms results in bad quality loans, and therefore, increases the level of non-performing loans. The banks' management might not correctly evaluate their customers' credit claim due to their poor evaluation. Lis, Pages and Saurina (2000) suggest that inefficient banks hold riskier portfolio. Salas and Saurina (2002) support the same hypothesis and affirm that inefficient managers are unable to cope successfully with credit risk management that will lower the banks' credit quality and increase credit risk.

Therefore, poor management in banks might lead to higher non-performing loans. However, more recently, skills.Ali, Akhtar and Sadaqat (2011) find a negative but insignificant relationship with credit risk of Pakistan commercial banks.

The other important determinant of management quality and riskiness of the strategy is the type of bank ownership. Micco et al. (2006) analyzed 119 countries' financial institutions with different ownership types. He concluded that state-owned banks in developing countries have higher ratio of nonperforming loans. Hu et al. (2004) found a positive correlation between state owned capital share and the level of non- performing loans using a panel of Taiwanese banks. Boudriga, Boulila Taktak and Jellouli (2009) found that foreign ownership has a positive impact on loan quality as it promotes imports of human capital, management skills and technologies and provides opportunity to raise funds cheaply on international markets. State banks are reported to have more incentives to involve in risky projects since they are more prone to «too big to fail problem». However, Hu et al (2006) using a panel dataset of commercial banks in Taiwan between 1996-1999 showed that banks with higher government ownership percentage record lower non-performing loans.

In recent times, Garcia-Marco and Robles-Fernandez (2007) provide evidence that privately owned banks are more exposed to risk than state owned banks.

Nevertheless, Rainer and Paul (2007) found no indication of excessive risk taking by any banks' specific ownership structure.

Considering capital adequacy, it is commonly accepted in literature that low capital adequacy ratio is associated with higher probability of bank's default.

According to moral hazard theory, it may induce management to engage in more risky project (Berger and DeYoung, 1997). Salas and Saurina (2002) and Berger and DeYoung (1997) confirm this statement. Furlong and Keely (1989) and Keely and Furlong (1990) show that capital requirement may reduce bank risks. Indeed, the option value of deposit insurance decreases in a bank's leverage. That's why The Basle Accord obliges banks to maintain a certain level of capital for risk-weighted assets.

Nevertheless, Kohen and Santomero (1980) and Kim and Santomero (1988) show that capital requirements can be positively correlated to risk taking at commercial banks. Indeed, since the capital requirements restrict the risk-return frontier of a bank, the obligatory reduction in leverage may forces the bank to adjust the composition of its risk assets portfolio, leading probably to a raise in risk taking behavior.

3. THE EMPIRICAL STUDY

In this section we present our data, identify their sources and describe the regression model we use to investigate the effects of macroeconomic, industry-specific and bank specific factors on bank credit risk. We also summarize our major empirical findings.

3.1 Data

To examine factors explaining bank risk taking in Tunisia, we collected data related to the 10 main deposit banks in Tunisia over the period 2000-2013 from annual reports of each selected banks. Non-performing loans variable is sourced from the Central Bank of Tunisia. We extracted the financial industry indicators and macroeconomic factors from World Bank Development Indicators database. Our dataset is then consists of 14 years observations on 10 banks. All the banks data in our sample are available for the entire period. So, we used in balanced panel data our empirical investigation.

3.2 Variables Definition

We proxy the risk-taking behavior of banks by different measures of default risk commonly used in the literature. We consider in alternatives specifications the Z-score, and the ratio of non-performing loans to total loans (NPL). Both are computed for each bank during the period under study on the basis of annual accounting.

The first measure (**Z-score**), proposed by Boyd and Graham (1986), represents a more universal measure of bank risk-taking and is defined as $Z = (ROA + EA) / \sigma(ROA)$, where ROA is the rate of return on assets, EA is the ratio of equity to assets and $\sigma(ROA)$ is an estimate of the standard deviation of the rate of return on assets. To calculate the standard deviation of ROA we use data on ROA from the two previous years and we verified that using three or four years produces very similar results.

This risk measure indicates the probability of failure of a given bank (Z) and has been widely used in the empirical banking and finance literature. Higher values of Z-scores mean lower probabilities of default.

The second measure, Nonperforming Loans (**NPL**), reflects the credit risk position of a bank. It is computed by the percentage of nonperforming loans in total bank loans. The Tunisian banks have inherited from the previous centrally planned economies a considerable volume of non-performing loans. In this country banking laws were generally developed to promote sound banking practices among existing and new market players, and to increase the efficiency of delivering intermediation services. Banks would therefore improve their performance by improving screening and monitoring of credit risk, with such policies involving the forecasting of future levels of risk.

Thus, in our analyses, we consider the Z-Score and NPL as the better-quality measures of bank's risk taking and use them as main dependent variables.

We try to look at the bank's credit risk impact of an extended number of factors with distinguishes bank-specific factors (size, operational efficiency, capital adequacy and bank ownership) to bank industry environmental factors (Concentration and size bank system) to macroeconomic factors (GDP Growth and inflation).

3.2.1 Macroeconomic Factors

GDP growth (**GDP**): measured by reel GDP per capita growth, this variable is used to report economic environment conditions. GDP growth varies over time but not among the banks.

Inflation (**INF**): measured by annual country inflation rate, this variable is used to account for the changes in the general price level.

3.2.2 Industry-Specific Factors

Concentration (**CONC**): measured by bank assets held by the three largest banks to total assets banks, this variable is a proxy of the competitiveness among bank sector. Higher value of CONC implies lower bank competition.

Size Bank System (**SBS**): measured by the ratio of total assets of banks to GDP, this variable reflects the importance of bank financing in the economy as a whole.

3.2.3 Bank's Specific Factors

Size (**Size)**: measured by the natural logarithm of the book value of total assets as a percentage, this variable measures the size of each bank.

Cost-Income Ratio (**CIR**): computed by total operating expenses (the sum of salaries and other operating expenses) over total generated revenues, this variable reflects bank's operational efficiency. More efficient banks are expected to be less risked.

Capital Adequacy (**CAPAD**): measured by the ratio of book value of equity to total assets, this variable reflects international prudential regulation. High level of equity is expected to reduce the bank risk.

Ownership (**OWN**): measured by the percentage of bank equity hold by private sector, this variable attempts to test whether privatization of Tunisian banks enhances risk taking behavior.

3.3 Model Specification and Estimation Methodology

We develop the following regression in order to test the bank-specific, industry-specific and macroeconomic factors influencing the Tunisian bank's credit risk:

$$\boldsymbol{CR}_{it} = \alpha_0 + \beta_{it}X_{it} + \sigma_{it}Y_{it} + \delta_{it}Z_{it} + \varepsilon_{it}$$

Where **i** refers to an individual bank, **t** refers to the year, ***CR*** is the dependent variable referring to the Credit Risk measured by NPL and Z-Score, **X** is a vector of the individual-specific factors of a bank, **Y** is a vector of the industrial-specific factors, **Z** is a vector of the macroeconomic factors.

The complete model is then described by regression bellow,

$$\boldsymbol{CR}_{i,t} = \alpha0 + \alpha1\ \boldsymbol{CR}_{i,t-1} + \alpha2SIZEi,t + \alpha5CIRi,t + \alpha6CAPADi,t + \alpha7OWNi,t + \alpha8CONCi,t + \alpha9SBSi,t + \alpha10GDPi,t + \alpha11INFi,t + \varepsilon i,t \quad (1)$$

Table 1: Independent variables' descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
ZSCORE	140	8.081852	13.64437	-103	17.48179
NPL	140	21.88929	18.07802	5.2	98
Size	140	21.61731	.5610169	20.45424	22.69988
CIR	140	49.71864	11.86809	24.57	84.8
CAPAD	140	9.249399	3.048374	-1.094332	17.46179
OWN	140	81.0521	23.08661	31.65	100
CONC	140	45.74847	1.521739	42.74229	47.4283
SBS	140	65.24694	5.157415	55.99841	76.53999
GDP	140	3.056032	2.113941	-2.947252	5.249388
INF	140	3.301598	.8538632	1.983333	4.920696

According to Table 1, Tunisian banks have a Z-SCORE of 8.08 over the entire period from 2000 to 2013.

Looking to Min and Max Z-Score allow to conclude that there is a large difference in failure risk's taking among the Tunisian banks. Non-performing loans amount to 21.88% on average. Which can be translated as a very high credit risk given the maximum value fixed by national prudential regulation (Tunisian Central Bank). But there exists again a large difference among the banks in our sample.

Concerning bank-specific indicators, the capitalization of Tunisian banks equals 9.24% on average, which mostly respect the principal international prudential regulation of Basel II. The best-capitalized bank in our sample has a capital ratio of 17.46%, where, for some banks and at some years, capital ratio is negative.

Private sector holds 80% of Tunisian banks equity with a minimum of 30% in public statue banks. The concentration amounts to 45.74% on average.

Table 2: Correlation matrix

	Size	CAPAD	CIR	OWN	CONC	SBS	GDP	INF
Size	1.0000							
CAPAD	-0.2811	1.0000						
CIR	0.0325	-0.4800	1.0000					
OWN	-0.4244	0.2009	-0.3129	1.0000				
CONC	-0.4557	0.1119	0.1508	-0.0582	1.0000			
SBS	0.5273	-0.1309	-0.1143	0.0665	-0.6126	1.0000		
GDP	-0.3400	0.0507	0.0896	-0.0373	0.5373	-0.7081	1.0000	
INF	0.4064	-0.1502	-0.0898	0.0711	-0.3575	0.3091	-0.0494	1.0000

As shown in the table 2, all correlation coefficients are lesser than 0.8. So, the null hypothesis of no correlation between explanatory variables is verified according to Kennedy (1985). Then, there is no problem of multicollinearity in our specification.

Given the dynamic nature of our model, least squares estimation methods are biased and inconsistent, because dynamic models are likely to suffer from both endogeneity and heterogeneity problems (Baltagi, 2001).

The presence of lagged endogenous variables will also bias the coefficient estimates for the OLS estimation.

Moreover, substantial differences in non-performing loans across banks may result in unobservable heterogeneity problems. Then, we use dynamic panel estimation technique that is able to deal with the biases and inconsistencies of our estimates. If there are no unobserved firm effects, we can apply the GMM technique in levels by using lagged right hand side variables as instruments.

A required condition for the validity of such instruments is verified in our estimation (Table 3). Indeed, the serial-correlation tests do not reject the null hypothesis of correct specification. The first is the Sargan test of over-identifying restrictions, which tests for the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process (p-value of Sargan test is larger than 5% with 1.000 for our two measures of CR). The second test verifies the hypothesis that the error term differenced regression is not second-order serially correlated, which implies that the error term in the level regression is not serially correlated. (P-value of AR (2) test of Arellano and Bond is larger than 5% for Z-SCORE (0.3410) and NPL (0.1335)), lending support to our estimation results.

Table 3: Explanatory factors of Tunisian banks' credit risk

	Z-SCORE	NPL
CR $_{t-1}$	0.1208** (2.032)	-2.1836** (2.352)
Constant	5.3115 (0.652)	-6.483 (0.650)
Bank Specific Factors		
Size	-4.1488 (0.581)	-3.4261 (0.346)
CAPAD	1. 2147* (1.769)	-2.9181* (1.611)
CIR	-1.621919*** (3.087)	0.9338** (1.296)
OWN	-0.6367 (0.310)	-0.1529 (0.980)
Bank Industry Factors		
CONC	1.4214** (1.907)	-2.5991*** (3.351)
SBS	1.2659 (0.632)	-1.3235 (0.445)
Macroeconomic Factors		

GDP	0.2021** (1.868)	-2.9398* (1.881)
INF	1.2744** (2.684)	-3.4605** (2.349)
N	125	130
Wald test	83.07***	1201.65***
P-value Wald test	0.000	0.000
AR (2)	0.95221	1.5005
P-value AR (2)	0.3410	0.1335
Sargan test	1.95e-18	1.30e-16
P-value Sargan test	1.000	1.000

This table presents the results from regressions conducted to determine explanatory variables of Tunisian bank risk taking. Estimations were performed using GMM dynamic model estimation in system. t-statistics in brackets; * Significance at the 10%.; ** Significance at 5%; *** Significance at 1% AR (2): test of null of zero second-order serial correlation, distributed N (0, 1) under null.; Sargan-statistics is the test of over-identifying restrictions.

Banks are Amen Bank, Arab Tunisian Bank, Banque de l'Habitat, Banque Internationale Arabe de Tunisie, Banque Nationale Agricole, Attijari Bank, Banque de Tunisie, Société Tunisienne de Banque, Union Internationale de Banques and Union Bancaire pour le Commerce et l'Industrie.

The lagged dependent variable (CR_{t-1}), which measures the degree of persistence of risk, measured by Z-SCORE or NPL, is statistically significant across all models, indicating a high degree of persistence of bank insolvency or credit risk and justifying the use of a dynamic model. However, looking to results summarized in table 3, we observe some differences between the estimation results of the different regressions.

According to Rainer and Paul (2007) there is no indication of excessive risk taking by any specific ownership or size categories of banks. Indeed, the coefficients of bank size and private ownership are insignificant with bank credit risk. As regards to bank size, this result opposing the findings of Saunders and al. (1990), Chen and al. (1998), Cebenoyan et al. (1999) and Megginson (2005), can be explained by the fact that Tunisian banks have approximately similar sizes, which leads to a minor influence on the level of credit risk.

The prudential regulation of banks' capital, negatively affect the level of banks' risks. Indeed, the coefficient of CAPAD is respectively negative and statistically significant at 1% confidence level for NPL and positive and statistically significant at 1% confidence level for Z-SCORE. This result converges with those of Kim and Santomero (1988); Furlong and Keely (1989, 1990) and Jacques and Nigro (1997) which support the fact that the over-capitalized banks force the under-capitalized ones to reduce their potential of credit bank risk taking. This result can be justified by the Tunisian Central Bank reforms announced in the circular N° 91 of December 17th, 1991. Indeed, the new prudential regulation in Tunisia tends to make the Tunisian banks at the same level as their foreign counterparts by imposing to banks to maintain net capital to total risk-weighted assets ratio over 5% with increasing of solvency ratio from 5% to 8%.

Cost income ratio has a positive relation with NPL and a negative relation with Z-SCORE with coefficients of 0.9338 and -1.6219 respectively. This means as banks improved on operational efficiency, credit risk reduced and vice versa. Operating inefficiency has a statistically significant impact on credit risk level to l 0%.

This result is similar to the findings of Salas and Saurina (2002) and Berger and De Young (1997).

According to those authors, inefficient management of the banking firms affects the process of granting loans. The banks' management might not correctly estimate their customers' credit application due to their poor evaluation skills and lack of satisfactory resources due to inefficiency.

Regarding to industry specific factors, only competition proxy affect significantly credit risk. Indeed, CONC is positively associated to the dependent variable Z-SCORE. While it is negatively and significantly at the level of 1 % associated to NPL. These findings support the hypothesis that more competitiveness among banks encourages bank risk taking behavior. This finding could make clear that Tunisian banks suffer from market pressure and diverse types of rivalries. Competitiveness among Tunisian banks may push them to develop risky activities to compensate the loss of revenues.

Finally, the results point out the decisive role of the macroeconomic factors in Tunisian bank credit risk-taking behavior. Indeed, the coefficients of GDP Growth and inflation rate are statistically significant at 5% confidence level for all our regressions. GDP coefficient is negatively associated to NPL and positively associated to Z-SCORE indicating that as economic performance improves the level of credit risk declines. Similarly, inflation coefficients imply that positive (increase) inflation reduced credit risk. In other words, during a high inflation period, Tunisian banks not intend to distribute long term loan and they maintain the lending only in guaranteed sectors in the economy. This process reduces the loan amount and the banks become more selective of

high quality borrowers which diminish the bank's credit risk. Those findings confirm the results of Shu (2002), Vogiazas and Nikolaidou (2011) and Zribi and Boujelbene (2011).

4. CONCLUSION

The latest financial disaster has revived the interest on the factors that may cause a banking crisis. The health of the financial sector is a matter of policy concern, especially in developing countries where failure in financial intermediation can disrupt the development process. Thus, in consideration of the new open and turbulent environment that characterizes the Tunisian financial market over the last few years, and in view of minimizing all kinds of risks, the Central Bank of Tunisia made it obligatory to respect certain reforms. In this setting, this paper has empirically examined how bank-specific, industry-specific and macroeconomic characteristics affect the risk held by Tunisian commercial banks over 2000 to 2013. For this purpose, we employed a dynamic model specification technique that allows for risk taking persistence.

Our results show that macroeconomic variables (GDP growth and inflation) are determinant factors influencing Tunisian bank credit risk-taking decisions.

Both economic growth and inflation reduce credit risk taking. On the other hand, competition, which has marked the Tunisian banking sector in recent years, partly explains the risk-taking behavior adopted by Tunisian banks.

We also found that the banks' characteristics are important factors influencing the level of the Tunisian bank credit risk-taking. Indeed, bank credit risk is mainly explained by capital adequacy and operational efficiency. So, Banks with relatively high level of capital are less exposed to risk than less capitalized ones. And efficient banks held low credit-risk compared to ones with high cost income ratio. However, contrary to expectation, the coefficients of bank size and ownership structure are insignificant with bank credit risk. Bank size and private ownership seem to have no influence on the level of credit-risk.

On the whole, our investigation provides some interesting new insights into the mechanisms that determine the Tunisian banks' credit-risk taking. We believe that our findings are fairly relevant for two reasons. First, because we retained a large set of bank-specific, industry-specific and macroeconomic variables to identify bank risk determinants. Second, we applied an advanced econometric approach that addresses the issue of endogeneity of explanatory variables. Further, our investigation seems to be incomplete. Indeed, we do not consider some managerial aspects that may affect Tunisian bank's credit risk. For instance, internal mechanism governance may be one of those important managerial aspects in explaining the high level of credit risk held by Tunisian banks.

REFERENCES

[1] Ali, K., M. Akhatar, and S. Sadaqat (2011): «Financial and Non-Financial Business Risk Perspective –Empirical Evidence from Commercial Banks», Middle Eastern Economics and Finance, 11(11), 150-160.

[2] Al-Smadi, M. O., and N.H. Ahmed (2009): «Factors Affecting Banks' Credit Risk: Evidence from Jordan», Proceeding of the Second International Conference on Arab-Malaysian Islamic Global Business ans Entrepreneurship.

[3] Anginer D., A. Demirguc-Kunt, and M. Zhu (2014): «How Does Bank Competition Affect Systemic Stability? », Journal of Financial Intermediation, 23(1), 1-26.

[4] Athanasoglou, P.P., M.D. Delis and C.K. Staikouras (2010): «Determinants of Bank Profitability in the South Eastern European Region», Journal of Financial Decision Making, 2, 1-17.

[5] Berger, A.N. and R. DeYoung (1997): «Problem loans and cost efficiency in commercial banks», Journal of Banking and Finance, 21, 849-870.

[6] Blundell, R. and S. Bond (1998): «Initial conditions and moment conditions in dynamic panel data models», Journal of Econometrics 87, 115–143.

[7] Boudriga, A., N. Boulila, and S. Jellouli (2009). «Does Bank Supervision Impact Nonperforming Loans: Cross Country Determinants Using Aggregate Data», Journal of Banking & Finance, 25(1), 47-95.

[8] Caminal, R. and C. Matutes. (2002): «Market power and bank failures», International Journal of Industrial Organization. 20 (9), 1341-1361

[9] Cebenoyan A.S., E.S. Cooperman and C.A. Register (1999): «Ownership structure charter value and risk-taking behavior of thrifts», Financial Management 28 (1): 43-60.

[10] Chen, C.R., T.L. Steiner, and A. M. Whyte, (1998): «Risk-taking behavior and management ownership in depository institutions», Journal of Financial Research 21, 1-16.

[11] Demirguc-Kunt, A. and H. Huizinga (1999): «Determinants of Commercial Bank Interest margins and Profitability: Some International Evidence», The World Bank Economic Review, 13(2), 379-408.

[12] Derbali, A. (2011): «Determinants of Banking Profitability, Before and During the Financial Crisis of 2007: The Case of Tunisian Banks», Interdisciplinary Journal of Contemporary Research in Business 3, 1256-1269.

[13] Ekanayake, A.M.N.E and A.A. Azeez (2015): «Determinants of Non-Performing Loansin Licensed Commercial Banks: Evidence from Sir Lanka», Asian Economic and Financial Review, 5(6), 868-882.

[14] Figlewski, S., H. Frydman and W. Liang (2012): «Modeling the Effect of Macroeconomic Factors on Corporate Default and Credit Rating Transitions», International Review Economics and Finance 21, 87-105.

[15] Furlong, F. and M. Keeley (1989): «Capital regulation and bank risk-taking: A note», Journal of Banking and Finance 13, 883-891.

[16] Ganic, M. (2014): «Bank Specific Determinants of Credit Risk: an Empirical Study on the Banking Sector of Bosnia and Herzegovina», International Journal of Economic Practices and Theories, 4(4), 428-436.

[17] García-Herrero, A., S. Gavilá and D. Santabárbara (2009): «What explains the low profitability of Chinese banks? », Journal of Banking and Finance 33 (11), 2080–2092.

[18] Garcia-Marco, T. and M.D. Robles-Fernandez (2002): «Risk taking behavior and ownership in the banking industry: The Spanish evidence», Journal of Economics and Business, 60 (4), 332-354.

[19] Gawashie, D.G (2013): «Determinants of Credit Risk in the Banking Industry of Ghana», Developing Country Studies, 3(11), 64-78.

[20] Ghazouani, I. and S. Moussa (2013): « Explanatory Factors of Bank Performance in Tunisia: A Panel Model Approach», Global Journal of Management and Business Research Finance, 13(5), 1-11.

[21] Goldlewski (2005): «Capital regulation and credit risk-taking: empirical evidence from banks in emerging market economies», Journal of Banking Regulation, 6(2), 148-125.

[22] Greuning H.V.and S.B. Bratanovic (2003): «Analyzing and Managing Banking Risk: A framework for assessing corporate governance and Financial Risk», The World Bank, Washington D.C.

[23] Gup, B. E., K. Avram, D. Beal, R. Lambert and J.W. Kolari (2007), Commercial Banking: The

[24] Management of Risk, 3rd Ed. Australia: John Wiley and Sons Ltd.

[25] Hu, J., L. Yang and C. Yung-Ho (2004): «Ownership and non performing loans: evidence from Taiwanese banks», The Developing economies journal, 42(3), 405-420.

[26] Jimenez, G. and J. Saurina (2006): «Credit cycles, credit risk and prudential regulation», International Journal of Central Banking, 2, 65-98.

[27] Keeley, M. C. and F.T. Furlong (1990): «A Reexamination of Mean Variance Analysis of Bank Capital Regulation», Journal of Banking and Finance. 14 (1): 69–84.

[28] Kim, D. and A. Santomero (1988): «Risk in Banking and Capital Regulation», The Journal of Finance, 43 (5), 1219-1233.

[29] Koehn, M. and A. Santomero (1980): «Regulation of Bank Capital and Portfolio Risk», Journal of Finance 35, 1235-1244.

[30] Lis, S.F., J.M. Pages and J. Saurina (2000): «Credit growth, problem loans and credit risk provisioning in Spain», working paper, Presented at BIS Autumn Central Bank Economists' Meeting. Banco De Espana, 18.

[31] Megginson, W. L. (2005): «The economics of bank privatization», Journal of Banking Finance, 29, 1931-1980.

[32] Micco, A. and U. Panizza (2006): «Bank ownership and lending behavior», Economics letters, 93(2006), 248-254.

[33] Mishkin, F. S. (1999): «Global Financial Instability: Framework, Events, Issues», Journal of Economic Perspectives, 13 (4), 3-20.

[34] Ngugi, R. W. (2001): «An empirical analysis of interest rate spread in Kenya», Nairobi: African Economic Research Consortium, Research Paper 106. Retrieved from http://dspace.africaportal.org/jspui/bitstream/123456789/32054/1/rp106.pdf?1

[35] Poghosyan, T. and H. Hesse (2009): «Oil prices and bank profitability: Evidence from major oil exporting countries in the Middle East and North Africa», IMF Working Paper

[36] Rachdi H. and I. Ghazouani, (2011). «Board Characteristics, Performance and Risk taking Behaviour in Tunisian Banks», International Journal of Business and Management, 6(6), 88-97.

[37] Rainer, H. and W. Paul (2007): «Risk taking by banks in the Transition countries», Comparative Economic Studies, 49(3), 411-429.

[38] Rajan, R. and S.C. Dhal (2003): «Non-performing loans and terms of credit of public sector banks in India: An empirical assessment», Reserve Banks of India, Occasional Papers, 24(3), 81-121.

[39] Rose, P. S. and S.C Hudgins (2008), Bank Management & Financial Series, 7th Ed; McGraw Hill/Irwin.

[40] Salas, V and J.Saurina (2002): «Credit risk in two institutional regimes: Spanish commercial and savings banks», Journal of Financial Services Research, (22), 203-224.

[41] Saunders, A., and M.M Cornett (2008), Financial Institutions Management, 6th Ed, McGraw-Hill/Irwin, pp 183-184. Saunders, A., E. Strock, and N. G. Travlos (1990): «Ownership structure, deregulation, and bank risk taking», Journal of Finance 45, 643-654.

[43] Tennant, D. and A. Folawewo (2009): «Macroeconomic and Market Determinants of Banking Sector Interest Rate Spreads. Empirical Evidence from Low and Middle Income Countries», Applied Financial Economics, 19 (6), 489-507.

[44] Vogiazas, S. D. and E. Nikolaidou (2011). «Investigating the determinants of nonperforming loans in the Romanian Banking System: An empirical study with reference to the Greek crisis» Economics Research International, 2011(2011), 1-13, Article ID214689

[45] Vazquez, F., B.M. Tabak and M. Sauto (2012): «A Macro Stress Test Model of Credit Risk for the Brazilian Banking Sector», Journal of financing stability (8), 69-83.

[46] Voridis, H. (1993): «Ceilings on Interest Rates and Investment: The Example of Greece», Review of Economics and Statistics, 75(2), 276-283.

[47] Zribi, N. and B. Younes (2011): «The factors influencing bank credit risk: The case of Tunisia», Journal of accounting and taxation 3(4), 70-78.