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Empirical Study of the Impact of Financial Risk and Regulation on the Performance of Moroccan Banks

Etude empirique de l'Impact des risques financiers et de la réglementation sur la performance des banques marocain

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Abstract

Following several studies in the theoretical and financial literature, many factors characteristic of the banking system related to risk, banking regulation and macroeconomic conditions are used in this paper to study their influence on the performance of Moroccan banks. In detail, we used the cost of risk as a bank risk variable. In addition, the capitalization ratio, leverage ratio, and liquidity ratio have been introduced as capital structure and prudential regulation variables, while bank performance is approximated by the return on assets ROA, return on capital ROE, and the interest margin ratio RRMNI. Beyond the integration of bank-specific variables, we use some macroeconomic control variables, namely the inflation rate and the economic growth rate. We try to explain how risk and regulation affect performance and also this relationship can be linked to macroeconomic variation.

This research concerns the 10 largest banks (AWB, Barid Bank, SGMB, CAM, BOA, BP, BMCI, CIH, CDM and CDG) over a period from 2010 to 2020. We have opted for the panel data analysis method with the generalized least squares method (GLS) to obtain robust and validated results. To do so, we described 3 econometric models conceptualized to answer our problem. At the end, these results have been subjected to in-depth analysis and discussion, while relating the role of risk and banking regulation in the financial and economic implications of the Moroccan banking and financial system.

Keywords: banking risks; prudential regulation; capital structure; liquidity; banking profitability.

Résumé

Suite à plusieurs études de la littérature théorique et financière, de nombreux facteurs caractéristiques du système bancaire liés au risque, à la réglementation bancaire et aux conditions macroéconomiques sont utilisés dans ce papier pour étudier leur influence sur la performance des banques marocaines. En détail, nous avons utilisé le coût de risque comme variable de risque bancaire. De plus, le ratio de capitalisation, d'endettement, et de liquidité ont été introduites comme variables de structure de capital et de réglementation prudentielle, tandis que la performance de la banque est approchée par le rendement des actifs ROA, le rendement des capitaux ROE et le ratio de la marge d'intérêt RRMNI. Au-delà de l'intégration des variables spécifiques aux banques, nous utilisons certaines variables de contrôle macroéconomiques à savoir le taux d'inflation et taux de la croissance économique. Nous cherchons ainsi à expliquer la manière dont le risque et la réglementation affecte la performance et si cette relation peut être liée à la variation macroéconomique.

Cette recherche concerne les 10 plus grandes banques (AWB, Barid Bank, SGMB, CAM, BOA, BP, BMCI, CIH, CDM et CDG) sur une période de 2010 à 2020. Nous avons opté ainsi pour la méthode d'analyse en données de panel avec la méthode des moindres carrées généralisées MCG pour obtenir des résultats robustes et validés. Pour ce faire, nous avons décrit 3 modèles économétriques conceptualisés afin de répondre à notre problématique. À la fin, ces résultats ont été soumis à des analyses et discussions approfondies, tout en relatant le rôle du risque et de la réglementation bancaire dans les implications financières et économiques du système bancaire et financier marocain.

Mots clés : risques bancaires ; réglementation prudentielle ; structure de capital ; liquidité ; rentabilité bancaire.

Introduction

The recent global financial crisis of 2008 underscored the importance of cost of risk control, regulatory compliance and effective liquidity management in banking systems. Regulators have responded to this situation by formulating new standards that ensure the soundness, solvency, stability, and resilience of financial systems. Thus, the results of our study could inform policymakers on how the cost of risk, regulation, and capital structure affect the profitability of banks in Morocco.

Overall, the results of this study will make various contributions to the theory and practice of finance. The recent global financial crisis of 2008 highlighted the importance of risk control and compliance with regulatory standards and effective liquidity and capital management in banking systems. Regulators have responded by formulating new liquidity and capitalization standards that will ensure the soundness, solvency, stability, and resilience of financial systems. Policymakers will be able to use this document as a guide to make capital structure, risk, and solvency decisions that will satisfy stakeholder interests in relation to profitability. In addition, this study will inform policymakers on how the cost of risk and capital structure affect bank profitability. It is a valuable source of information. Thus, future studies can build on this study, including taking advantage of its limitations and recommended future research directions.

So how do risk and prudential regulation influence bank performance?

In the first step an excerpt from the most important literature review was set up and in the second step the impact of risk and regulation on bank performance was econometrically analyzed.

1- Literature review

This section provides an overview of previous studies that have shed light on the determinants of bank profitability. It discusses studies that have examined macroeconomic variables and then those that have tested bank-specific variables.

According to Murthy & Sree (2003) Bank's liquidity position and performance can be measured by various financial ratios such as return on assets (ROA), return on equity (ROE), current ratio, quick ratio and net interest margin (NIM) etc.

Alzorqan (2014) used ROA and ROE to study the performance of banks in Jordan.

The first set of studies examined macroeconomic control variables such as inflation rate and real GDP growth rate.

For example, Li (2007) studies the impact of bank-specific and macroeconomic factors on bank profitability in the UK. The results show that macroeconomic variables such as inflation do not have a significant impact on performance. He also finds that the GDP growth rate has an insignificant impact on bank performance. Similarly, Alexiou and Sofoklis (2009) find that the GDP variable is highly insignificant.

On the contrary, Sufian and Habibullah (2009) study the determinants of profitability in the Chinese banking sector during the post-reform period of 2000-2005. They find that the impact of economic growth on profitability is positive.

The second part of the literature tested bank-specific variables. Studies on internal determinants employ variables such as bank capital, liquidity risk, credit risk, bank size.

Pasiouras and Kosmidou (2007) found a positive relationship between capital (equity/asset ratio) and profitability. Moreover, the coefficient on capital size has the highest explanatory power for profitability in the domestic bank model. They report that well-capitalized banks face lower funding costs due to lower bankruptcy costs and less need for external funding.

In addition, Ben Naceur and Goaied (2008) suggest that Tunisian banks, which hold a relatively high amount of capital and higher overhead costs, tend to have a higher net interest margin and profitability level. In addition, Ben Naceur and Omran (2008) analyze the influence of banking regulation, concentration, and financial and institutional development on Middle Eastern and North African (MENA) countries. They find that bank-specific characteristics, particularly bank capitalization, have a positive and significant impact on banks' net interest margins, cost efficiency, and profitability. Similarly, Sufian and Habibullah (2009) find that capitalization has a positive impact on the profitability of public commercial banks.

In addition, Garcia-Herrero et al. (2009) indicate that better capitalized banks tend to be more profitable.

Ozili (2017) concludes in their paper that regulatory bank capital has a positive impact on the profitability of commercial banks in Africa.

According to Pracoyo and Imani,(2018) there is an inverse relationship between bank liquidity and profitability. Theoretically, when banks hold a higher amount of liquid assets, they lose the opportunity cost gains. However, banks that hold a smaller amount of liquid assets normally earn a larger profit.

Like Pasiouras and Kosmidou (2007), Li. find that the impact of liquidity on bank profitability is mixed and not significant, indicating that the conclusion regarding the impact of liquidity remains debatable and that further research is needed (Li, 2007).

On the other hand, Alexiou and Sofoklis (2009) find that the relationship between bank liquidity, as measured by the ratio of loans to deposits, and profitability is negative and significant. The estimated coefficient for this particular fact suggests that an increase in liquidity leads to a decrease in profitability. These results highlight the trade-off between liquidity and profitability.

On the other hand, Ben Naceur and Omran (2008) find that bank specific characteristics, especially credit risk, have a positive and significant impact on net interest margin, cost efficiency and profitability. Similarly, Sufian and Habibullah (2009) indicate that credit risk has a positive impact on the profitability of public commercial banks.

On the other hand, Dietrich and Wanzenried (2011) report that credit risk is insignificant in the total sample and in before the financial crisis and turned out to be significant and negative during the crisis. They propose that before the crisis period, Swiss banks reported very low loss provisions, while during the crisis period, these provisions increased significantly. Similarly, Ommeren (2011) finds that credit risk has a negative relationship with profitability. The coefficient is significantly higher during the crisis than before the crisis.

Ozili (2015) reports a negative and insignificant impact of credit risk on profitability while testing Nigerian commercial banks. In light of the above arguments, there seems to be a need to test the impact of credit risk, especially when measured by the ratio of loan loss provisions to subprime loans in developed Asian economies for the post-crisis period.

In addition, Ben Naceur and Goaied (2008) find that size is negatively related to bank profitability. Sufian and Habibullah (2009) find the same results. They find that size leads to lower profitability of urban commercial banks.

Conversely, Alexiou and Sofoklis (2009) find that the coefficient on the size variable measured by the logarithm of assets is positive and highly significant, reflecting the benefits of being a large firm in the financial services sector. The estimated coefficient shows that the effect of bank size on profitability is positive, a fact that is consistent with the theory of economies of scale.

2- Methodology in panel data

Following several studies mentioned in the previous chapters, many internal variables are used in this paper to study the profitability of banks in Morocco. In addition, the literature suggests that external factors such as macroeconomic trends, stock market development and monetary policy influence banks just as they affect any other type of business. In this study, several sets of data are examined.

This research attempts to identify the risk and regulatory factors that determine the profitability of banks in Morocco, by examining their effect on profitability, mainly (asset size, capital structure, cost of risk, debt ratio and liquidity). Thus, an attempt is made to add improvements to existing studies, using updated published data on banks. In addition, we seek to consider the effect of external factors related to macroeconomic conditions and characteristics of the Moroccan banking system. Thus, we collect financial data related to the balance sheet, income statement, and market, available in the annual reports or websites of the main financial institutions (national banks, Casablanca Stock Exchange BVC, Moroccan Capital Market Authority AMMC). In addition, macroeconomic data are available in the database of the World Bank and the International Monetary Fund (IMF). The sample consists of all universal banks observed over 11 years, from 2010 to 2020. The choice was therefore to focus on the 10 largest banks with a market share of more than 90% and for which data is fully available. We run a series of regressions on several determinants of bank performance. We first measure bank performance through the economic profitability ratio (ROA, ROE and MNI) which are widely used performance measures in the literature (Bonin, Hasan and Wachtel (2005); Beck, Demirgüç-Kunt and Merrouche (2013); Anginer and Demirgüç-Kunt (2014)).

As mentioned above, one of the contributions of our study is to test the hypothesis of a differential impact between banks' performance in terms of risk, capital structure and prudential standards. Indeed, we use the generalized least squares method (GLS) for the panel data study. Overall, we opt for three alternative models of the regression equation for the whole sample. Beyond the integration of bank-specific variables, we use previously defined (macroeconomic) control variables, namely the inflation rate and the economic growth rate.

At the panel data modeling level, we estimate the selected model using the econometric method: ordinary least squares (OLS) in the presence of individual effects. To determine the best specification that fits the available data, we use the Hausman test. Then, we test successively the hypotheses of heteroskedasticity, correlation and autocorrelation. If the model contains

individual effects, but no heteroscedasticity, no correlation and no autocorrelation, we use the WITHIN estimator of the OLS method. Otherwise, we estimate the model by the GCM (Generalized Least Squares) method.

The details of the variables used in our models are presented in the table below. In addition, based on the literature review, we were able to identify certain hypotheses concerning the direction of impact of these variables on the profitability of banks. Thus the expected sign can be positive, negative, or unknown (see Table 1 below):

Table 1: Summary of the definitions of the selected variables and their expected effects for the study

Category of variables		Variables used	Ratings	Measure or ratio used	Expected sign of impact
Dependent variables: banking performance Bank		profitability: Returns on assets (ROA) Net banking	ROA	income / Total assets	
		Bank profitability: Returns on equities (ROE) ROE	ROE	Net banking income / Total assets	
		Bank profitability: Net interest margin ratio (NIM)	MNI	NIM Net interest margin / Net banking income	
Independent Variables	Macroeconomic Control Variables	Economic growth	gdp_growth	rate of real gdp %	+
		Inflation rate	inflation	Consumer price index growth rate %	+/-
	Risk and Regulatory Variables	Bank Size	size	Logarithm of Total Assets	+
		Cost of risk	cost_risk	cost of risk / Net banking income	-
		Capitalization ratio	Ratio_capitalis	Total equity / Total assets	-/+
		leverage ratio	leverage	Total liabilities / total assets -	-
		liquidity ratio	liquidity	loans/assets	+

Source : The authors

3- Empirical Results on the Determinants of Moroccan Banks' Profitability

This section explores the empirical results on the impact of risk cost, prudential regulation and capital structure standards on bank profitability.

- Model (1) of the Influence of Risk Cost and Prudential Regulation on the Variable of Return on Assets ROA

This model provides an economic analysis of the relationship between risk and prudential regulation variables with bank profitability ROA while considering the impact of macroeconomic variables (inflation and gdp growth rates) as control variables. These variables typically include bank size, cost of risk, capitalization, leverage and liquidity ratios.

-Model specifications (1):

〚ROA〛_it = Const+ β_1*inflation_it+β_2* 〚growth_pib 〛_it+ β_3*size_it+β_4* 〚risk_cost 〛_it+β_5* 〚ratio_capitaliz〛_it+ β_6* 〚rat_liqui_assets〛_it+β_7* 〚debt 〛_it+ e_it (1)

With:

〚ROA〛_it: The profitability of bank i in year t

β_j: The coefficients associated with each of the variables j estimated by the model.

Const: The constant.

e_it: The residual or error term

i={1,...,10} Code of each bank; t=l^' year

- Results of model (1) in panel data:

The Hausman specification test was performed to identify the most appropriate model among the two models with fixed and random effects. The results presented in Table 1 are obtained by estimating equation (1) using panel data modeling techniques (random and fixed effects). In addition, heteroskedasticity is present in our sample. The same is true for contemporaneous correlation and autocorrelation. Thus, the Breush-Pagan test for contemporaneous correlation, the modified Wald test for heteroskedasticity, and the Wooldridge test for autocorrelation were used. Subsequently, generalized least squares (GLS) panel data techniques were adopted to control for potential problems of endogeneity and violation of the heteroskedasticity, correlation, and autocorrelation assumptions. Thus, three different specifications of Model 1 were used in the analysis considering the dependent variable "return on assets (ROA)".

The final results of the influence of the cost of risk and prudential regulation on bank profitability are presented in the table below:

Table 2: Results of fixed effects, random effects, and Generalized Least Squares GCM panel modeling on ROA profitability

	Variables	Fixed-effects model (FE)	Random-effects model (RE)	Generalized Least Squares model (GLS)
Macroeconomic control variables	Inflation	0.005	-0.030	0.018
	gdp_growth	0.012	0.017	0.019**
Bank-specific risk and regulatory variables	Size	0.001*	0.001**	0.001***
	risk_cost	-0.020***	-0.023***	-0.020***
	Ratio_capitalis	0.101***	0.098***	0.063***
	Ratio_liquidi	0.031***	0.007**	0.002
	indebtedness	-0.028**	-0.053***	-0.022**
	Constant	-0.014	0.028*	0.007
	Wald statistic	36.40***	179.24***	126.21***
	Hausman test	64.97*** (EF)		
	Number of observations	110		

Source: The authors

Significance level: *** (p<0.01), ** (p<0.05), * (p<0.1).

Robust estimation of heteroscedasticity, correlation and autocorrelation using the generalized least squares (GLS) method.

WALD chi2: overall significance test of the regression.

Table 2 presents the estimation parameters from the 3 specifications of model 1. The estimated coefficients of the bank-specific variables are all significant and have a significant influence on the asset returns of Moroccan banks. In detail, the study observed that there is a strong negative relationship between risk costs, leverage on the one hand and bank performance on the other

hand. This means that as risk costs and leverage increase, bank profitability decreases. Consistent with previous expectations, bank size has a significant positive relationship with bank performance. This means that as bank size increases, bank profitability also increases.

The results for liquidity show that there is a positive relationship between liquidity and bank profitability. This means that having more loans relative to assets can lead to an increase in ROA profitability. On the other hand, the obtained capitalization ratio is very significant and favorable for the profitability of Moroccan banks.

As for the bank specific variables, the coefficient of the cost of risk ratio is negative and statistically significant at the 1% level (coefficient =-0.02). These results indicate that the higher the cost of risk, the lower the bank's performance. Indeed, the increase in costs related to non-performing loans and other risks incurred can affect their profitability.

3.1- Model (2) of the cost of risk and prudential regulation on the variable of return on capital ROE

This model provides a quantitative analysis of the relationship between the cost of risk, prudential regulation and the ROE variable while considering some macroeconomic variables as control variables.

Model specification (2):

〖**ROE**〗_it = Const+ β_1*inflation_it+β_2* 〖growth_pib 〗_it+ β_3*size_it+β_4* 〖risk_cost 〗_it+β_5* 〖ratio_capitalis〗_it+ β_6* 〖rat_liqui_assets〗_it+β_7* 〖debt 〗_it+ e_it (2)

The final results of the influence of risk cost and regulatory variables on bank ROE are presented in the table below (see Table 3):

Table 3: Results of fixed-effects, random-effects, and Generalized Least Squares GCM panel modeling on ROE profitability

	Variables	Fixed-effects model (FE)	Random-effects model (RE)	Generalized Least Squares model (GLS)
Macroeconomic control variables	Inflation	0.033	-0.180	0.006
	gdp_growth	0.157**	0.219**	0.156***
Bank-specific risk and regulatory variables	Size	-0.002	0.006	0.009***
	risk_cost	-0.216***	-0.219***	-0.212***
	Ratio_capitalis	-0.207	-0.036	0.010
	Ratio_liquidi	0.192***	0.070***	0.025***
	Indebtedness	-0.197**	-0.287***	-0.247***
	Constant	0.215	0.226*	0.162***
	Wald statistic	20.84***	114.38***	3744.20***
	Hausman test	20.10***		
	Number of observations	110		

Source: The authors

Significance level: *** (p<0.01), ** (p<0.05), * (p<0.1).

The results in Table 3 show that there are five variables that are significant with the profitability of Moroccan banks measured by ROE. These variables are economic growth, bank size, cost of risk, liquidity ratio and debt ratio.

First, regarding the impact of macroeconomic variables, the sign and significance of the coefficient of GDP growth indicates that banks' profitability increases with the increase of real GDP growth rates. On the other hand, inflation has no impact on bank ROE performance in Morocco. This may suggest that due to the inability of banks to accurately predict inflation levels, they fail to reflect changes in inflation on their ROA and ROE returns. For the economic variable, in times of strong growth, consumption and investment pick up. Indeed, national

wealth supports all economic activity in the country, and therefore positively affects the performance of the banking sector.

In the context of the regulatory variables specific to banks, the coefficient of the cost of risk ratio is negative and statistically significant at the 1% level. This result shows that any increase in the bank's cost of risk would lead to a decrease in ROE. This result is similar to the previous one obtained in model 1 for the return on assets ROA.

On the other hand, another significant variable is the debt ratio, the coefficient is negative and significant in all regressions. This suggests that a higher debt ratio tends to decrease performance by reducing the ROE of banks. As a result, an over-leveraged situation could expose a bank to a major risk of insolvency due to the costs generated by successive declines in its returns. According to our results, the estimated coefficients are negative, indicating that a higher risk-cost ratio decreases the volume of ROE returns. This is because a higher cost may affect the availability of loanable funds for distribution.

Again, the coefficient on the level of liquidity (loans/assets) is positive and significant in all 3 columns. The empirical results show that liquidity has a significant positive relationship with profitability at the 1% level. This is consistent with the expectations of the study because high loans provide funds for banks to lend to interested borrowers, thereby increasing the number of borrowers and bank ROE returns.

3.2- Model (3) of the risk influence of prudential regulatory standards on the net interest margin ratio of NIM banks:

This model provides a quantitative analysis of the relationship between the capital structure in terms of risk and regulatory standards and the MNI net interest margin ratio while considering macroeconomic variations.

Model specification (3):

〖MNI〗_it = Const+ β_1*inflation_it+β_2* 〖growth_pib 〗_it+ β_3*size_it+β_4* 〖risk_cost 〗_it+β_5* 〖ratio_capitalis〗_it+ β_6* 〖rat_liqui_assets〗_it+β_7* 〖leverage 〗_it+ e_it (3)

The final results of the influence of capital structure and prudential regulatory standards on the net interest margin ratio are presented in the table below (see Table 4) :

Table 4: Results of fixed-effects, random-effects, and Generalized Least Squares GCM panel modeling on the NIM net interest margin

	Variables	Fixed-effects model (FE)	Random-effects model (RE)	Generalized Least Squares model (GLS)
Macroeconomic control variables	Inflation	0.593	0.999	1.208***
	gdp_growth	0.206	0.235	0.210***
Bank-specific risk and regulatory variables	Size	0.015	0.015	0.019***
	risk_cost	-0.079	0.024	0.118***
	Ratio_capitalis	-0.179	-0.276	-0.738***
	Ratio_liquidi	0.494***	0.774***	0.945***
	Indebtedness	-0.695***	-0.374*	-0.222***
	Constant	0.687*	0.186	-0.103
	Wald statistic	14.37***	169.79***	9154.28***
	Hausman test	91.51***		
	Number of observations	110		

Source: The authors

Significance level: *** (p<0.01), ** (p<0.05), * (p<0.1).

From the results in Table 4, the sign and significance of the estimated coefficients of the macroeconomic variables indicate that the interest margin of banks increases significantly with higher real GDP growth rates and inflation. Certainly, the coefficient on inflation is positive and significant, indicating that higher inflation leads to better performance. This is reasonable because high inflation would mean that banks can charge high interest on loans.

As expected, GDP growth has a significant positive impact on the interest margin of Moroccan banks. In addition, the positive and significant coefficient on the size variable supports the hypothesis of economies of scale and market power. Larger banks achieve efficiencies that can translate into higher profits and interest.

In addition, the results again indicate that the capital ratio has a significant negative effect on bank performance as measured by NIM. Thus, despite having sufficient capital, banks tend to limit the volume and amount of loans they make for fear of having high solvency and liquidity ratios, which has a negative effect on their performance. Similarly, there is a negative relationship between the interest margin ratio and the debt ratio. The leverage ratio is seen as a measure of solvency by measuring a bank's debt level as a percentage of its total assets. In our study, the liquidity ratio is significant and has a positive impact on NIM. Nevertheless, the positive relationship obtained shows that to compensate for the higher level of loans relative to assets, banks try to pay more for this higher credit risk.

Conclusion

The results of our thesis regarding the determinants of bank performance would be useful for bank risk management and assessing the impact of prudential regulatory standards. As for the capital adequacy ratio (capitalization ratio), it positively influences ROA but negatively influences ROE and NIM. Thus, one can consider that the relationship between the capital ratio and performance can be negative in the short term, particularly with the interest margin, by reducing the equilibrium deposit rate required by depositors. On the other hand, if loans take longer to reprice, this will create a negative causality between past equity and current returns. On the other hand, the cost of risk negatively impacts ROA and ROE, but positively impacts NIM. This implies that a higher cost of risk leads to lower earnings as measured by ROA and ROE, but it favors net interest margins.

In the wake of the implications of this thesis, the results are important for policy makers as they will facilitate the formulation of policies regarding risk, prudential regulatory standards, through the implementation of effective capital, risk and liquidity management in banks. It is imperative for banks, regulators and policy makers in Morocco to continue to promote the implementation of effective risk management in banks. This will help avoid the threat of insolvency or bankruptcy.

Based on the results of the study, the following recommendations can be made: The results show that policymakers can boost performance by lowering the capital adequacy ratio requirement since this study showed, overall, a negative relationship between the capital adequacy ratio and performance. A reasonable level of capital relative to assets for banks and other prudential measures will provide the necessary protection against insolvency risk while ensuring better performance. As for bank managers, the study suggests that they should

regularly monitor risk and regulatory indicators and pursue policies to diversify revenue sources while maintaining operational cost optimization. It is important to note that capital adequacy ratios, liquidity, leverage, risk costs incurred by banks as well as macroeconomic factors such as inflation are key determinants of financial performance.

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