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Credit Risk Management Analysis

AFFES M'HAMED
Doctor-researcher in economics And member of the research unit in development economics (URED)
at the Faculty of Economics and Management
of SFAX (FESGS)

Supervised by: HAMMAMI SAMI

Abstract:- This article is motivated by an empirical study is carried out to estimate the prudential capital requirements to the credit risks actually incurred on their different categories of commitments, which has become increasingly close to reality and allows banks to hedge against the risk of failure; And how banks using modern internal control instruments (IRBs) to manage their credit risks are rewarded with relatively lower regulatory capital requirements. However, banks provide coverage against the risk of default of their client by the constitution of regulatory capital which is estimated with specialized models and specific for each type of outstanding.

Keywords:- *Credit Risk, Basel II, Basel III, experimental economics , IRB approach.*

I. INTRODUCTION

Banking activity is not an activity like any other because of the specific risks it poses to the community: loss of depositors' savings, systemic crisis in the event of the failure of one or more credit institutions or even of the entire banking system.

This is why the Basel Committee instituted on July 15, 1988 an international prudential standard, Basel I, also called the “Cooke ratio” in order to ensure the security and stability of the international financial system.

This system operated for a few years and quickly showed its weaknesses with the banking crises that Asia in particular experienced and which run counter to the efforts made to increase the stability of the international financial system. Experience shows that the major crises of the international financial system of the 1990s have thus revealed all the limits of the Cooke ratio and have led the regulatory authorities to consider new rules and a revision of the 1988 agreement.

Known as Basel II, the new capital adequacy system aims primarily to define a set of rules that take better account of the risks associated with credit transactions. Indeed, the design of the new Basel II agreement enters an era of better management of banking risks, the objective of which is to prevent bankruptcies and strengthen the preventive dimension of prudential regulation. ()

The timetable for the implementation of Basel II in the G10 countries is set for December 31, 2006. On the other hand, the movement towards Basel II for developing countries constitutes a real opportunity to take advantage of the expected benefits. Tunisia, too, will be called upon to adopt Basel II in order to consolidate the financial foundations of the banking system.

In a sector undergoing restructuring, the new Basel agreements are timely for Tunisian banks, most of which have embarked on a path of reform.

Indeed, with the advent of foreign banks, the opening of the Tunisian market and the privatization of public banks, banks will not be spared.

The time has come to discuss issues relating to the modeling of credit risk within Tunisian banks.

This being the case, the reform of the solvency ratio and the modernization of Tunisian banks have meant that the moment is more favorable than ever for the latter to think about the establishment of a risk management system in accordance with the requirements of Basel II.

Thus, a risk management model based on a rating would allow banks to better control their risks, to have an objective assessment of their client portfolios, to maximize the use of their own funds and to understand a new approach to corporate relations. business that binds them to their customers.

However, after several years of application of the Basel I recommendations and before the official implementation of Basel II in banking circles, we can now see that the issue of bank capital and its interaction with banking behavior has taken hold. breadth both in theoretical research and in empirical studies, of which ours is one.

The objective of this work is therefore to try to answer the following problem :

A. *What would be the impact of the adoption of the Basel Committee regulations on credit risk management and on the regulatory capital of banks ?*

The objective of this work is to contribute to previous research concerning the Basel II accord by studying the prospects for its adoption on credit risk measurement techniques and on the regulatory capital of banks.

This research is based on the simplified version of Basel II in order to determine the capital requirement.

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II. EMPIRICAL EVIDENCE OF THE IMPACT OF THE ADOPTION OF BASEL II ON CREDIT RISK MANAGEMENT TECHNIQUES AND ON REGULATORY CAPITAL RELATING TO CREDIT RISK

In a logic of globalization and in a banking sector known for its interdependence, it is clear that the Mc Donough ratio will take its place almost everywhere in the world, once adopted by European and American countries.

Thanks to a deep restructuring-modernization reform, the national banking landscape has evolved a lot and gained in maturity.

The approach based on internal bank ratings is the great novelty compared to the 1988 agreement. It is the one that should eventually be imposed for all international banks, this is the objective of the bale committee. This approach is based on the following principles :

- The IRB approach is based on internal assessments of the probabilities of default : banks must assess their credit risk themselves.
- Banks must classify the exposures of their banking book into broad asset categories characterized by different underlying credit risks, respecting the following definitions: corporates, sovereigns, banking, retail clients and equities, for each of these asset classes, there are three main elements :
  - A set of credit risk assessment parameters namely probability of default (PD), loss given default (LGD), exposure at default (ECD) and maturity (M) which are provided all or in part by the bank.
  - A weighting calculation function specified by the bale committee and integrating the set of parameters.
  - A number of minimum quality requirements that must be met by a bank wishing to use these approaches. Knowing that the use of the latter is subject to validation and approval by national control authorities.
    - The IRB approach presents:
      - An evolving structure defined by :
        - ✓ A simple approach in which only the probability of default (PD) is estimated by the bank while the other parameters are provided by the regulatory authorities.
        - ✓ An advanced approach, in which all parameters are estimated by the bank.
      - An incentive structure, the capital requirement in the advanced approach will be lower than in the foundation approach. However, a bank that adopts the advanced method cannot have a capital requirement lower than 90% of that calculated with the simple method (this is the concept floor).
    - The minimum capital requirements (k) of banks must be determined by applying the following general formula which varies according to the portfolio considered :
      - PD = Probability of default.
      - PCD = loss given default.
      - ECD = exposure at default.
      - M = maturity.

- $$f\left[\sum\left[\begin{matrix}pondération\\ f\ (\mathrm{PD, PCD, M})\end{matrix}\right]\times\left[\begin{matrix}\text{exposition}\\ \text{ECD}\end{matrix}\right]\right]=\text{own background requiremen ts}$$

The weighting calculation functions make it possible to determine the level of capital necessary for a bank to default on a type of credit with a fixed time horizon (1 year) and with a determined confidence interval (99.9%) . In other words, banks will hold equity to deal with a possible " unexpected " loss (PNA). This loss is the difference between a coverage threshold S and the average expected loss (PA). It depends on the variance of the probability distribution of losses knowing that PA = PD x PCD x ECD

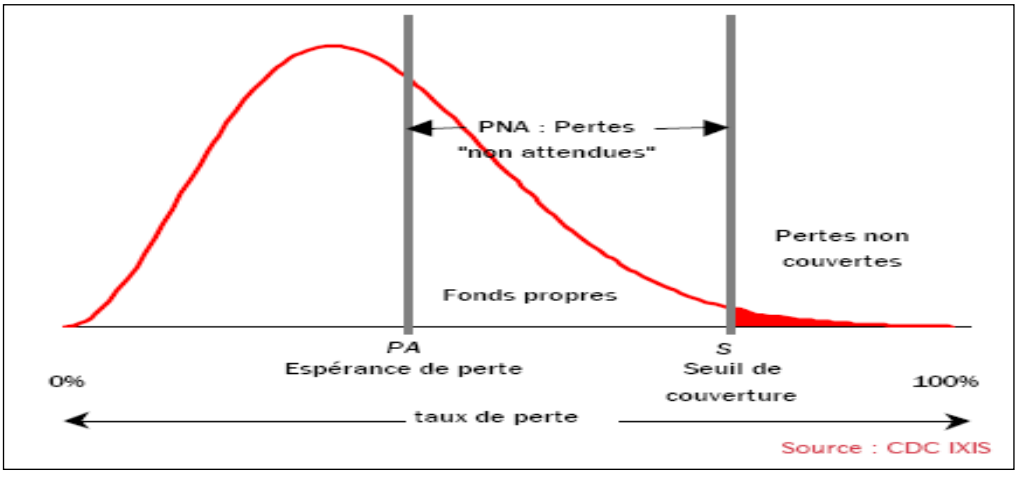

Fig. 1: Example the doric of a probability distributioné losses and funds own requirements at the threshold of coverage.

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III. THE APPLICATION OF THE IRB APPROACH TO THE VARIOUS CATEGORIES OF EXPOSURE

Under the NI approach, banks must classify the exposures of their different portfolios : a / corporates, b / borrowers, c / banks, d / retail customers and e / equities. The business category has five specialized financing sub-categories while the retail category has three. In this phase, we will first define the different categories of exposure and then we will present the application of the NI approach to its various categories. It will be necessary to distinguish the two NI approaches : simple and complex.

A. Definitions of the different asset classes :

- Definition of corporate exposures :

An exposure to a business is generally defined as an obligation of a business, partnership or sole proprietorship. Banks are allowed to classify exposures to small and medium-sized enterprises (SMEs) separately.

The business category includes five specialized finance (FS) subcategories : project, object and commodity finance, report real estate, and high volatility commercial real estate.

- Definition of exposures to sovereign borrowers :

This asset category covers all exposures to governments and their central bank as well as to certain public enterprises and multilateral development banks.

- Definition of exposures to retail customers :

An exposure falls into this asset class if it meets all of the following criteria :

  - Nature of the borrower : Receivables from retail customers, such as revolving credits and lines of credit, term loans and leases, are generally eligible for the treatment applicable to retail customers regardless of their amount.
  - Low exposure value : Loans to small businesses and managed as retail exposures may qualify for the treatment of this category, provided the total banking group exposure to a corporate borrower is less than $ 1 million. euros.
  - Multiple Exposures : To be treated as a retail exposure, a receivable must be part of a large batch of exposures managed by the bank on a collective basis. The control authorities are free to set a minimum number within the lot.

- Definition of equity exposures :

Equity exposures are generally defined according to the economic nature of the instrument. They include both direct and indirect interests, with or without voting rights, in the assets and income of a commercial enterprise or a financial institution.

IV. THE APPLICATION OF SIMPLE AND COMPLEX APPROACHES DEPENDING ON THE ASSET CATEGORY

- Exposure to sovereign borrowers, corporate banks :
  - As part of the foundation approach, banks must themselves assess the probability of default (PD) for each of their borrower ratings, but they must use prudential estimates for other risk components.
  - As part of the advanced approach, banks provide their own estimates of PD, LGD and ECD and must assess maturity (M) themselves.
  - In this context, the five sub- categories of specialized funds are exceptions to this general rule.

- Retail customer exposures :

Banks in this asset class must provide their own PD, LGD and ECD estimates. No distinction is made here between foundation approach and advanced approach.

- Equity exposures :

Two main approaches are used to calculate the risk-weighted assets of exposures not entering the trading book A market-based approach and a PD / PCD approach. The latter is still possible for banks adopting the advanced approach for other types of exposure.

- Generalization of the NI approach to all asset categories :

A bank that adopts the NI approach for part of its receivables is supposed to extend it to its entire banking group. Nonetheless, the committee recognizes that for many banks it may be difficult for a variety of reasons to apply the IRB approach simultaneously to all major asset classes. This is mainly due to the imperfect nature of the data. Thus, banks can meet the criteria for using their own LGD and ECD estimates for some asset classes but not all at the same time.

In this context, the supervisory authorities can authorize banks to gradually program the NI approach throughout their banking group. This gradual evolution includes :

- gradual adoption of the NI asset class approach by asset class within a single institution.
- The gradual adoption of the NI unit-by-unit approach within a single banking group.
- The transition from the foundation approach to the advanced risk component by component approach.

However, a bank that adopts an NI approach for an asset class must also apply it to all exposures within that class.

In addition, banks that adopt an NI approach are expected to continue to use it. Only exceptional circumstances can authorize a return to the standardized approach or the foundation approach and this must be with

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the agreement of the supervisory authority in the case, for example, of a transfer of credit-related activities.

Given the imperfect nature of FS exposure data a bank may continue to apply prudential ranking criteria for one or more of the FP subcategories ; FO ; FPB ; IDR or ICFV and switch to foundation or advanced approach for other sub-categories of business assets.

V. THE METHOD OF CALCULATING CAPITAL REQUIREMENTS

In this part, we will explain the method of calculating the capital requirements for the various categories of exposure :

- Exposures to companies : sovereign borrowers and banks :

In this subsection we will show that the same weighting function is used for these three categories with one exception : prudential coefficients are provided for each FS sub-category of the enterprise category with in addition a specific weighting function for high volatility commercial real estate ICFC.

- Formula for calculating risk-weighted assets :

Risk-weighted assets are calculated based on estimates of PD, LGD and ECD and in some cases the maturity M of a given exposure.

We first calculate a correlation function of risky assets as a function of the probability of default by applying the following formula :

- Correlation (R) = 0.12 x (1- EXP ((- 50) x PD) / (1- EXP (–50)) + (1)

0.24 x [1- (1- EXP ((- 50) x PD) / (1 - EXP (- 50))]

Since the assets do not have the same maturities, we must adjust the probabilities of default :

- A precisely linked to maturity (b) = (0.11852 - 0.05478 x ln (PD)) ^{2} (2)

Finally, the formula for calculating the capital requirements which is a function of PD, LGD and M is as follows :

Capital Requirements (K) = PCD x N [(1 - R) ^ - 0.5 x G (PD) + (R / (1 - R)) ^ (3)

0.5 x G (0.999)] - PD x PCD x (1 - 1, 5 xb) ^ -1 x (1+ (M - 2, 5) xb)

Risk Weighted Assets (RWA) = K x 12.5 x ECD (4) With log : corresponds to the natural logarithm

N (x) ; indicates the cumulative distribution function for a normal standard random variable i.e. the probability that a normal random variable with mean zero and variance 1 is less than equal to ax).

G (Z) : represents the inverse cumulative function for a normal standard random variable.

- Analysis of the results of the simulations of the previous formulas :

Table 1 and Figure 2 represent the evolution of the maturity adjustment as a function of the probability of default, we can observe in this framework that b decreases as the probability of default increases.

PD	DEADLINE ADJUSTMENT (b)
0.01%	0.388
1%	0.137
5%	0.079
10%	0.059
15%	0.049
20%	0.042
25%	0.037
30%	0.034
35%	0.030
40%	0.028
45%	0.026
50%	0.024
55%	0.022
60%	0.021
65%	0.020
70%	0.019
75%	0.018
80%	0.017
85%	0.016
90%	0.015
95%	0.014
100%	0.014

Table 1. Maturity adjustment (simulation of formula 2)

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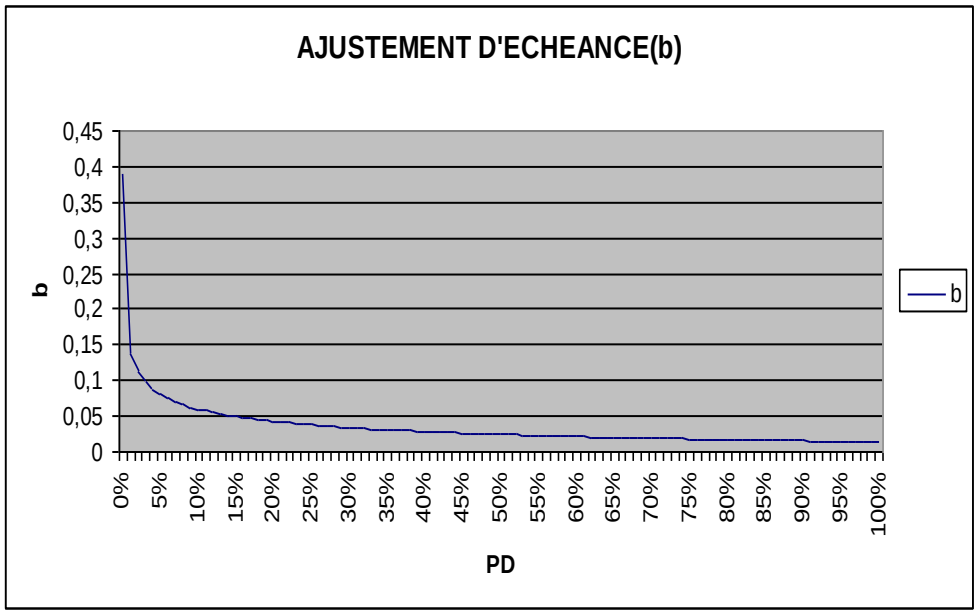

Fig. 2. The evolution of the maturity adjustment (simulation of formula 2)

From Table 2 as well as Figure 3, we can see that the correlation function is strictly decreasing with respect to the default probability so if PD = 100%, we have R = Rmin and if PD = 0%, we have R = Rmax.

PD	CORRELATION (R)
0%	0.24
1%	0.192
5%	0.164
10%	0.146
15%	0.136
20%	0.129
25%	0.125
30%	0.123
35%	0.122
40%	0.121
45%	0.120
50%	0.120
55%	0.120
60%	0.120
65%	0.120
70%	0.120
75%	0.120
80%	0.120
85%	0.120
90%	0.120
95%	0.120
100%	0.120

Table 2: Correlation (simulation of formula1)

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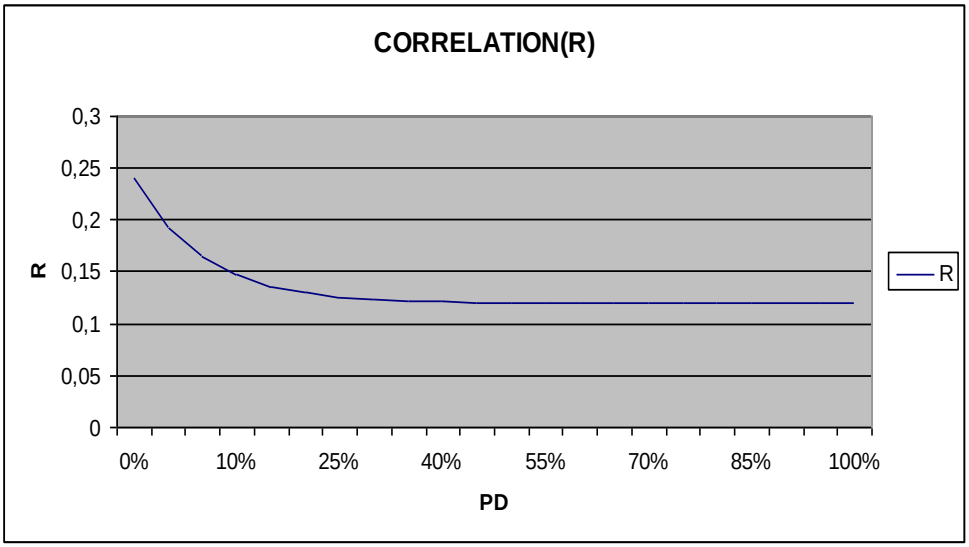

Fig. 3: Evolution of the correlation parameter (simulation of formula 1)

The Tables 3 and 4 show the weights for credit risk on Companies under the Internal Ratings Based (IRB) approach. The data used to define the weights are the probability of default (PD), loss given default (LGD) and an assumed maturity (M) of 2.5 years for Table 2 and 1 year for Table 1 and a turnover of 50 million euros.

Let us note in this context that we will take an ECD = 100 thousand euro for the simulation of this formula as well as all the formulas relating to the calculation of the requirements in clean background.

According to these two tables as well as Figures 4 and 5, it can be seen that the weighting coefficients increase with the increase in the probability of default of companies as well as the loss given default and the maturity of the loans granted.

Nevertheless, we note that after a certain default probability threshold (31% for the first table and 30% for the second) the formulas become incapable of properly evaluating the weighting coefficients since we observe a decrease in the latter for companies with the highest probability of default.

PCD	0.25	0.45	0.85
PD	RWA 1 (%)	RWA 2 (%)	RWA 3 (%)
0.01	40.71	73.27	138.41
0.05	73.27	131.89	249.14
0.1	97.63	175.75	331.97
0.15	113.93	205.09	387.39
0.2	123.87	222.96	421.15
0.3	131.17	236.11	445.99
0.31	131.22	236.20	446.16
0.32	131.17	236.10	445.98
0.4	127.54	229.58	433.65
0.5	116.59	209.86	396.41
0.6	100.28	180.51	340.96
0.7	79.82	143.69	271.41
0.8	56.01	100.82	190.44
0.9	29.34	52.82	99.78

Table 3: Weighting coefficients relating to unexpected losses from exposure to companies (Simulation of formulas 3 and 4 with M = 1 year and CA = 50).

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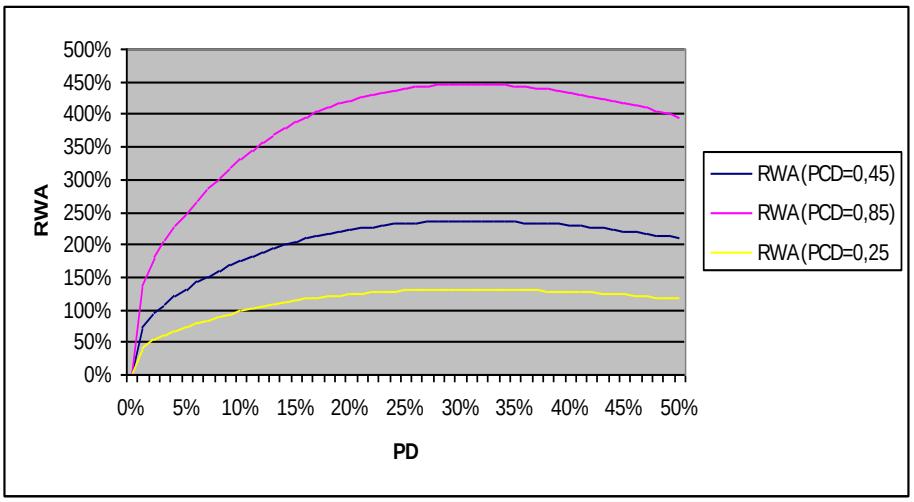

Fig. 4: Changes in weights relating to unexpected losses Applicable to exposures to companies (Simulation of formulas 3 and 4 with M = 1 year and CA = 50)

PCD	0.25	0.45	0.85
PD	RWA 1 (%)	RWA 2 (%)	RWA 3 (%)
0.01	51.28	92.31	174.37
0.05	83.25	149.85	283.05
0.1	107.27	193.08	364.71
0.15	123.07	221.53	418.45
0.2	132.35	238.23	449.99
0.29	138.21	248.79	469.94
0.3	138.23	248.81	469.98
0.31	138.13	248.65	469.67
0.4	133.23	239.82	452.99
0.5	121.03	217.86	411.53
0.6	103.62	186.51	352.30
0.7	82.17	147.91	279.40
0.8	57.48	103.47	195.45
0.9	30.04	54.08	102.15

Table 4: Weighting coefficients relating to unexpected losses from exposure to companies (Simulation of formulas 3 and 4 with M = 2.5 years and CA = 50).

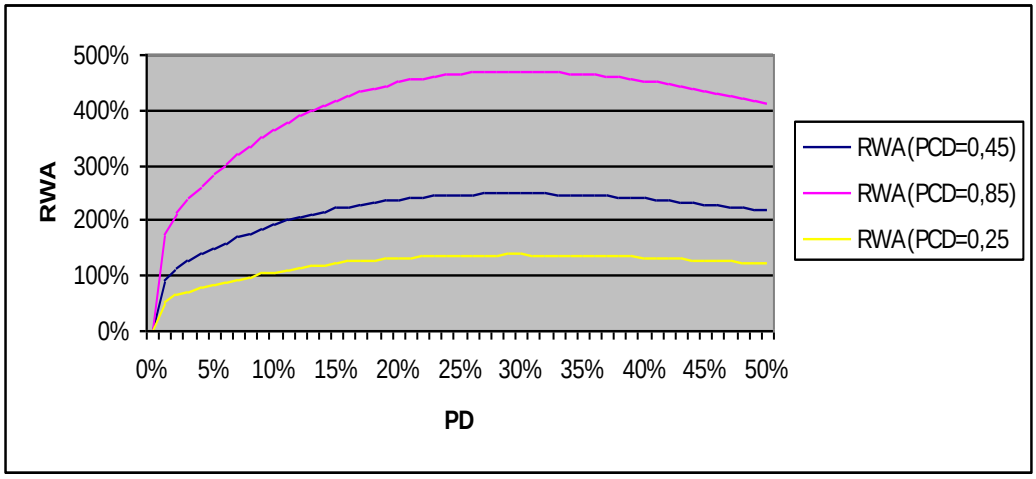

Fig. 5: The evolution of weights relating to unexpected losses Applicable to exposures to companies *(Simulation of formulas 3 and 4 with M = 2.5 years and CA = 50).*

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VI. CONCLUSION

Basel I, through the Cooke ratio, seems to have had its day since 1988, when it entered into force. As it stands, it is difficult to secure the banking and financial system. As a result, the ever-increasing perception of the weaknesses associated with the Cooke ratio, as well as the development of credit portfolio risk management techniques by the most advanced financial institutions, made it necessary to review this agreement.

The reform of the "Mc Donough" bank solvency ratio is part of a global approach to the regulation of the banking profession, the objective of which is to prevent systemic risk and to establish an effective methodology for selecting and managing banking risks. . Based on three complementary pillars, the Basel II accord introduces substantial changes in the treatment of credit risk and the explicit introduction of operational risk in the calculation of minimum capital requirements.

Furthermore, the promotion of best risk management practices, which guarantee the stability and security of the international financial system, is at the heart of the Basel II accord. To this end, the introduction of internal models in the assessment of credit risk is undoubtedly the great innovation of the reform of the solvency ratio. It has positive aspects not only for the modernization of risk measurement techniques within banks, but also for the reduction of banking risk as a whole.

The adoption of such an agreement by Tunisian banks seems to be an opportunity to be seized in order to follow the practices of the big international banks and to develop modern methods of banking risk management.

The objective of this research work would be to study the impact of the adoption of Basel II by Tunisian banks on credit risk management techniques and on regulatory capital.

The approach used is at the crossroads of two perspectives; a theoretical perspective and an empirical perspective.

To highlight this impact, it would be more judicious to reveal the prerequisites for the implementation of Basel II in the Tunisian banking system, namely the evolution of Tunisian banking regulations and the overhaul of the information system.

An analysis of the various studies carried out to determine the impact of Basel II on the regulatory capital of banks was presented, the standardized approach was often considered to be penalizing, while this opinion turned out to be much more nuanced or even neutral in the light of the result of a number of studies. This divergence oriented this research towards the study of the case of Tunisia.

The impact of the adoption of Basel II by Tunisia on regulatory capital will be measured by applying the simplified version of Basel II.

The results found a sample of Attijari BANK commitment portfolio indicate that the capital requirement will increase by 5 533 046 DT against the Cooke ratio in the context of the implementation of the simplified version of the Basel II agreement.

The narrowness of the number of entities in Tunisia is an explanatory factor for this modification of the solvency ratio.

The second explanatory variable is the maintenance of the 100% weighting for unrated companies. It turned out that this unchanged weighting is at the origin of this insignificant variation.

The third variable, and which is perhaps the most important, is the failure to take into account the mortgage as a deductible guarantee for the amount of the commitment, contrary to the old Basel accord. Indeed, the mortgage is a very common practice in the Tunisian context.

Another limit relates to the unavailability of information on SME commitments which will benefit from a favorable weighting of 75%.

Basel II appears at first glance as a constraint, beyond the high implementation costs that it implies, it should be made an advantage; it is indeed an intelligent way to exercise the profession of banker and to equip oneself with an effective risk management system. It is therefore now for the Tunisian banking sector to register, as it has done in the past for the Cooke ratio in the movement towards Basel II which constitutes a real opportunity insofar as it contributes to the upgrading of credit institutions and constitutes an appropriate therapy for the problems of Tunisian credit institutions.

Therefore, beyond the numerous constraints and the heavy investments required for the implementation of this new device, Basel It remains an ambitious project for the improvement of risk management techniques.

Certainly maintaining the current ratio remains an alternative for Tunisian banks for some time, but awareness of the expected benefits of this new ratio would constitute a preliminary and essential step for its implementation in the coming years.

The Basel committee recommends to developing countries the standardized approach pending the finalization of the IRB approach. The Basel II implementation process is a sequential process, the standardized approach of which constitutes a temporary stage in a dynamic transition.

As part of Tunisia's orientation towards the adoption of Basel II. a number of prerequisites must be met:

- Development of an appropriate regulatory system to align with Basel II requirements. Already, the law n ° 2006-19 of May 2, 2006 modifying and supplementing the law 2001-65 relating to the credit institutions, shows the will of the supervisory authorities for the adoption of Basel II.

  The low penetration of ratings in Tunisia could reduce the interest of the standardized approach. Nevertheless,

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by relaunching the provisions of circular n ° 2001-12 of May 4, 2001. The BCT could push banks to demand from their customers the adoption of a rating system. The provisions of this circular will make it possible to expand the number of rated entities in our country and to establish more transparency between the banks and their customers.

- Tunisian banks should make great efforts to renovate their information system and their organization, which are the key factors for the success of an operational and efficient implementation of the Basel II reform.

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