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Analyse quantitative du risque opérationnel et de la performance des banques islamiques

Quantitative analysis of operational risk and performance of Islamic banks

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Résumé

L'objectif de cette recherche est d'analyser l'effet du risque opérationnel (RO) sur la performance des banques Islamiques. Il se distingue dans les banques islamiques par le risque de la non-conformité à la Shariah ou par une défaillance de la responsabilité fiduciaire de l'institution. Le RO est mesuré par les charges et l'actif pondéré du RO, tandis que la performance est mesurée par la rentabilité financière et autres ratios. La période est entre 2007 et 2011 pour 94 banques, de 17 pays. Les données sont obtenues à partir des rapports financiers des banques islamiques. Des techniques de données de panel sont utilisées pour atténuer les problèmes potentiels d'endogénéité. Les résultats indiquent que le RO a un effet négatif sur la performance à long et à court terme et que la réglementation prudentielle dans les banques islamiques présente certaines limites dans le calcul du capital réglementaire et n'offre pas des méthodes avancées pour évaluer le RO.

Mots clés :

Risque Opérationnel ; Ratio Coût ; Actifs pondérés ; performance ; Analyse en données de panel

Abstract

The objective of paper is to analyze the effect of operational risk on performance of Islamic banks. It is distinguished in Islamic banks by the risk of noncompliance to the Shariah banking or in the failure of the institution fiduciary responsibility. Operational risk was measured by cost ratio and risk weighted assets (RWA) while performance by return on equity ratio and others. The period was between year 2007 and 2011 for 94 banks, of 17 countries. Data was obtained from annual financial reports of Islamic banks. Panel data techniques of random effects estimation was used to mitigate potential endogeneity problems. Findings indicate that losses of operational risk and the RWA has a negative effect on the performance both in long and short run. The results confirm that the reglementation prudential for the Islamic financial institutions present some limitations in the calculation of regulatory capital and don't offer advanced methods for evaluating operational risk.

Keywords :

Operational Risk ; Cost ratio ; Risk weighted assets ; performance; Panel data.

Introduction

In recent years, the growth of Islamic finance highlights the importance of adopting policies to foster its integration into national and international financial systems. The applicability of conventional prudential regulation and risk management models to Islamic banks is a central concern for regulators. Although the Basle II or Basel III agreement is the international standard practice for conventional banks in terms of bank capital, the Sariah's financial instruments and the associated specific risks are not recognized in this agreement. Indeed, the principles that govern the functioning of an Islamic financial system are different from the spirit of conventional finance and require the respect of all the ethical principles of the Sharia, which changes the pattern of banking intermediation classic. (Khan & Ahmed, 2001, Sundararajan & Errico, 2002, Grais & Kulthunga, 2007).

Thus, IFSB standards (2005) are largely inspired by the second Basel Treaty. The objective is to develop an approach that is more sensitive to the specific characteristics of Islamic banks and proposes standards adapted to Islamic banking intervention.

In Islamic banking institutions, financing and investment techniques also expose the bank to operational risks similar to its traditional counterpart and to unique operational risks. These risks manifest themselves by the risk of non-compliance of banking operations with Shariah or a default in the fiduciary responsibility of the institution. The management of this risk is necessity for the IFIs. This role is assigned in the Islamic Financial Services Board (IFSB).

However, the IFSB does not propose advanced methods for the estimation of risks. Moreover, it has restrictions in the calculation of its regulatory capital and consequently in the calculation of its prudential ratio. Then, we ask "what is the impact of operational risk on the performance of Islamic banks?"

To answer this question, we will first study the theories of financial structure and profitability in an Islamic context; then, we will discuss a conceptual review of operational risk. Thereafter, we analyze the impact of operational risk charges and RWA on financial structure and profitability in Islamic banks. The methodology used is that of panels by using two econometric software: Eviews and SPSS. The sample of the study is composed of a database of 94 Islamic banks, with financial data of 5 years (from 2007 to 2011) of 17 countries.

1. Theory of market finance in an Islamic context

The study of the profitability of firms has long been the central theme of market finance. Financial theories report that risk and profitability should not be judged independently. The first attempts at theorization took place with Markowitz's (1952) work on the study of portfolios and the optimization process, based on their profitability and level of risk. It is an optics of maximizing utility in an expectancy-variance plan. The contribution of his theory resulted in the definition of an "efficient frontier". According to this definition, the efficient portfolio is the most profitable portfolio for a given level of risk, or the least risky for a given level of profitability. Various non-efficient portfolios are rejected or eliminated because they are not located on the efficient frontier; they are either too risky (for a given level of profitability) or not very profitable (for a given level of risk).

Markowitz's portfolio theory does not escape from criticism because it considers that investor choice is based on only two parameters (expectation and variance), whereas in reality agents may also be sensitive to other factors.

However, Markowitz's (1952) model is at the root of scientific developments in finance, paving the way for other work that has been devoted to the evaluation of performance itself, and has given birth to several models. Thus, one-factor or multifactorial models emerged with the work of Sharpe (1963, 1964), Lintner (1965), Treynor (1965), and other models that followed, including those of Ross (1976), of Fama and French (1992), Carhart (1997),… etc.

The financial lever relationship is another relation reported by financial theory and explains the return on equity according to profitability, assets and the cost of debt.

All the suggested theories have been developed in a context of classical finance. We question the applicability of these theoretical and practical contributions to profitability and risk in an Islamic banking context.

The Risk-Profitability dichotomy is therefore one of the fundamental principles and a reference concept of finance. It is applicable in any decision situation and a basic assumption in any theoretical model.

The Islamic banking model offers products governed by contracts of trust (Amana) and others governed by guarantee contracts (Dhamanah). (Joutti, 2013)

For financing governed by a guarantee contract (Dhaman), the customer is required to repay the amount financed in addition to the margin, regardless of the result of their activity. In this case, the Islamic bank reduces its risk and limits it to counterparty risk only.

Given a low level of risk, the expected profitability is generally low. Thus, the financing operations governed by a contract of Dhaman guarantee low levels of risk but also low returns. (Example of a Murabaha contract for real estate secured by a mortgage (low risk) with a well-defined margin rate (safe and low profitability)).

Financing governed by a guarantee contract (Dhaman) is margin sales (Murabaha, Salam, Istisna ', etc.).

On the other hand, for contracts of trust (Amana), the client shares the gains and losses with the bank and does not guarantee the financed capital. For this purpose, the Islamic bank is exposed to a high risk, but in the hope of benefiting from high profitability.

Funds governed by a trust contract (Amana) are profit sharing and loss formulas such as Musharaka, Mudharaba, etc.

With respect to investment deposits governed by Amana's contracts, Islamic banks transfer the risk of loss and default of investment to depositors who agree to share the gains and bear the losses. However, the Islamic bank is required to ensure significant returns for its depositors to avoid the risk of a deposit leak.

Thus, in the case of an Amana deposit agreement, the risk is low since the bank is responsible for any loss on the depositors' accounts.

On the other hand, for deposits governed by Dhaman's contracts, Islamic banks can use them as part of their financing by guaranteeing the capital to the depositors. In this case, the risk is significant since the bank guarantees the funds deposited.

In one type of contract or another, the level of profitability depends on the fund utilization by the Islamic bank.

The classic financial theories are also based on the fact that the introduction of debts increases the financial risk of firms. This additional risk is borne by the shareholders. The latter, in accepting this risk, require a higher rate of return. Market theories explain that the economic profitability and the financial lever explain the return on equity.

The particularity of these institutions is that they collect the funds in the form of participatory investment deposits. Unlike conventional deposits, these funds are unsecured. Therefore, the mobilization of investment funds by Islamic banks does not increase their risk of bankruptcy and their financial risk. The shareholders of the Islamic banks will not require a higher rate of return on equity compared to the shareholders of the conventional banks (which require higher equity returns with the increase in indebtedness). Al Deehani (1999) concluded that if

debt increases the profitability of equity in conventional banks, the mobilization of investment accounts does not allow it in Islamic banks

To conclude, in a conventional context, the origin of a good return on equity results from the profitability of the economic asset and / or the pure financial construction that is the lever effect. In an Islamic context, the return on equity is largely explained by the profitability of assets.

Lever is weaker in Islamic banks compared to conventional banks due to the existence of participatory investment accounts.

2. Theory of financial structure in an Islamic context

The starting point of capital structure theory was set by the famous article of Modigliani and Miller (1958). They point out that in a frictionless world with no information asymmetry and in the absence of incomplete markets, capital structure has no impact on a firm valuation. Firms should be indifferent to different sources of funding. Thus, the choice of the capital structure should not therefore change firms' risk-taking behavior. However, the existence of market imperfections calls into question the neutrality of capital structure.

After the work of Modigliani and Miller (1958), various theories have been proposed to loosen their hypotheses such as the theory of optimal debt ratio (Myers 1984), pecking order theory (Myers 1984; Myers and Majluf 1984), agency theory (Jensen & Meckling 1976), signaling theory (Ross 1977).

The determination of capital structure depends, first, on the costs associated with conflicts of interest (Jensen and Meckling 1976). Two types of conflicts must be distinguished. The first type pits shareholders against managers. Managers can seek the maximization of their personal satisfaction to the detriment of the goal of maximizing the firm value. Jensen and Meckling (1976) propose, for the firm, the recourse to the debt which obliges the managers to provide the necessary effort to remunerate the creditors. The second type of conflict of interest concerns creditors and shareholders. The debt contract entails an incentive for the shareholders' sub-optimal investment. The optimal capital structure is therefore obtained by arbitrage between the agency costs and debt and its benefits.

The determination of capital structure also depends on the existence of information asymmetries. Managers are expected to hold private information on the evolution of corporate returns and investment opportunities. Two approaches make it possible to explain the choice

of the capital structure by the existence of information asymmetry. The first approach assumes that the choice of the company's capital structure signals the information to investors (Ross 1977). The company's use of debt signals its ability to repay principal and interest. The second approach (Myers and Majluf 1984) suggests that, due to strong information asymmetries and reporting problems associated with equity issuance, the funding preference goes to internal funds from external funds and then debt on equity, with a preference for the least risky debt possible, this is pecking order theory.

Unlike other companies, the capital structure of financial institutions is characterized by the large share of deposits of small depositors who have neither the capacity nor the incentives to monitor the behavior of these institutions. Deposit funding may encourage banks to take more risks by choosing the riskiest assets. The expected gain may exceed the loss to which shareholders are exposed in case of bankruptcy. This effect is known as asset substitution effect. It is supported by depositors. To maintain depositors' confidence, the bank may use the services of deposit insurance. However, the existence of this insurance increases the incentive for excessive risk taking by shareholders. In these circumstances, it is essential that a representative agent (regulator) defends the interests of depositors through regulatory capital requirements in order to annihilate this incentive for excessive risk taking by shareholders.

In keeping with these founding works, the question of the optimal financial structure has become a complex issue in the Islamic logic. If the management of the financial structure in conventional finance conforms to this arbitrage, the principle of backing contracts to real assets requires investors to engage in the real economy. Indeed, Islamic banks are characterized by a higher proportion of tangible assets, which reduces the costs of violation and helps control risk exposure. From that, backing contracts to real assets represents a safety mechanism and an additional guarantee against the risk (Toumi 2011).

In an Islamic context, other agency relationships are added to the traditional relationships (shareholder - managers - creditors) represented by the shareholders-depositors relations in investment account, managers-depositors in investment account and managers of Sharia Advisory Committee (Archer and Abdelkarim 2007).

Conflicts of interest between managers and investment account holders are represented by managers' excessive risk taking to obtain high returns, the holders of the investment accounts also exercise disciplinary control over managers by the threat of withdrawing their funds. In an Islamic context, the objective is not only the maximization of one's own wealth but the

respect of ethical principles, managers are thus encouraged to provide a consistent effort to maximize the final output while preserving the rights of depositors (no excessive risk taking, and fair sharing of profits).

Due to the similarity of incentives, agency conflicts between shareholders and holders of investment accounts, on the level of bank risk, exist. But since the excessive risk-taking and speculation are banned in Islamic finance, the interests of shareholders and depositors in investment accounts are not very divergent. Holders of investment accounts can safeguard their interests by relying only on shareholders' control to act on their behalf for lack of conflicts of interest between them (Toumi 2010).

Conflicts may exist between managers and the Sharia Advisory Committee. Note first that the power of the Sharia Board is limited. Indeed, in the annual report on compliance with Sharia, some committees like to incorporate the following clarification: "the responsibility of stating that the institution operates in accordance with the standards and principles of Sharia burdens on the management. As for our responsibility, it is limited to issue an independent opinion, based on our business supervision of the institution's operations and to prepare a report for you." Such a clarification in annual reports gives a clear idea about balance of power between the advisory committees and financial institutions managers (Saas Ould 2010). If the committee undeniably has a legitimization power of legitimation, the power of execution remains in the hands of the managers. Ould Saas (2010) proposes that the Sharia Boards be appointed by a joint assembly composed of representatives of shareholders, holders of investment accounts and managers. Generally, the board of directors requires proceedings minutes and Sharia compliance audits which give rise to reports. The latter are even (theoretically and according to AAOIFI) included in the institution's annual report.

The classical relations of agency theory are present in an Islamic context through agency conflicts between shareholders and guaranteed fund depositors, and between shareholders and managers.

In an Islamic context, Sharia compliance committee plays a key role in ensuring the interests of all stakeholders. As a result, under the control of this committee, executives have less incentive to maximize benefits to the detriment of shareholders. Agency costs, related to the agency-shareholder relationship, are lower in Islamic banks compared to conventional banks.

In theory, this committee plays a central role in reducing information asymmetries and agency costs in an Islamic bank.

The philosophy of Islamic finance leads in absolute terms to an information symmetry and a perfect transparency of the acts between the Islamic bank and its actors. The principle of profit and loss sharing motivates the entrepreneur to make an adequate effort to manage the bank's funds as its remuneration depends mainly on its provided effort and its know-how. The higher the profit share, the more incentive the entrepreneur will have to manage the bank's funds.

Also, Islamic finance requires transparency in transactions by the prohibition of speculation, which is defined as the set of situations where information is incomplete (El Gamal 2006), hence any situation characterized by lack of information. Information or excessive risk-taking goes against the principles of Islamic finance. Consequently, the transparency of information considerably reduces information asymmetries and subsequently conflicts of interest.

In the same way, the principle of asset tangibility allows the Islamic bank to have a clearer vision on the allocation of funds of savers in assets, and especially to control it. By this means, there will be no leakage of funds from savers to very risky projects. In addition, this principle obliges the bank to allocate funds to areas that respect Islamic ethics and are socially responsible, which reduces information asymmetries that would exist between the bank and depositors.

In an Islamic context, the principle of sharing losses and profits represents an effective system of risk mitigation. Theoretically, the Islamic bank does not need minimum capital requirements to protect the holders of profit sharing investment accounts. However, it should be noted that the regulatory authorities in the majority of the countries in which Islamic banks are located believe that these should not allow depositors in profit sharing investment accounts to incur a loss on their invested capital or a significant drop in yields on their deposits (Toumi 2011)

Thus, profit sharing investment accounts are considered as guaranteed capital accounts (Fiennes 2007) because Islamic banks therefore have an implicit obligation to insure and guarantee the investments of depositors. In this context, the Islamic bank has the obligation to hold equity in order to absorb any losses.

Although in Islamic theory, Islamic banks would be less capitalized than conventional banks; in practice they hold a considerable proportion of equity.

3. Operational risk in Islamic banks

Operational risk has become increasingly important because of financial scandals in the world of banking such as Barings, Daiwa and Merril Lynch (Hoffman 2002, Hull 2007, Hussain 2000). Faced with this growing materialization of operational risks, the Basel Committee (2003) has found it necessary to define the operational banking risk, to list the events related to it, to ensure coverage by the development of best practices within banks and by setting up capital requirements. Under his leadership, a specific literature on banking operational risk has gradually been created (Embrechts and Pucetti, 2007, BCBS, 2003). The objective is to consider a financial treatment of operational risk through the implementation of quantification and valuation methodologies.

In the Islamic banking system, the main theoretical and empirical work on risk management in Islamic finance has focused mainly on credit risk and the importance of contract design as a risk management tool. However, the operational risk is ranked as the second most dangerous risk faced by risk managers of Islamic financial institutions.[1]

Moreover, the specificity of deposits and Islamic financing techniques exposes the Islamic bank to operational risks of a unique nature (Archer & Haron, 2007, Sandararajan, 2007, Sundararajan & Errico, 2002, Khan & Ahmed, 2001). The sources of operational risk in Islamic banks are mainly the risk of Sharia non-compliance, fiduciary risk, people risk and legal risk. (Izhar, 2010)

3.1. The risk of non-compliance with Shariah

The Islamic Financial Service Board (IFSB) defines in its guiding principles for institutions offering financial services the risk of non-compliance with the Sharia as the risk of non-compliance with the rules and principles of Sharia determined by the Sharia board or the competent organ of the Islamic Financial Institution (IFI). (IFSB, 2005).

These Sharia compliance requirements must be omnipresent and integrated throughout the organization, as well as into its products and activities. Respect for the Sharia is considered an essential priority for the survival of the institution. The violation of the principles of Sharia in

1 In 2002, the IDB carried out a risk perception study with 17 IFIs from 10 different countries; 15 Islamic banks participated effectively in this research, led by Tariqullah Khan and Habib Ahmed (Risk Management: An Analysis of Issues in Islamic Financial Industry, Jeddah: IRTI), These are Bahrain, United Arab Emirates, India, Bangladesh, Pakistan, Russia, Malaysia, Saudi Arabia, Sudan and Turkey.

a transaction will result in the cancellation of the transaction or the generation of illegitimate income.

Given the diversity of interpretations of Sharia requirements in banking contracts, the Accounting and Auditing Organization of Islamic Financial Institutions (AAOIFI) has published the latest Sharia standards for Islamic banks.

3.2. The fiduciary risk

Islamic banks are responsible for losses due to negligence, mismanagement or violation of one of the principles of Islamic finance. The risk of loss associated with these events is called fiduciary risk. (IFSB, 2005)

Fiduciary risk losses can cause the volatility of the bank's revenues and, consequently, the volatility of its partners' revenues. Similarly, the Islamic bank may become unable to respond to requests from holders of guaranteed fund accounts or to protect the interests of investment account holders.

In addition, the volatility of the income of investment fund custodians or the non-protection of their interests may lead to a failure to maintain the fiduciary responsibility of the IFI. As a result, the institution is obliged to protect the interests of its custodians, and likewise it must ensure transparency, effective management and credibility of its promises in order to maintain investor confidence. (IFSB, 2005) Two important aspects that must be taken into consideration in safeguarding the trust of donors:

- Sharia Aspect: The Islamic bank must ensure that the activities and products are in accordance with the Sharia. This goal can only be achieved by complying with all instructions from the Sharia Board of the bank.
- Performance aspect: the Islamic bank is required to achieve a suitable financial performance, failing which; the lenders might suspect mismanagement or conduct of the bank.

3.3. The staff risk

Another aspect of operational risk is the risk of people, resulting from either incompetence or deception related to human behavior and which may expose the Islamic bank to potential losses. Akkizidis and Kumar (2008) state that the greatest number of staff losses result from intentional activities such as fraud and unauthorized transactions; it can also invade all areas of activity where a pattern coincides with an opportunity. In addition, Akkizidis and Kumar

(2008) suggest that financial institutions should put in place appropriate systems and in-depth controls of operational risk.

The operational risk in the IFI is also linked to the lack of qualified Finance and Sharia staff. At the same time, the skills required deserve special multidisciplinary training in risk management, regulation, supervision and Sharia.

The Islamic banking industry must have a new generation of innovators, risk managers, regulators and supervisors who are able to ensure the proper fusion of knowledge in finance and Sharia. (Aziz, 2006).

3.4. The legal risk

The term "legal risk" is not clearly mentioned in the IFSB standard to specify the operational risk aspect, the legal risk of IFI cannot be neglected in the context of Islamic finance. It is mainly due to the uncertainty of laws, the lack of an adequate legal system reinforcing financial contracts, the lack of legal experts, the uncertainty of contract interpretations, and the changing of laws and regulatory systems. (Sundararajan 2005, Kumar 2008). As a result, the majority of banks operate in different business and legal environments in their home countries, and the number of separate contracts required to execute an Islamic financial transaction amplifies operational risk in the IFIs.

Although the legal risk profile in Islamic banks seems similar to conventional banks, the Sharia aspect makes the difference between the two. However, most banking, commercial and tax laws and the inherent regulations do not provide for provisions specific to Islamic finance instruments.

The bank secretary general of Al Baraka Nasser (2010) suggests, as a solution to the legal risk, the development of new legal instruments of Islamic banks in litigation and the continuation of efforts to the development of a legal framework, regulatory and fiscal recognizing the specific legal and economic instruments of Islamic finance and induced neutralizing any over-taxation.

The IFSB standards related to operational risk are largely based on the Basel Committee's approach, with modifications necessary to reflect the nature and characteristics of products that comply with Sharia.

Some difficulties inherent in the lack of reliable financial data on Islamic financial institutions remain the major obstacle for more refined measures of the risks related to the Islamic

banking activity. This is the reason why the IFSB does not suggest advanced methods for risk estimation.

According to the Basel II rule, a bank must hold an equity amount of 8% of the risk-weighted assets remains unchanged. The calculation of regulatory capital is based on the Basic Indicator approach and the standard approach of Pillar 1 of the Basel II Accord. However, due to the different structure of Islamic banking trades, only the basic indicator approach is retained with the same rate of 15% as that of Basel II. Advanced risk measurement approaches are not developed in this agreement, this choice is justified by the lack of historical financial data on Islamic financial institutions, including financial data relating to losses related to non-compliance with the Sharia (IFSB, 2005). As a result, the IFSB (2005) requires Islamic banks to set aside an additional amount above 15% of average annual gross income to cover all operational risks. From this observation, we assume as a research hypothesis that operational risk charges and risk weighted assets have a negative impact on the performance of Islamic banks (profitability and financial structure).Our theoretical analysis has allowed us to conclude that, theoretically, Islamic banks and conventional banks have different structure, profitability and operational risks.

4. Methodological framework

From the review of the theoretical literature presented, we seek to test the impact of operational risk on profitability and financial structure whose objective is to improve other methods of quantification of risk in Islamic banks. We therefore assume that:

Operational risk charges and risk weighted assets negatively affect the profitability and financial structure of Islamic banks.

The methodology used in our empirical analysis is that of panels. It is about a form of multiple regression that allows for the joint processing of individual and temporal effects. This double dimension makes it possible to simultaneously account for the dynamics of behavior and their possible heterogeneity, which is not possible with time series and cross sections. (Sevestre, 2002)

This analysis of the panel data will be solved using three econometric software namely: Eviews, XL-stat and SPSS.

The sample of the study is composed of a database of 94 Islamic banks, with financial data of 5 years (from 2007 to 2011) of 17 countries; this sample is distributed as follows (Table 1):

Table 1: List of banks surveyed by country

Pays	Nombre de banques islamiques
ARABIE SAOUDITE	8
BAHRAIN	15
BANGLADESH	3
BOSNIA AND HERZEGOVINA	1
INDE	1
INDONESIE	2
IRAN	3
JORDANIE	1
KUWAIT	14
MALAYSIA	9
PAKISTAN	10
QATAR	7
SOUDAN	5
TURKEY	3
UAE	6
UK	4
YEMEN	2
Total	94

Source: authors

The determinants of bank profitability have long been a major focus of research in many countries. Studies on the determinants of banking performance focused on the two categories of banks, on the one hand Islamic (Srairi 2008, Sanusi and Ismail 2005, Bashir and Hassan 2003, Bashir 2003).

and on the other hand, conventional (Olson and Zoubi, 2011, Dietrich and Wanzenried, 2011, Athanasoglou et al, 2008, Rouisi et al, 2008, Srairi, 2008). The variables often used are: ROE (financial return on equity) and ROA (financial profitability of the company's assets).

All empirical studies consider internal factors related to bank-specific characteristics as well as external factors related to the banking industry and the economy. Internal factors are generally management-related factors such as risk management, cost management, liquidity, capital, size, etc. External factors are not under the direct control of management, but under that of other institutions.

The main ones are regulatory factors, competition, concentration, market share, inflation and the demand for money, etc. Economic theory and existing empirical studies often differ on the impact of these factors on bank profitability.

The following table summarizes the different variables used in this research to study the financial performance and operational risk of Islamic banks. (Table 2)

Table 2: The main variables of the financial performance and operational risk of Islamic banks

Rentabilité de l'actif total : ROAA (Return on average assets)	Ratio de liquidité immédiate CR (Current ratio)	Levier financier DER (Debt equity ratio)	Variation des charges des risques opérationnels Var RO
Rentabilité du capital investi : ROAE (Return on average equity)	Ratio de liquidité générale LDR (loan deposit ratio)	Levier global DTAR (Debt to total asset ratio)	Variation du capital servant à couvrir le risque opérationnel Var RWARO (risque weighted assets)
Marge des frais de profit PEM (Profit expense margin)	Ratio de capacité financière NLTA (Net loan / total asset ratio)	ELR (Equity/Liabilities ratio)	Taille de l'entreprise Log cap
		CRAR (Capital Risk Asset ratio)	Approches réglementaires

Source: authors

5- Presentation of results and interpretations

In order to test the hypothesis that operational risk and its weighted assets influence the profitability of the Islamic bank, we consider the following model:

ROAEit = f (var RO / var RWA; log K; DTAR; CRAR; LDR; CR; ROAA; PEM; Reg; App)

The profitability of the bank, as we have already mentioned, was measured by the ratio between net income and invested capital. This ratio is interesting for the shareholders because it indicates the counterpart of each cent invested by the owners.

The theoretical and empirical literature has allowed us to raise a set of variables that can influence the profitability of the bank that we will consider in order to increase the internal validity of the model.

We will work initially by the variation of the operational risk charges.

The presence of individual effects test allows us to reject the null hypothesis (group constant difference test). The model is heterogeneous and therefore we opt for the introduction of individual effects.

The rejection of the homogeneity of the data leads to two types of models: those with fixed effects and with random effects. The Hausman test makes it possible to reject the fixed-effect model, the corresponding p-values are greater than 5%, and we then retain the null hypothesis and opt for the random effects model. Our model will therefore keep the form with random individual effects and is as follows:

$ROAE = \beta0 + \beta1 \text{ var RO} + \beta2 \log K + \beta3 \text{ DTAR} + \beta4 \text{ CRAR} + \beta5 \text{ LDR} + \beta6 \text{ CR} + \beta7 \text{ ROAA} + \beta8 \text{ PEM} + \beta9 \text{ Reg} + \beta10 \text{ App} + (\alpha_i + \varepsilon_i, t)$

For all (i = 1... 94)

❖ Homoscedasticity test

The inter-individual heteroscedasticity test gives us an F of 7.884425 of degree of freedom of (52, 113) with a p value of 0.0000 below the threshold of 5%. As for the homoscedasticity test of time origin, it gives us a value of 0.3763.

Therefore, we reject the null hypothesis and conclude that individual heteroscedasticity exists.

❖ Auto correlation test

Under the null hypothesis of the test, we assume the absence of self-correlation between inter and intra-individual residuals or between residuals and explanatory variables.

The p values are greater than 5%, so we conclude that the residuals are not self-correlated and that there is an absence of autocorrelation between the residuals and the explanatory variables.

❖ Multicolinearity test

The comparison of the simple correlation coefficients resulting from the combination of the different explanatory variables and the coefficient of determination of the model makes it possible to avoid the bias of multicolinearity.

❖ Correction of heteroscedasticity and autocorrelation of the model:

The use of GCM (Generalized Least Squares) method allows us to correct the heteroscedasticity detected.

After correcting inter- and intra-individual autocorrelation and heteroscedasticity, the final model is reported in the table (Appendix 1).

Quality of fit is acceptable with more than 73% of the overall variance explained. The statistically significant model at the 1% level. Thus, it is possible to infer this result at the level of Islamic banks with a risk of error of less than 1%.
Operational risk charges negatively affect profitability, which is in line with the theoretical and empirical study made.

Second, we will approach the same model but change the charge in operating expenses by the risk of weighted assets RWA and we will follow the same methodology of analysis.
After correcting inter and intra individual autocorrelation and heteroscedasticity, the final model is reported in the table (Appendix 1).
The quality of fit is acceptable with more than 80% of the overall variance explained. The model is statistically significant at the 1% level. Thus, it is possible to infer this result at the level of Islamic banks with a risk of error of less than 1%.
Operational risk-weighted assets have a negative impact on the profitability of the Islamic bank, which matches our theoretical predictions. The arbitrary calculation without taking into account the specificity of the operational risk of the Islamic banks and the lack of the precision in the determination of capital covering this risk only wants to end up with detrimental repercussions on the profitability of the Islamic banks.

To test the hypothesis of the impact of operational risks on the financial structure of Islamic banks, we refer to the following model (which is a priori a mathematical model):
NLTAit = f (var RO / var RWA; log K; DER; CRAR; LDR; CR; ROAA; PEM; Reg; App)
To do this, we reduce the level of the bank's financing capacity as measured by the ratio between the value of loans granted by the bank and the value of all its assets. Indeed, given the theoretical literature on the coverage of risk by banks, an increase in operating expenses of the bank, marking an increase in its level of risk, is supposed to be accompanied by a reduction in the amount of loans granted to commitments within the framework of banking prudential standards.
In order to increase the internal validity of the econometric model of the 2nd hypothesis test, we integrate control variables. These reflect factors that, in the light of the empirical and theoretical literature, have an influence on the level of liquidity. Thus, we control the effect of the following factors:

The value of the bank's capital;

The level of indebtedness in the bank's liabilities (or its debt leverage);

The regulatory regime;

The calculation approach for the operational-risk-weighted assets;

Its financial and commercial performance.

The first factor (value of the bank's capital) is valued by the decimal logarithm of the equity value. The use of the logarithmic transformation is done to avoid the bias of the heterogeneity of the variables used in the same econometric model.

The second factor (the level of indebtedness) is measured through the share of debt in the balance sheet liabilities of the bank over its equity total.

The third variable is the bank's regulatory regime and its approach for determining operational-risk-weighted assets.

Finally, the dimensions of the financial and commercial performance were operationalized respectively through the variables reporting the net result to the total assets and those resulting from the division of the profit before taxes on the total of the operating expenses, which translates the bank's efficiency in generating benefits that exceed the expenses associated with its current activity.

Referring to the theoretical literature, the financing capacity is a linear function of the set of exogenous variables edited in such a way that we write the following formula:

NLTAit = f (var RO / var RWA; log K; DER; CRAR; LDR; CR; ROAA; PEM; Reg; App)

We will work initially by the variation of operational risk charges and we will follow the same analysis methodology of profitability/operational risk.

The correction of all the biases gives rise to the model reported in the table (Appendix 2).

An increase in the variable variation in the operating expenses value leads to an increase in the variable which reports the value of the loans granted by the bank to the value of these assets total.

Second, we will address the same model but changing the variation of operating expenses by the variation of the operational-risk-weighted assets. The data in our database are in the form of panel data that present observations for each bank over time.

The final model is reported in the table (Appendix 2).

A reading of the model allows us to say that the higher the operational-risk-weighted assets, the lower the bank's share of these assets total, and less its ability to offer new loans. Thus, the random determination of RWA can affect the funding capacity of the Islamic bank.

Operational risk charges negatively affect profitability, which is in line with the theoretical and empirical study made. The more the bank assumes operational risks, the higher its costs, the lower the profitability or the profitability of the shareholders. In fact, the increase in the value of the operational risk charges at time t deprives shareholders of their profitability shares at time t + 1. Thus, an increase in the operational risk of the bank constitutes a restriction of the profitability of the investments made. Our results are in line with other research linking risk and profitability (Dietrich and Wanzenried 2011, Rouissi et al 2010, Athanasoglou 2008, TOUMI 2011).

Moreover, market theories always emphasize the interactions between risk, diversification and performance. The hypothesis is therefore verified.

Operational risk-weighted assets have a negative impact on the profitability of the Islamic bank, which matches our theoretical predictions. The arbitrary calculation without taking into account the specificity of the operational risk of the Islamic banks and the lack of the precision in the determination of capital covering this risk only wants to end up with detrimental repercussions on the profitability of the Islamic banks.

The negative link between profitability and holding capital above the regulatory minimum has already been confirmed by Foneska and Gonzalez (2010), Brewer et al (2008). Our results show that this is true for Islamic banks as well. In addition, the results confirm the market theories of which the degree of risk taken by Islamic banks is different compared to conventional banks.

Additionally, an increase in the variable variation in the operating expenses value leads to an increase in the variable which reports the value of the loans granted by the bank to the value of these assets total. Thus, the higher is the portion of the operating expenses (marking an increase in the banking risk), the more is the portion of the loans granted by the bank in view of the value of its assets, and the less is the capacity of the Islamic bank to offer new loans. Indeed, the increase in the value of loans granted time't' deprives subscribers of larger parts of loans time't+1'. Therefore, an increase in the bank's operational risk constitutes a restriction in front of its funding capacity. The model also highlights that the influence of

operational risk on the bank's funding capacity is statistically significant on the verge of 1%. Thereby, it is possible to deduce this result to the population of Islamic banks with a risk of error of less than 1%.

In light of this result, it is possible to say that the hypothesis is verified.

Furthermore, the higher the operational-risk-weighted assets, the lower the bank's share of these assets total, and less its ability to offer new loans. Thus, the random determination of RWA can affect the funding capacity of the Islamic bank.

The model shows us that the lack of precision or the random determination can have a negative impact on the funding capacity of the company.

The model is statistically significant at the 1% level. Thus, it is possible to infer this result at the level of Islamic banks with a risk of error of less than 1%.

We conclude that the hypothesis is true even though the coefficient of determination is low.

On the other hand, this model is underpinned by the hypothesis of residuals normality that has not been realized.

Conclusion

In Islamic financial institutions, the nature of financing and investment techniques expose the bank to operational risks similar to its conventional counterpart and to unique operational risks.

The Islamic Financial Service Board (IFSB) has associated operational risk with losses resulting from the inadequacy or failure of internal processes, people or systems or external events, including losses resulting from non-compliance with the Sharia or a failure of the fiduciary responsibility of the Islamic Financial Institution (IFI). (IFSB, 2005).

In addition, the operational risk standards of the IFSB are largely based on the Basel Committee approach, with the necessary modifications to match the nature and characteristics of the products that conform to the Sharia.

Some difficulties inherent in the lack of reliable financial data on Islamic financial institutions remain the major obstacle for more refined measures of the risks related to the Islamic banking activity. This is the reason why the IFSB does not suggest advanced methods for risk estimation.

As a result, our study has shown that an increase in the change in the value of operating expenses results in a decrease in profitability. Thus, the higher the share of operating expenses is important (materializing an increase in bank risk), the less the Islamic bank's capacity to offer new loans. In fact, an increase in the bank's operational risk constitutes a restriction in terms of its financing capacity. The influence of operational risk on the profitability of the bank is statistically significant at the 1% level.

To conclude, Islamic banking is constrained by an increasingly competitive environment and the risk-sharing culture requires more rigorous regulation which takes into account the specificity of Islamic banks.

APPENDIX 1: Estimation of model coefficients after bias correction

Tests		Profitability	
		ROAE	
RO	P value	0.000000	
	R squared	0.732947	
	F stat	38.42399	
	Durbin watson	1.715145	
	Coefficients	Var RO	- 0.008511
		Log K	0.001580
		DTAR	0.000301
		CRAR	-0.105674
		LDR	0.048287
		CR	0.012988
		ROAA	4.639282
		PEM	-0.001930
		B1/IFSB	0.121456
		BIA	-0.053213
		S/MA	-0.029812
	Constante		-0.095495

Tests		Profitability	
		ROAE	
RWA	P value	0.000000	
	R squared	0.800423	
	F stat	27.70951	
	Durbin watson	1.982733	
	Coefficients	Var RO	-0.006689
		Log K	-0.008330
		DTAR	-0.031840
		CRAR	-0.244130
		LDR	0.084141
		CR	0.049015
		ROAA	5.374158
		PEM	-0.032438
		B1/IFSB	0.094431
		BIA	-0.082279
		S/MA	-0.003955
	Constante		0.163825

Source: Eviews Release (Personal Treatment)

APPENDIX 2: Estimation of model coefficients after bias correction

Tests		NLTA (liquidity)	
RO	P value	0.000000	
	R squared	0.620374	
	F stat	22.87844	
	Durbin watson	1.540167	
	Coefficients	Var RO	0.006733
		log K	0.041794
		DER	0.060955
		CRAR	0.096996
		LDR	0.108468
		CR	-0.033826
		ROAA	0.175618
		PEM	-0.005071
		Bl/ IFSB	-0.081505
		BIA	0.068512
		SA / S/AM S	-0.011839
	Constante		-0.322462

Tests		NLTA (Liquidity)	
RWA	P value	0.000000	
	R squared	0.553666	
	F stat	8.570557	
	Durbin watson	1.509800	
	Coefficients	var RO	0.000138
		log K	0.037480
		DER	0.050480
		CRAR	0.082657
		LDR	0.164586
		CR	-0.140772
		ROAA	-0.127235
		PEM	0.015777
		Bl/ IFSB	0.079059
		BIA	-0.071760
		SA / S/AM S	-0.097182
	Constante		-0.223481

Source: Eviews Release (Personal Treatment)

Bibliographic References

Akkizidis, I. and Khandelwal, S. (2008), Financial risk management for islamic banking and finance, Palgrave Macmillan, 256 p. DOI: 10.1057/9780230598751

Archer, S. and Haron, A. (2007). Operational risk exposure of Islamic banks, John wiley&Sons, 121-131. https://doi.org/10.1002/9781118390443.ch6

Asarpota, A.K and Kader, J.M. (2007). Comparative Financial Performance of Islamic Banks vis-à-vis Conventional Banks in the UAE, Proceeding on Annual Student Research Symposium and the Chancellor's Undergraduate Research Award, available at http://sra.uaeu.ac.ae/CURA/Proceedings (accessible le 10 Octobre 2016).

Athanasoglou, P. P., Brissimis, S. N. et Delis, M. D. (2008). Bank-specific, industry-specific and macroeconomic determinants of bank profitability", Journal of International Financial Markets, Institutions and Money, 18, 121-136. http://dx.doi.org/10.1016/j.intfin.2006.07.001

Aziz, Z. A. (2006). Building a Robust Islamic Financial System. Available at http: //www.bis.org /review /r060208e.pdf (accessible 30 septembre 2014).

Bashir, A.H.M. (2003). Determinants of Islamic banking profitability: some evidence from the Middle East, Islamic economic studies, 11, 31-57.

Bashir, A.H.M. and Hassan, M. (2003). Determinants of Islamic banking profitability, 10th annual conference of Economic Research Forum, Marrekech, Morroco.

Basel Committee on Banking Supervision. (2003). Sound Practices for the Management and Supervision of Operational Risk, available at http://www.bis.org, (accessible 07 Mai 2018).

Bhambra, H. (2007). Supervisory implications of islamic finance in the current regulatory environment, dans Simon Archer & Rifaat Ahmed Abdel Karim, Islamic finance: the regulatory challenge, Edition John Wiley&Sons, Ltd, pp. 199-211.

Carhart, M. M. (1997), On Persistence in Mutual Fund performance, Journal of Finance, 52, 57-82.

Cibafi, 2009, Les principes de juste milieu au secours de la finance mondiale, Documentation CIBAFI.

Dietrich, A. and Wanzenried, G. (2011). Determinants of bank profitability before and during the crisis: evidence from Switzerland, Journal of International Financial Markets, Institutions and Money, 21, 307–327.

Embrechts, P. et Pucceti, G. (2008). aggregating risk across matrix structured loss data : the case of operational risk, Journal of operational risk.

Fama, E.F.(1965). Random walks in stock market prices, Financial Analysts Journal, 21, 5, 55–59. https://doi.org/10.2469/faj.v51.n1.1861

Fiennes, T. (2007). Supervisory Implications of Islamic banking: A supervisor's perspective, Islamic finance: the regulatory challenge, Wiley&Sons, 247-256.

Foneska, A.R. and Gonzalez, F. (2010). How bank capital buffers vary across countries: The influence of cost deposits, market powerand bank regulation, Journal of Banking and Finance, 34, 892-902.

Grais, W. and Kulathunga, A. (2007). Capital structure and Risk in Islamic Finance Services, Islamic finance: the regulatory challenge, Wiley&Sons Ltd, United Kingdom, 440p. https://doi.org/10.1002/9781118390443.ch4

Hideur, N. (2010). Identification et mesure des risques juridiques dans une banque islamique, conférence sur la gestion des risques en Finance Islamique, 7 janvier 2010.

Hoffman, D. G. (2002). Managing Operational Risk: 20 Firmwide Best Practice Strategies, John Wiley & Sons, Inc, Newyork, 576 p.

Hull, J. (2007). Gestion des risques et institutions financières, Pearson Education, Paris, 555p.

Hussain, A. (2000). Managing Operational Risk in Financial Markets, Oxford: Butterworth-Heinemann, 91 – 142.

IFSB (2005). Guiding Principles of Risk Management for Institutions (other than insurance institutions) offering only islamic financial services, available at http://www.ifsb.org/published.php, (accessed 07 Mai 2018).

IFSB (2007). Disclosures to Promote Transparency and Market Discipline for Institutions Offering Only Islamic Financial Services (Excluding Islamic Insurance (Takaful) Institutions and Islamic Mutual Funds), available at http://www.ifsb.org/published.php,(accessed 07 Mai 2018).

Izhar, H. (2010). Identifying Operational Risk Exposures in Islamic Banking, New horizon global perspective on islamic banking et insurance, 44, 175, pp12 -16.

Jensen, M.C.et Meckling, W. (1976). Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure, Journal of Financial Economics, 53-82.

Jouti, AT. (2013). le couple risque – rentabilité dans le modèle bancaire islamique , cahier de la FI n°4, 43- 65.

Khan, T. and Ahmed, H. (2001). "Risk Management: An analysis of issues in Islamic financial industry, Islamic Development Bank, 183p.

Modigliani, F. et Miller, M. (1958). The cost of capital, corporation finance and the theory of investment, American Economic Review, 261-297.

Myers, S.C. et MAJLUF, N. (1984). Corporate Financing and Investment Decisions when Firms Have Information That Investors Do Not Have, Journal of Financial Economics, 13, 187 - 221.

Myers, S.C. (1984). The capital structure puzzle, Journal of Finance, 34, 575-592.

Olson, T. and Zoubi, A. (2008). Using accounting ratios to distinguish between Islamic and conventional banks in the GCC region, The International Journal of Accounting, 43, 45-65.

Ross, S. A. (1977).The Arbitrage Theory of Capital Asset Pricing, Journal of Economic Theory, 13, 3, pp. 341-360. https://doi.org/10.1016/0022-0531(76)90046-6

Rouisi, R.B. (2011), Les déterminants de la rentabilité des banques françaises : comparaison entre banques domestiques et banques étrangères. Unpublished doctoral dissertation, Université Rennes 1, 324p.

Sanusi, N.A., & Ismail, M.S. (2005). Actes du colloque du séminaire national de Islamic Banking and Finance: Islamic Wealth Management, Issues and Challenges, 29-30.

Sevestre, P. (2002), Econométrie des données de panel, Dunod, 224 p.

Snoussi, K.J. (2012), La finance islamique, Repères, La découverte, 128 p.

Srairi, A. (2008). Comparaison of the profitability of Islamic and conventional banks: the case of GCC countries, Bankers, Markets and Investors, 98, 16-24. DOI : 10.12691/jbe-3-1-6

Sundararajan, V. et Errico, L. (2002). Islamic Financial Institutions and Products in the Global Financial System: Key Issues in Risk Management and Challenges Ahead. IMF Working Paper, WP/02/192. http://www.imf.org/external/pubs/ft/wp/2002/wp02192.pdf

Sundararajan, V. (2007). Risk characteristics of Islamic product: implications for risk measurements and supervision, Islamic finance: the regulatory challenge, wiley&sons, 121-152.

Toumi, K. (2010). L'impact des comptes d'investissement participatifs sur le ratio prudentiel des banques islamiques, les cahiers de la finance islamique de l'université strasbourg , 76, 2, 39-49