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Competition, stability, and productive efficiency of The MENA Banking Sector

Reem Hamieh

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des Pays de l'Adour en Sciences de gestion**, sur le thème :

Competition, stability, and productive efficiency of The MENA Banking Sector

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**Competition, stability, and productive efficiency of The MENA
Banking Sector**

ABSTRACT

The objective of this thesis research is two-fold: on the one hand, to examine the relationship between competition, cost efficiency, and banking stability; and on the other, to assess the relationship between governance and banking stability both of which relate to commercial banks operating in the Middle East and North Africa (MENA) region. The research covers the period from 1999 to 2020. To meet this two-fold objective, we based our analysis on theories of industrial organization economics and competition (i.e. structure-conduct-performance paradigm; Lerner index; Panzar-Rosse model), productive efficiency (stochastic frontier model) and governance. The results obtained using panel data models and the Generalized Method of Moments (GMM-System) demonstrate that cost efficiency, capital ratio, liquidity ratio, profitability, and investment rate of economic growth positively affect banking stability in the MENA region. In addition, the results show that there is a negative relationship between market power and banking stability. Regarding the relationship between governance and banking stability, the results indicate the existence of a negative relationship between stability and the role duality of the chairperson and CEO on the one hand, and a positive relationship between risk committee, board size, gender diversity, and banking stability on the other. Finally, the results demonstrate that institutional factors (i.e. control of corruption, quality of regulation, rule of law, etc.) are considered as explanatory factors for banking stability in the MENA region.

Key words: SCP paradigm, Efficient structure, Competition, Market power, Bank risk taking; Cost efficiency; Corporate governance framework; Bank performance; MENA region.

RÉSUMÉ

Cette thèse vise à étudier la relation entre la concurrence, l'efficacité coût et la stabilité bancaire d'une part et, la relation entre la gouvernance et la stabilité bancaire d'autre part pour un échantillon des banques commerciales opérantes dans la région MENA au cours de la période 1999-2020. Pour atteindre cet objectif, nous nous sommes basés sur les théories de l'économie industrielle, de la concurrence (modèle structure-comportement-performance ; indicateur de lerner ; la Statistique H de Panzar-Rosse), de l'efficacité productive (modèle de frontière stochastique) et de la gouvernance. Les résultats obtenus à l'aide des modèles des données de panel et de la méthode des moments généralisés (GMM-Système) ont montré que l'efficacité coût, le ratio de capital, le ratio de liquidité, la rentabilité et le taux de croissance économique affectent positivement la stabilité bancaire. Cependant, les résultats ont révélé l'existence d'une relation négative entre le pouvoir de marché et la stabilité bancaire. En ce qui concerne la relation entre la gouvernance et la stabilité bancaire, les résultats ont montré l'existence d'une relation négative entre la stabilité et la dualité de fonction de président et de directeur général d'une part, et d'une relation positive entre le comité de risque, la taille du conseil d'administration, la diversité des genres et la stabilité bancaire d'autre part. Enfin, les résultats ont révélé que les facteurs institutionnels (contrôle de la corruption, qualité de la régulation, l'État de droit, etc.) sont considérés comme des facteurs explicatifs de la stabilité bancaire dans la région MENA.

Mots clés : Paradigme SCP, structure efficace, concurrence, pouvoir de marché, prise de risque bancaire, efficacité coût, cadre de gouvernance d'entreprise, performance bancaire, région MENA.

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Introduction

In the mid-1990s, The MENA countries (Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, Palestine, Yemen, Sudan, and Turkey) launched banking deregulation strategy which was aimed at increasing competition in the banking sector (Berger et al., 2009). Over the years regulatory authorities have gradually reduced the scope of laws regulating the banking sector² which have triggered a consolidation wave in the banking market.

This deregulation of the MENA banking sector has led to an increase in competition that can be observed particularly through the decline in bank margins (Hassan et al., 2011). The intensification of banking competition can also be explained by the entrance of foreign banks (those with more than 50% of capital held directly or indirectly by foreign investors). Being more efficient, having proven know-how and undertaking more diversified activities, banks have recorded lower interest margins which, in turn, has exposed to greater competitive pressure. To cope with this reorganization of the market, domestic banks have had to restructure their activities and review their competitive strategies (Awdeh and EL Moussawi, 2009; Farazi et al., 2013; Caporale et al., 2016; Elfeituri, 2018).

Efforts to stimulate banking competition were motivated by the idea that this increase in competition would lead to more sustainable growth since the banking sector has a particular influence on economic activity. Macroeconomic gains are thus expected from the increase in banking competition: the induced fall in interest rates should lead to an increase in investment and thus promote growth (Schumpeter, 1911; McKinnon, 1973; Levine, 2002; Levine, 2005). These expected gains essentially result from two distinct mechanisms: the first is that increased banking competition leads to a reduction in monopoly rents in favor of lower interest rates (Bikker et al., 2007). This is based on a standard economic theory: competition forces companies to bring their prices closer to marginal cost pricing, which contributes to maximizing overall welfare. At the company level, it is a question of improving the allocative efficiency of the market – i.e. allowing a better allocation of the resources. Within the banking industry regulations that existed until the 1990s had created significant monopoly rents on the banking markets which suggest high potential gains in welfare (Coccoresse, 2017).

The second mechanism is that increased banking competition should encourage banks to reduce their incremental costs and improve their cost efficiency, which, in turn, should lead to lower interest rates and thereby affect the stability of the banking sector. The theoretical and empirical literature shows that the degree of competition prevailing in the banking sector has (albeit rather ambiguously) some implications for the stability of the banking sector. On the one hand, collusion between banks enables them to avoid a price war (interest rate) and therefore instability in the sector (Dewatripont and Tirole 1994; Boyd and De Nicoló 2005; Schaeck and Cihak 2012; Fiordelisi and Mare, 2014); and on the other, the absence of competition between banks leads to the existence of inefficient banks and eventually to the weakening of the banking sector as a whole (Marcus, 1984; Keeley, 1990; Hellmann et al., 2000; Matutes et Vives 2000; Cordella and Yeyati 2002; Martinez-Miera and Repullo, 2010).

Empirical studies have demonstrated the existence of a high level of cost inefficiency in the banking sector in both developed and developing countries (Berger and Humprey, 1997; Altunbas et al., 2007; Fiordelisi et al., 2011; Doan et al., 2018). Indeed, studies on the cost efficiency of banks conclude that there are, on average, 20-30% cost inefficiencies, i.e. banks could reduce their costs by 20 to 30% while maintaining their level of production. As a result, there is a high level of potential cost efficiencies in the banking sector in both developed and developing countries.

Efficiency consists of producing a given quantity of outputs using the minimum quantity of production factors (inputs) or producing the maximum quantity of outputs given the quantity of inputs (Fare et al., 2008). According to Coelli et al. (2005), efficiency is the optimal use of inputs in the production process of a decision-making unit. Thus, inefficiency is measured by the distance which separates an inefficient bank from the optimal production frontier.

Efficiency plays an important role in the competitive behavior of banks. In contrast to the market power theories (structure-conduct-performance hypothesis and relative market power) developed by Hicks (1935) and Bain (1956) where the negative effect of the non-competitive market and market power is revealed. Efficiency of banks is an approach based on the so-called efficient structure theory which indicates that the most efficient banks are expected to have higher profits. This allows them to gain higher market share thereby making the market less competitive (Demsetz, 1973; Peltzman, 1977).

At the same time, there is a positive relation between efficiency and market power of banks: due to their market power banks have better efficiency (Carletti et al., 2024; Shaffer, 1999 Dell'Araccia, 2001; Kasman and Carvalho, 2017) Characterized by information asymmetry the banking market makes banks more sensitive to the economic situation. Shaffer (1999) and Dell'Araccia (2001) provide theoretical arguments about the difficulty of reducing information asymmetry problems in a competitive environment. The researchers maintain that entrepreneurs generally tend to be somewhat hesitant when it comes to matters of selection and external monitoring of investment projects. On the other hand, in many cases, entrepreneurs do not want to reveal the true solvency of their projects. So, the more banks operate on the market, the more likely that poor quality firms will be financed. The intensification of competition makes it difficult to develop and maintain long-term relationships between banks and firms that usually allow banks to obtain information on the risk taker and/or risk averse behavior of customers and thus reduce the moral hazard and adverse selection problems (Freixas and Rochet, 2008). In the same vein, Hauswald and Marquez (2006) have shown that the intensification of competition reduces investment in information recovery of banks, which accentuates the adverse effects of the presence of information asymmetry. Marquez (2002) posits that high market concentration allows banks to have better knowledge about the market which reduces the adverse selection problem. Thus, a competitive and/or less concentrated market prevents a decrease in asymmetric information and may have negative effects on the efficiency of banks. This theoretical current is grouped under the title Information Generating Hypothesis (Marquez, 2002; Kozak S., & Wierzbowska, 2021). The banking systems in the MENA countries are characterized by the existence of an informational opacity as evidenced by low access to accounting data which should reinforce the arguments of the theory of Information Generating Hypothesis.

Several studies have analyzed the relationship between the degree of banking competition, stability, and the cost efficiency of banks by regressing cost efficiency and banking stability on the degree of competition (Olson and Zoubi, 2011; Haque and Brown, 2017; Apergis and Polemis, 2016; Gonzáles et al., 2017). The results of these empirical studies have demonstrated that the intuitive positive link between the degree of competition and cost efficiency is unclear. Moreover, this generally leads to a negative relationship between the degree of competition and banking stability or to a positive relationship between concentration and banking stability. The empirical evidence thus remains uncertain and

cannot support the existence of a positive relationship between competition, stability, and banking efficiency. Hence engaging in empirical research to clarify the nature of the relationship between competition, stability, and efficiency of operating banks in the MENA region is indeed important.

Finally, it should be noted that the majority of previous studies did not take into account the effects of good governance in working to enhance the efficiency and stability of the banking sector (Liang et al., 2013; Dong et al., 2017). In the past two decades, interest in the concept of bank governance has increased in most developed and developing countries, especially in the wake of the financial and banking crises that many countries and continents witnessed, which led to destabilization in the banking sectors. Given that banks are generally known to play an important role in financing the national economy through, for example, providing loans for the development of commercial and industrial projects in addition to providing services to individuals and institutions, it is reasonable to assume that the failure of banks to perform this function will most likely have negative consequences on depositors, companies, and the national economy. This, in turn, is likely to lead to the possible bankruptcy of some banks and the emergence of systemic risks and, finally, to the occurrence of banking crises. As a result, maintaining the ability of banks to perform the function of financial intermediary between those with financial surpluses and those charged with the responsibility of ensuring banking stability (i.e. the government) is of the utmost importance (Karamanou and Vafeas 2005; Adams and Mehran, 2012; Abid et al., 2021). In light of the changing economic and financial environment that has been accompanied by structural reform programs, the subject of studying the effects of governance on the stability of the banking sector has become one of the important elements through which channels capable of reducing the degree of risk for banks operating in the MENA region can be identified.

1. Objective of the research

The main objective of this thesis research is to demonstrate precisely why competition in the banking sector does not necessarily lead to improved efficiency and stability of banks, and to verify these claims empirically.

More precisely, this thesis has three complementary objectives. The first objective is to analyze the impact of competition on the stability/fragility of banks operating in the MENA region. The second goal is to determine the level of efficiency and development of banks in a competitive environment so as to determine the extent of their impact on banking stability. As a result, we seek to assess the potential impact of these factors on stability and efficiency resulting from increased competition in the banking sector of countries in the MENA region. The final goal of this research is to study the effects of applying good governance principles on banking stability.

2. Problem statement and research question

The novelty of this research lies in its empirical investigation into the effects of competition on the stability and efficiency of banks operating in the MENA region. As a result, the following research questions have been proposed to guide our work:

What is the impact of banking competition on the stability and efficiency of the banking sector in the MENA region?

What is the impact of governance on the stability of the banking sector in the Middle East and North Africa region?

Operating within a dynamic and competitive environment prompts inquiry into the nature of the relationship between competition, efficiency, and banking stability. This determination is crucial for managers, supervisory bodies, and regulatory authorities, all striving to ensure the smooth functioning of banks and the stability of the banking industry. Amidst constant change, understanding whether recent deregulation and reforms (particularly the intensification of competition) have led to the stability of banks and their improved cost efficiency in the MENA region has become imperative. Furthermore, identifying the internal and environmental factors influencing competition, efficiency, and stability of banking is essential for responding effectively to these developments. Finally, examining the impact of governance on risk and, consequently, banking stability is crucial. Excessive risk-taking by banks often stems from factors beyond competition, including deficiencies in the board of directors' functions. Drawing from the theory of banking governance, our study aims to provide both theoretical and empirical insights into the risk-taking behavior of banks operating in the MENA region.

Based on the preceding discussion we have developed the following research hypotheses (associated with the research question) to better address the issue.

3. Hypothesis

As already mentioned, our study aims to address the outlined research question and contribute to the existing body of literature through an examination of the situation of banks operating in the MENA region from 1999-2020. We rely on the theories of information asymmetry, new industrial organizations, and productive efficiency to answer our research question and validate the following hypotheses:

First hypothesis (H1): There is a statistically significant relationship between competition and cost efficiency.

Second hypothesis (H2): There is a statistically significant relationship between competition and banking stability.

The third hypothesis (H3): There is a statistically significant relationship between governance indicators and banking stability.

Fourth hypothesis (H4): There is a statistically significant relationship between internal (size, capital ratio, liquidity, etc.), external variables (economic growth, inflation, control of corruption, political stability, quality of regulation), efficiency, and banking stability.

4. Research Methodology

Theoretical and empirical work examining the relationship between competition and performance often relies on the structure-conduct-performance (SCP) paradigm. According to this paradigm, the competitive structure of a market considered exogenous determines the behavior of agents in terms of pricing and quantities produced.

Several critical appraisals of the SCP paradigm can be found in the literature. Proponents of the contestable market theory question the theoretical existence of a link between concentration and performance when there is no barrier to entry (Baumol 1986). Moreover, for proponents of the theory of efficiency, a positive and significant link between performance and concentration does not necessarily reflect market power but may reflect a difference in efficiency between banks.

The theoretical and empirical deficiencies of the SCP paradigm have contributed to the emergence of new methods for studying the link between competition, stability, and efficiency of banks: the mark-up test of Bresnahan (1982, 1989) and Lau (1982); and the income test of Panzar and Rosse (1987). The first test is meant to estimate a structural model with separate supply and demand equations setting the mark-up above marginal cost as a measure of market power. This test has been criticized because it assumes that banks are price-takers in the market system. In addition, econometric regressions are often accompanied by a problem of multicollinearity. Since the mark-up test is a structural model, these problems cannot be solved by suppressing series which puts this test at a disadvantage compared to the Panzar and Rosse method. In addition, there is, according to Shaffer (2004), a bias of the results if the bank follows a preference behavior for expenses.

The second test proposed by Panzar and Rosse (1987) based on the estimation of an equation that links income to a vector of factor prices. Panzar and Rosse show that the sum of the income elasticities with respect to each production factor, denoted by H-Statistics, is negative for a monopoly or oligopolistic collusion and is equal to 1 for a bank which operates in perfect competition in the long run. All intermediate values of the Panzar and Rosse H-statistics are between zero and unity indicates monopolistic competition. This methodology is easy to use and the econometric techniques employed are not complicated and often transferred into to panel models.

This approach often used in the literature gives H-statistics that do not vary with the quantity produced (outputs) and with the quantities of input factors which leads to a constant demand elasticity over time. In this regard, it should be noted that the body of empirical work examining the relationship between competition, stability and efficiency of banks, and particularly those related to the banking systems in the MENA region was based on the equation of reduced form as proposed by Panzar and Rosse (1987). Taking into account the disadvantages of these two approaches, we will not use the structural model in its reduced form. To measure the banking competition in the MENA region, we will adopt, contrary to the existing works, a flexible functional form of the trans logarithmic or trans trigonometric type in order to: 1) allow the H-statistics to vary with the production mix and the factors of production, and 2) to have results that correctly reflect the type of competitive equilibrium

(monopoly, oligopoly, monopolistic competition, etc.) and the degree of competition prevailing in the banking systems of the MENA region.

In terms of bank cost efficiency assessment, we will use the productive frontier techniques developed by Farrell (1957), Aigner, Lovell, and Schmidt (1977), Battese and Corra (1977), Meeusen and Van den Broeck (1977), Charnes et al. (1978), Banker et al. (1984), and Battese and Coelli (1995). The use of these techniques makes it possible to overcome the problems related to the use of the ratio method to measure the cost efficiency of banks. The use of productive efficiency as a tool for measuring productive performance makes it possible to take into account the different aspects of performance of a production unit. But two problems appear at the center of the efficiency measure: on the one hand, the estimation of the frontier which proves a complex problem in the presence of a multi-factor/multi-product technology; and, on the other, the measurement of the deviation of the production plan evaluated at a reference point on the frontier. Obviously, these two problems are closely related to the body of hypotheses established on the production set, to the choice of a functional form for the specification of the technology as well as to the choice of the estimation method.

There are two basic methodologies in the literature that are used for estimating the frontier of a production set in economic theory. A parametric or econometric approach can be distinguished (Aigner et al., 1968; Lovell, 1993; Greene, 2017) which assumes that the frontier can be represented by a production, cost or profit function with constant parameters that it is necessary to estimate (Cobb-Douglas function, CES function, Translog function, etc.) the non-parametric approach which does not specify any precise functional relation. In this thesis research, we employ both parametric and non-parametric approaches to measure the cost efficiency of operating banks in the MENA region. Specifically, we utilize the Stochastic Frontier Analysis (SFA) method as a parametric approach and the Data Envelopment Analysis (DEA) method as a non-parametric approach. The complementary use of these two methods ensures a comprehensive and robust analysis of cost efficiency.

The major benefit of the study of cost efficiency using a cost boundary is that this type of efficiency is the only common goal for all firms in a market regardless of their status. Indeed, the use of this modeling makes it possible to consider internal and external factors that reflect the intra-organizational dimensions as well as the inter-organizational dimensions that have an influence on the performance of banks. The analysis of the determinants of performance leads to a better analysis than the simple ranking of banks by their level of performance.

Moreover, it allows the capture of the effects of the economic environment and to assess the managerial capacities or the effort of the managers within each bank. This type of analysis of managerial efficiency, perceived as an estimate of the quality of management, makes it possible to extract from inefficiency the “share” of managerial inefficiency by isolating the effects generated by the economic environment on bank efficiency.

Concerning the study of the impact of governance on risk and banking stability, the methodology chosen consists of using the method of generalized moments in system (GMM-system) to determine the nature of the relationship between the variables relating to governance, variables specific to each bank, macroeconomic and institutional variables with risk and banking stability (Arellano and Bode, 1991; Arellano and Bover, 1995). The use of this method makes it possible, on the one hand, to avoid the problems of endogeneity between the dependent and independent variables, and on the other, to reduce the problem of autocorrelation between the error terms of econometric models.

The main benefit of studying the relationship between competition, cost efficiency, and banking stability on the one hand, and the relationship between governance and banking stability on the other, using random cost limits and the (GMM-System) method, lies in the fact that it allows the introduction into the estimated standard models of a set of internal and external factors that reflect the internal and external organizational dimensions. External regulatory framework, which is expected to have an impact on the performance and efficiency of banks and on governance mechanisms and banking stability. Moreover, the importance of the study is evident in that it allows monitoring of the impact of the economic environment and evaluating the administrative capabilities (or effort of managers) within each bank in order to develop strategies to maximize profits and reduce risks.

This methodology will be used to perform empirical tests, answer our research question and validate our hypotheses.

5. Plan of the thesis

To address the research question, our work is divided into four chapters.

Chapter one provides a comprehensive overview of the theoretical models for measuring competition. It begins with a discussion of the descriptive approach employing traditional

indicators of concentration and profitability, then transitions to the modeled approach, incorporating the Structure-Conduct-Performance (SCP) paradigm and the Bresnahan model (1982, 1987) in order to identify market power. Additionally, the chapter explores the Rosse and Panzar Model (1987), which estimates a profit equation linking a bank's total income with input prices in order to ascertain the prevailing competitive equilibrium in the studied market.

Chapter two delves into the relationship between competition, efficiency, and banking stability within the MENA region. It reviews the body of literature on these relationships and delineates the methodology and econometric techniques employed to empirically study them. Finally, the chapter presents empirical results and conducts robustness tests to validate the findings.

In Chapter three the focus shifts to analyzing the impact of governance mechanisms on banking stability in the MENA region. The chapter reviews theoretical and empirical literature on this topic, introduces the banking data used, and outlines the methodology adopted to test the models. Empirical results and robustness tests obtained using panel data models and the GMM framework is then presented.

Finally, there is a Conclusion chapter that summarizes all the findings in a coherent manner and addresses their managerial implications.

CHAPTER I: STRUCTURE-CONDUCT-PERFORMANCE RELATIONSHIP

This chapter aims to present different theoretical models for measuring the degree of competition. First, we use the descriptive approach to measure the degree of competition using traditional indicators of concentration and profitability. Second, we move to the modelled approach by focusing on the problem of identifying market power using the SCP paradigm and the Bresnahan (1982, 1987) model. Thirdly, we present Rosse and Panzar (1987) attempts to identify the degree of competition by estimating a profit equation, which links the total income of the bank with the prices of the production factors (inputs). The estimation of this equation makes it possible to determine what type of equilibrium competitive (monopoly, perfect competition, oligopoly) prevails in the studied market. Finally, we shall discuss competition models in strategic management. The literature emphasises three dominant strategic models that help explain the relationship between competition and corporate performance: the Porter economics approach, the resource-based approach and the relational approach, which was developed from the criticism of the first two. Each of these frameworks had a significant impact in strategy. We highlight their contributions and their limits for the construction of a model of strategic analysis in an internationalised context marked by inter-organisational networks and multi-market competition.

I.1. The relationships between structures, conduct and performance: lessons from industrial organization economics

The industrial organization economics approach was developed from a general model of economics, (attributable to Mason, 1939) and synthesized during the period 1960-1970. This general model is known as the Structures-conduct-Performances (SCP) paradigm. Its development is explained by the dissatisfaction felt with the traditional microeconomic theory, i.e. the theory of pure and perfect competition in which the explanation of the performance of firms does not pose a problem (Freixas and Rochet, 2008). The term performance refers to very general content, such as profitability, growth, etc. If we integrate it into the profit rate, it is obvious that the explanation of this rate is not a problem in pure and perfect competition: according to Mason (1939, 1949) all firms perceive, at equilibrium, the same rate of profit regardless of their activity. The main idea of the SCP paradigm is based on the fact that the performance of firms is explained by the characteristics of the markets, i.e.

by the structures (monopoly, pure and perfect competition, oligopoly, monopolistic competition, etc.) and by the way in which firms act on these markets (conduct).

Industrial organization economics is therefore concerned with market structures in which firms hold market or monopoly power (Scherer, 1980). These structures are described by concentration – the reason why we will first expose the link that may exist between market concentration and profitability and its overcoming by approaches that question the causality underlying the traditional approach. However, this connection has both theoretical and empirical limitations. We must therefore consider new formulations that favor the behavior of firms.

I.1.1. Concentration, profitability: from the original model to the new vision

The foundation of the original model of the SCP paradigm is a break with traditional microeconomic theory, more specifically with the analysis of pure and perfect competition. It is based on an essentially empirical approach, but which, nevertheless, has an analytical foundation. We will then discuss the problems posed by the measurement of concentration before returning to the relationship between concentration and profitability, which corresponds to the so-called *structuralist approach*. The formulation of a more satisfactory model, which calls for a formalisation of competition in an oligopolistic market, makes it possible to understand the limits of the structuralist approach.

I.1.1.1. The principle of the SCP relationship

The analysis starts with an empirical observation: the performance of firms varies significantly depending on the market. It seeks to propose a general model capable of explaining these differences and which can be verified statistically. Mason (1939) seeks to establish a causal link between the performance of firms and behaviour. The analysis provided by Mason (1939) shows that this causality is unidirectional, and it starts from structures towards performance via the conduct of firms. This causal chain can be represented as follows:

$Structure \rightarrow conduct \rightarrow Performance$

This approach favours a cross-section approach in which firms belonging to different industrial sectors are compared at one point in time. Its application supposes, in the first

place, the specification of the structures. As this is reasoning carried out within the framework of a market, assimilated to a sector, the indicator which reflects the structures of a market and the most commonly used is the concentration index. This indicator poses many problems to which we will come back later (Scherer, 1980).

Once the structures are known, it is then necessary to study the behaviours. It is in this area that the traditional relationship manifests the most obvious weaknesses. The behaviour has not, in fact, been the subject of systematic attention or even of an attempt to deepen it. Very often, the behaviour simplifies profit maximisation, an assumption of traditional microeconomics (Cubbin, 2001). As a result, the role of behaviour in the SCP trilogy is minimised. Firms are happy to adapt to the competitive environment, without seeking to act on it. This can be summed up by stating that in the original model, firms do not have strategic conduct, i.e. they do not seek to influence the conduct of other firms (Tirole, 1992). We will see later the importance of new approaches of taking into account the possibilities of strategic conduct.

Finally, the performance is almost always adjusted to an indicator of profitability; the other dimensions of this term, such as growth, for example, appear to be less important. However, there are many possible approaches to profitability, depending on whether we use a margin rate or a profit rate. The margin rate (mark-up) or Lerner index can be measured by the difference between prices (P) and marginal costs (MC). In perfect competition, the prices equal the marginal cost, and the margin rate is zero. On the other hand, in a monopoly situation, the margin rate becomes close to unity (Maudos and Fernandez de Guevara, 2007). The profit rate represents the profitability achieved during a given period (Bessi, 2015). This profitability can be approximated by economic profitability (a ratio between net profit and total assets) or financial profitability (ratio between net profit and bank equity). As we will see later, the margin rate is preferred, for reasons relating to the formulation of the model, this rate can be explained at the level of the firm as well as that of the sector or the market.

The relation makes it possible to state a simple result: firms operating in two different sectors should have an identical level of performance when the market structure is identical, which results from the secondary role of behaviour in reasoning. Indeed, different forms of behaviour could have given rise to different performances, for the same market structure.

I.1.1.2. Measurement of concentration

The objective of analysing the structure of a market is to determine the competitive equilibrium that prevails in this market. Deregulation and the transformation of the banking

industry has given a strong weight to market mechanisms and facilitated competition between banks. In reaction, the banks entered into a logic of concentration. Mergers and acquisitions between banks have enabled them to achieve economies of scale, to build up market power (they are able to act on interest rates) and thus preserve their profit. Today, the banking sector is fairly concentrated as evidenced by the concentration indicators whose values are increasing in the MENA region.

To understand the market structure of the banking sector, it is necessary to exploit other models than those of pure and perfect competition. Some models are more suitable than others for understanding the proper functioning of markets where competition is weak between banks, and where the problem of information asymmetry is strong between lenders (banks) and borrowers (firms). This is if we want to understand why certain sectors like the banking sector allow firms to generate high and sustainable profits, it is imperative to exploit models of imperfect competition. To account for the existence of a phenomenon of concentration, which is most often accompanied by the existence of market power for banks, theoretical work uses two types of arguments:

- Market power can be explained by the presence of a barrier to enter and exit the market, which weakens the competitive pressure weighing on existing banks (Freixas and Rochet, 2008).
- Market power can arise from the differentiation of products sold by banks in a market. Indeed, the differentiation of products sold by banks can give them significant market share. In other words, banks can differentiate not on the price (interest rate) but on the quality of the products offered to customers in order to maximise their profits.

However, the work of Baumol, Panzar and Willig (1982) has in fact shown that it is not market concentration that makes it possible to assess the competitive pressure weighing on banks. The theory of Baumol, Panzar and Willig is based on the notion of potential rivalry, of market contestability: if other banks can freely enter and leave to challenge the existing banks, then market discipline is imposed on existing banks even in small numbers. The latter therefore, do not adopt a competitive behaviour because they are forced to do so (discipline linked to a regulation imposed by the regulatory authorities) but because market mechanisms lead to pressure being exerted on the behaviour of all actors.

A. The usual concentration indices

There are large number of indices aimed at measuring concentration. Their multiplicity is in itself revealing of the difficulties in having a very satisfactory measure (Jacquemin and Berry, 1979). In addition, the concentration can be measured on the revenues, which is the most frequent case, but also on the paid workforce. We will only retain in our work the two indices most used in the theoretical and empirical literature.

- **The discrete index of concentration** can be measured by the market share held by the (m) largest firms. In general, we use the values $m = 4, 8, 15, 20$ for industrial firms or $m = 3$ et 5 for banking firms but any other figure is possible (the INSEE thus publishes (C_{50})). This index is written as:

$$C_m = \sum_{i=1}^m S_i \quad (i=1, \dots, n)$$

(1)

with i represents the rank of the firm. The firms are ranked in descending order according to their size; S_i represents the market share of the firm i (let q_i/Q with q_i that represents the supply on the market of the firm i and $Q = \sum_{i=1}^n q_i$, i.e. the total supply on the market).

- **The Herfindahl index** is equal to "the sum of the squares of the market shares of all firms in the sector", let:

$$H = \sum_{i=1}^n S_i^2 \quad (i=1, \dots, n)$$

(2)

These two indices are widely used in empirical work to measure market concentration. Other indices are used for specific purposes but are of only minor interest in industrial economics (for a full discussion, see Schmalensee, 1988).

B. The criteria for choosing between concentration indices

By following the presentation of Waterson (1984), it is possible to distinguish three orders of criteria making it possible to choose between the different indices.

- Economic theory provides a first indication. The Herfindahl index is often preferred because it makes it possible to study the price margin over costs;

- Axiomatic is a second reference. Beyond the peculiarities and limits specific to each index, it is possible, according to the analysis developed by Cairns (1995), to give a general expression of the concentration indices and the conditions that they must satisfy.

Define the expression C as follows:

$$C = \sum_{i=1}^n h(S_i) \cdot S_i$$

(3)

where $h(S_i)$ is a function that reflects the weight given to the firm's i market share S_i . For the expression C to be a measure of concentration it must satisfy four conditions:

- Concentration must not decrease in the event of a merger of firms in the sector;
- The transfer of market shares from one firm to another must be reflected in the value of the index;
- There is a decreasing link between concentration and the number of firms when they are of equal size;
- If two sectors are made up of the same number of firms and if the market shares of firms in the first sector, ranked in descending order, are always greater than or equal to those of firms in the second sector, the concentration index of the first sector must be greater than or equal to that of the second.

For these four conditions to be fulfilled and for C to be a measure of concentration, it is sufficient that the function $h(S_i)$ is non-decreasing and the function $h(S_i) \cdot S_i$ is convex (Encoaoua and Jacquemin, 1980).

These conditions of concentration mean that mergers and acquisitions must be reflected directly in the market share of firms and therefore in an increase in market concentration. This concentration, linked in large part to the size of firms, should lead to the appearance of two effects. On the one hand, it can lead to efficiency gains, in the form of lower production costs, improved quality, introduction of new products, etc. On the other hand, it can allow firms to increase their prices strategically, which constitutes a strengthening of market power (Williamson, 1968).

The usual concentration indices presented above satisfy all these properties. It is therefore not possible to justify the adoption of one index in preference to another on this basis. Finally, statistical criteria can explain the choice of an index. Thus, the decomposition property of the Herfindahl index makes it possible to deal with cases where the sector is formed of sub-sectors: the global index of a sector can be decomposed by considering the markets that appear in the sector. This makes it possible to account for situations where there is a "dominant fringe" which fixes the price and a "dominated frontier", which can only accept this price, as in the model of Stackelberg (Encaoua and Jacquemin, 1980).

I.1.1.3. Concentration, an explanatory factor for profitability

One of the essential objectives of studies of sectorial concentration is to explain the profitability of firms belonging to the sector. The reasoning adopted amounts to making concentration the explanatory factor of the behaviour of firms in terms of prices. The starting point of the analysis is the existence of two extreme situations in a market: monopoly and pure and perfect competition. The first case corresponds to the highest possible profit rate in this market while the equilibrium profits are zero in the second case. It is tempting to broaden the reasoning and introduce a link between rate of return and concentration. The relation can be represented, econometrically, by a simple theoretical model of the type:

$$\pi_s = \beta_0 + \beta_1 I_{cs} + u_s$$

(4)

With π_s which represents the profit level of the sector s , I_{cs} ¹ any indicator of sector s concentration and u_s an error term with the usual characteristics (random variables defined as white noise). The goal of applied research is then to estimate β_0, β_1 that has no particular theoretical significance, other than an approximation of a minimum profit rate not influenced by sectoral characteristics. The hypothesis tested is that $\beta_1 > 0$, in other words, there is a positive link between concentration and profitability. This approach is the one implemented in particular by Bain (1951). What can be the theoretical basis of this link between concentration and profitability?

It is possible to justify it by an argument, which links the concentration and the number of firms belonging to the sector: in a highly concentrated market, the existing firms have a monopoly power allowing them to adopt collusive behaviour (Hay and Morris, 1991). If the

¹ The letter (c) stands for concentration

collusion is perfect, the firms will maximise their profits and behave like a monopoly. The same reasoning can be adopted to extend the analysis to intermediate market structures. This positive link between concentration and profitability should not be considered universal. Indeed, the estimations carried out by Bain (1951), Cowling and Waterson (1976), Clarke and Davies (1982) indicate that the relation (4) is not linear. The interpretation adopted is that there is a critical level of competition. Below this threshold, the coefficient β_1 is not significantly different from zero (there is therefore no relationship between profit and concentration); beyond this threshold, the concentration is strong enough for collusion to take effect and therefore β_1 is positive. The link between market structure and the behaviour of firms (here the practice of collusion) is not a general relation since it is characterised by a discontinuity. Below the critical threshold, profitability is no longer explained by the proposed model. The structuralist hypothesis must therefore be questioned: the statistical results do not conform to the predictions of the theoretical model (Shepherd, 1972). More fundamentally, the theoretical model is open to criticism relating to the causality retained by the SCP trilogy. Indeed, the envisaged causal relationship is unidirectional. It starts from market structures to achieve profitability. However, the profit level of firms undoubtedly exerts in its turn an influence on market structures in a later period. It is therefore not possible to consider these as exogenous. Likewise, not taking behaviour into account is not satisfactory: firms can, through the strategies they adopt, influence market structures (Scherer and Rosse, 1990; Schmalensee, 1988). In addition, this model suffers from insufficient analysis of the nature of competition: the reasoning relates only to concentration whereas the developments of microeconomics in imperfect competition have shown that, more than the concentration, the type of oligopoly in which firms operate explains the results of firms (Tirole, 198). It is on this basis that authors have tried, from the 1970s, to reformulate in a more rigorous way the relationship between market structure, firm conduct and performance.

I.1.1.4. The new vision of the relationships between structures, conduct and performance

Cowling and Waterson (1976) and Clarke et al. (1984) developed a general analysis of the determination of the profitability of firms from the study of profit maximisation by firms belonging to an oligopoly. This model makes it possible to rigorously reformulate the relationships between structures, conduct and performance.

A. Model hypotheses and first results

Firms in the market operate in a market environment that can be described, briefly, as one of oligopolistic markets. The main features of an oligopoly are:

- There are a small number of suppliers on the market whose decisions are interdependent;
- Firms face a large number of clients who cannot influence the price;

To formalise the competition between firms more easily, we will assume here that the product offered by the different firms is homogeneous, far from the problems. We will see the problems posed by the introduction of product differentiation later.

Cowling and Waterson assume that there are n firms, producing a homogeneous good, i.e. little differentiation from one firm to another. These firms maximise their profits over a period. They also choose the quantity produced (so-called Cournot hypothesis) and it is the market (i.e. demand) that determines the market's equilibrium price according to the equation:

$$p = p(Q) = p\left(\sum_i^n q_i\right)$$

where Q the total quantity produced, q_i that is produced by the firm i . The behaviour of the firm i is written:

$$\text{Max } \pi(q_i) = p(Q) \cdot q_i - c_i(q_i)$$

(5)

where c_i is the total cost of the firm i . By cancelling the first derivative, we obtain:

$$\frac{\partial \pi_i}{\partial q_i} = 0 = p(Q) + q_i \cdot \frac{\partial p}{\partial Q} \cdot \frac{\partial Q}{\partial q_i} - \frac{\partial c_i}{\partial q_i} \quad (6)$$

This manipulation makes it possible to reveal the ratio $\frac{\partial Q}{\partial q_i}$, which has an important economic significance. In fact, it represents the variation in the total supply of the sector resulting from the variation in the total quantity produced by the firm i . It is therefore the overall reaction of the sector to a variation in the quantities produced by which the firm i has taken the initiative. To better clarify this point, it is possible to break down Q into two elements, q_i the production of the firm i and q_j that of the set of rival firms (i.e. $Q - q_i$).

The ratio $\frac{\partial \sum_{j \neq i}^n q_j}{\partial q_i}$ represents the firm's i opinion on the reactions of its rivals to a variation in the firm's i output. Indeed, when the firm proceeds to profit maximisation, it has no information, apart from the case of collusion, on the strategy of its rivals. It therefore reasons on an a priori magnitude; the firm i modifies its production (∂q_i) and anticipates a reaction from its competitors (∂q_j) which has not yet taken place when i fixes the quantity it

produces. Let a_i the expression $\frac{\partial \sum_{j \neq i}^n q_j}{\partial q_i}$ to be called conjectural variation. These

decompositions allow rewriting $\frac{\partial Q}{\partial q_i}$ in the form (7):

$$\frac{\partial Q}{\partial q_i} = \frac{\partial \left(\sum_i^n q_i \right)}{\partial q_i} = \frac{\partial q_i}{\partial q_i} + \frac{\partial \sum_{j \neq i}^n q_j}{\partial q_i} = 1 + a_i \quad (7)$$

The first order condition can therefore be rewritten, by replacing $p(Q)$ by p in equation (6) and by deferring (7) in (6):

$$\frac{\partial \pi_i}{\partial q_i} = 0 = p + q_i \cdot \left(\frac{\partial p}{\partial Q} (1 + a_i) \right) - C'_i \quad (8)$$

This writing is only a particular form of equality between marginal revenue and marginal cost. Indeed, apart from a situation of equilibrium of pure and perfect competition, there is no equality between price and marginal cost. It is from this basic idea that it is possible to calculate a firm performance indicator, a margin rate which measures the difference between the relative price and the marginal cost, obtained with $(p - C'_i) / p$. It is therefore a measure of profitability (which is the markup rate that measures the difference between price and marginal cost. This indicator is an increasing function of market power and a decreasing function of demand elasticity). This metric is known as the Lerner's Market Power Index. By rearranging equation (8), dividing the two terms by P and multiplying the right-hand side by Q / Q , we obtain an expression for the rate of return, defined here as the deviation of the price over the marginal cost as a percentage of the price. The margin rate for each firm is given by relation (9):

$$\frac{(p - C'_i)}{p} = - \frac{q_i}{Q} \cdot \frac{Q}{p} \cdot \frac{\partial p}{\partial Q} (1 + a_i) \quad (9)$$

In this equation, the denoted market share $\left(\frac{q_i}{Q}\right)$, noted by s_i , is represented by the first term of the right hand side of equation (9); the second, $\frac{Q}{p} \cdot \frac{\partial p}{\partial Q}$, corresponds to the inverse of the price elasticity of demand. This elasticity is negative in the general case since quantities and prices vary in opposite directions. The margin rate is therefore positive and we will denote the modulus (e) of the elasticity of demand, removing the minus sign from the right-hand side of equation (9). The margin rate is then written as follows:

$$\frac{(p - C'_i)}{p} = \frac{s_i}{e} (1 + a_i) \quad (10)$$

The relation (10) shows the three components of the SCP trilogy:

- The structures, represented by the concentration or, more precisely, the market share of the firm, s_i , and the elasticity of demand e ;
- conducts, which here refer to the maximisation of profits and the response of rivals to a modification of the quantities produced by the firm, i.e. a_i ;
- Performance, i.e. the price margin over marginal cost.

However, if the three terms are present in equation (10), the idea of a sequence between them is not found: no causal relation can be presented here. We then pass from a causal relation to a relation of simultaneity.

B. Generalisation of the relationship at sectoral level

So far, determining the profitability of the firm has only been considered at the individual level. It is interesting to generalise the formulation at the sectoral level, i.e. to seek to explain the sectoral average profit rate, if only to allow the connection with the traditional structuralist approach. In addition, in many cases, individual data relating to firms cannot be obtained, while sectoral data, which is the aggregation of individual data, is easier to access. To conduct research of this nature, it is traditionally easier to access aggregated data of a secondary, published nature. However, when it comes to the detailed empirical data that can be obtained from organizations, it is preferable to approach organizations to provide data of an empirical nature. However, in the banking sector, particularly in the MENA region, banks are very hesitant to provide data of a microeconomic nature because they believe that this

could erode their competitive position in the market.

Starting from equation (8), and assuming that all the firms are in equilibrium, the first step consists in multiplying the expression by q_i and in summing on i , that is:

$$\sum_{i=1}^n pq_i + \sum_{i=1}^n q_i^2 \left[\frac{\partial p}{\partial Q} (1 + a_i) \right] - \sum_{i=1}^n q_i C'_i = 0 \quad (11)$$

By rearranging (11), dividing by pQ , and using the definitions of market share s_i and elasticity e , we then obtain:

$$\frac{\sum_{i=1}^n pq_i - \sum_{i=1}^n q_i C'_i}{pQ} = \frac{\sum_{i=1}^n s_i^2 (1 + a_i)}{e} \quad (12)$$

For the left-hand side to be able to represent an indicator of profit in relation to sectoral revenues (pQ), it is necessary to pose the hypothesis of equality between the average variable cost and the constant marginal cost. Equation (12) can be rewritten as follows:

$$\frac{\pi}{R} = \frac{\sum_{i=1}^n s_i^2 (1 + a_i)}{e} = \frac{Her}{e} (1 + m) \quad (13)$$

With R is the turnover, Her is the Herfindahl index and m the sum of the terms of conjectural variation. All other things being equal, the sectoral rate of return increases if concentration, as measured by the Herfindahl index, increases. To appreciate the scope of equation (13), it is interesting to firstly reason on two limit cases, pure and perfect competition and monopoly, to see if we can find the results established by traditional analyses.

- In a monopoly situation, $Her = 1$, and since there are no competitors, a_i and m therefore are equal to zero. We then find with equation (13) the classic result: the monopolist's rate of return is equal to the inverse of the price elasticity of demand.
- In a market of pure and perfect competition, Her tend towards zero, since the market shares of firms themselves tend towards zero. Firms are no longer interdependent and therefore, also tend towards zero. The rate of return tends towards zero: this is the characteristic result of the competitive market.

- On the other hand, all oligopoly situations are intermediate, with π / R between 0 et $1/e$.

Cowling and Waterson's model therefore provides a general framework for explaining, both at the sector level and at the firm level, the way in which structures (represented by the concentration and price elasticity of demand), conduct (described by profit maximisation and conjectural variation) and performance (adjusted to the price margin rate over costs) interact. However, it also suffers from limitations. The main one is that it is a homogeneous product model (i.e. competitors sell a perfectly identical product), which is very restrictive. In addition, competition is affected by quantities: firms fix the volume of production they deliver on the market, and that determines the equilibrium price by a mechanism which is not really explicit. However, industrial reality shows that most products are differentiated, and that competition is not only exercised by quantities but also by prices. However, the main criticism that can be levelled at this model is that there is no causality or even a simple correlation between structure, conduct, and performance. Moreover, all the empirical attempts which sought to highlight the relation of Waterson and Cowling did not conclude in a clear way. Therefore, it is the particularities of each industry that will determine the major causal links.

I.1.2. Overview of empirical studies of the PCS paradigm applied to the banking industry

The US banking system has long been a breeding ground for empirical studies related to the SCP. The geographic segmentation of the American banking market makes it possible to divide the national market into different local markets and to measure the degree of concentration and the level of profitability there. The possibility of comparing different markets within the same country has a great advantage in terms of the homogeneity of observations (identical regulations, equivalent accounting principles, characteristics of the market and more comparable banks). According to Gilbert's (1984) survey of the United States, 15 of the 26 reviewed studies report a positive relationship between profitability and concentration. However, only five studies show any robustness, that is, the positive and significant connection persists when they change the performance indicator.

Smirlock (1985), Evanoff and Fortier (1988) test the relationship between profitability, measured by ROA and market share. They find that the influence of market share prevails over that of concentration. This result indicates that the link between performance and market structure is not explained by the SCP paradigm but by the efficient structure.

Molyneux and Forbes (1995) apply the SCP to 18 European countries. Their econometric estimates reveal the existence of a positive and significant link between profitability (ROA) and concentration (market share of the 10 largest banks). Bourke (1989) studies the relationship between profitability and concentration of 116 banks in 15 countries. The results obtained do not show the existence of a positive link between concentration (C3) and performance indicators (ROA, ROE, and the added value). Molyneux and Thornton (1992) apply the study of Bourke (1989) to a sample of European banks for the period 1986 to 1989. The results obtained support the SCP paradigm. Ruthenberg and Elias (1996) find that the concentration measured by the Herfindahl index negatively affects the interest margin. Most authors, however, only test a limited number of indicator combinations.

Seelanatha, L. (2010) applies the SCP model to commercial banks in Sri Lanka. The results obtained show that the concentration of the banking market is not a determining factor in the profitability of banks. In addition, the results of the various econometric estimates reveal the existence of a positive link between efficiency and performance, which argues in favour of the efficient structure hypothesis.

Nabieu (2013) uses panel data techniques to study the link between concentration and profitability of banks operating in Ghana over the period 2007-2012. The results obtained reveal the existence of a negative link between concentration and bank profitability measured by ROE and ROA.

Anasweh (2015) applies the SCP trilogy to a panel of banking institutions operating in Qatar. He finds a positive and significant link between market share and bank profitability. This result shows that, over the period 2009-2014, the link between market structure and performance is explained by the SCP model.

I.1.3. Criticisms of the results from the SCP model

The first series of critiques of the empirical application of the SCP concerns the weak robustness of the link between the performance indicator and the concentration indicator (Schmalensee, 1987):

- The link between concentration and profitability varies significantly depending on the indicators considered. Indeed, we have highlighted certain profitability and concentration indicators. There are therefore many possible combinations of these two types of indicators. Of these combinations, only a minority leads to a positive and meaningful relationship. The contradictory results of empirical studies can therefore only be interpreted in terms of market power if the theoretical analysis and the examination of

market characteristics make it possible to favour a particular indicator of concentration and profitability and therefore such and such a combination.

- The estimated equations have little explanatory power. The average R^2 is 0.08 in the estimates of Molyneux (1993) and 0.25 in the survey of Gilbert (1984). In this case, we cannot exclude that the estimated equation is specified incorrectly or that essential explanatory variables have been omitted, which considerably reduces the scope of the results. Indeed, the banking SCP model assumes a linear relationship between the explanatory variables and the explained variable, more particularly between performance and concentration. However, it may very well be that this relationship is not linear, i.e. for different levels of concentration, we would have different effects on performance. Moreover, this model is limited to the assumption that the goal of managers is profit maximisation. However, their objectives may vary according to the size of their bank and according to their market power. Finally, cross-sectional estimates very often give little explanatory power.

The second set of critiques is more conceptual:

- For supporters of the efficiency theory, a positive and significant link between performance and concentration does not necessarily reflect market power but can also reflect a difference in efficiency between firms. If a firm has a cost advantage over its competitors, it can use this to increase its market share, resulting in increased market concentration. In this case, higher profitability observed in a market will not reflect greater market power but greater efficiency among firms with a larger market share. If profitability is greater among firms with the largest market share, regardless of concentration, the efficiency hypothesis should be favoured at the expense of the SCP hypothesis. Smirlock (1985) and Evanoff and Fortier (1988) accept the efficiency hypothesis for the US banking market and reject the SCP. Molyneux and Forbes (1995), on the other hand, reject the efficiency hypothesis for European banks.
- A high level of profitability may reflect the fact that banking activity is riskier in some countries (credit risk, volatility of interest rates). When the level of risk is not comparable from one country or institution to another, the omission of this factor can then bias the relationship between performance and concentration. Heggestad (1977) notes that the inclusion of a risk indicator does not change the relationship between performance and concentration. The significance of this result is however, reduced by the fact that it is difficult to account for the risk factor appropriately.

- The PCS test should be performed in long-term equilibrium markets (Schmalansee, 1987). This assumption is difficult to respect in several markets simultaneously. The results may therefore be biased by a disequilibrium prevailing in one or more of the markets under study. The impact of the concentration could for example be underestimated if during the observation phase, the banking markets of the countries where the concentration is high encounter difficulties; this was precisely the case in the early nineties for the Nordic countries, where the top ten banks held more than three quarters of the market and suffered huge losses. We should be particularly wary of studies, which only cover a small number of periods. The impact of not respecting the long-term equilibrium assumption is illustrated by the results of Molyneux and Forbes (1995), who find that concentration has a significant and positive impact on profitability for the year 1987 but observe the opposite result for the year 1986.
- Finally, supporters of contestable markets theory refute the theoretical existence of a link between concentration and performance when there is no barrier to entry. This criticism has been partially taken into account by Ruthenberg (1994) and Hannah and Kay (1977) who introduce into their equation a variable reflecting the degree of market contestability. The level of barriers to entry plays a significant role in these two studies. However, it is very difficult to find an indicator that correctly reflects the level of barriers without introducing bias in the estimated relationship.

The main lesson that we can draw from this review of theoretical and empirical literature is that the results obtained are not very conclusive, especially with regard to statistical inference since certain statistical assumptions are not met. This would therefore call into question the model for estimating the SCP relationship that is generally adopted, i.e. the linear regression model. Two main complaints can be addressed to it. First, it assumes a linear relationship between performance and the explanatory variables, including concentration, while we may have a non-linear relationship. Second, there are no economic theories on which we can base our choice of model variables especially for measures of performance, focus, and efficiency. Given the low robustness of the results based on the SCP trilogy, we must therefore consider another model that allows properly establishing the relationship between the structure, conduct, and performance of banks.

I.2. The theory of contestable markets, monopolistic and oligopolistic competition

I.2.1. The theory of contestable markets

In the SCP vision, the structure of a market is basic data measured by a concentration index.² They determine the behaviour of firms intervening in this market and ultimately the performance measured, for example by the profit rate. Much empirical work has sought to highlight the impact of the degree of concentration on performance indicators.³ The theory of contestable markets operates a complete reversal in the approach to the characteristics of a sector insofar as there is simultaneous determination of structure, conduct and performance. Only the characteristics of technology and demand intervene exogenously.

Contestable Markets Theory attacks the core of the SCP paradigm: the exogeneity of the supply structure. It makes it possible to consider the structure of a market as an endogenous variable. It claims that the important factor influencing efficiency is not market concentration but its contestability.

According to the theory of contestable markets developed by Baumol, Panzar and Willig (1982), a small number of existing firms in a concentrated market can behave in a perfectly competitive manner when there is a threat of market penetration by potential entrants. If market entry and exit are free, existing firms are forced to set a competitive price to avoid the entry of new competitors attracted by profit opportunities. Potential competition in a concentrated market would therefore be as effective as actual competition in a poorly concentrated market, and the intervention of competition authorities would not always be necessary. Certain assumptions of the contestable markets approach have however, been the subject of critique: in many markets, there are sunk costs on entry and exit, and the information on profits cannot instantly satisfy all the demand. The effectiveness of potential competition is often limited, which justifies the current power of competition policy.⁴ This optimal configuration constitutes what Baumol, Panzar and Willig call a natural market structure.

According to Baumol, Panzar and Willig, two properties characterise potential market entrants. In the first place, these entrants must be able to serve the same market demand without restriction and use the same production techniques as those available to the existing firms: with regard to the latter, potential entrants therefore do not suffer from any cost disadvantages. Second, new entrants appreciate the profitability of entry based on the prices

² Encaoua and Jacquemin (1980) proposed an axiomatic of the measurement of market concentration in order to compare the properties of the concentration indices generally used.

³ Gilbert (1984) reviews the main conclusions of studies on the banking firm that fall within this framework of analysis.

⁴ In the case of a multi-product firm, the price of each product is equal to the marginal cost weighted by a demand elasticity factor for the product.

charged before entry by the existing firms.

More generally, entry is free since potential competitors have the same cost functions and can enter and exit without loss of capital in the time required for a price change by the existing firms. This theory therefore replaces, as Spense (1983) points out, the price-taker hypothesis with that of rapid entry and exit. Several definitions corresponding to successive inclusions are therefore essential to characterise an equilibrium configuration in a perfectly contestable market.

I.2.1.1. Achievable and sustainable equilibrium configuration

- The configuration of an industry is said to be feasible if the firms which form it produce the quantities of output Q_j at a non-negative price, P , such that the market ensures equality between supply and demand $\sum_{j=1}^n Q_j = Q(P)$, and that each firm at least cover its production costs $PQ_j - C(Q_j) \geq 0$, $j = 1, \dots, n$. This industrial configuration will be that of a monopoly if $n = 1$, competitive if the number of firms is large enough and oligopolistic for intermediate values of n .
- An industrial configuration achievable with a price P and quantities of production of firms, Q_1, \dots, Q_j , is said to be sustainable if it does not offer any profitable entry opportunity, i.e. $P^e Q^e \leq C(Q^e)$ ⁵ for all $P^e \leq P$ et $Q^e \leq Q(P^e)$ that are positive. In other words, there is no feasible plan of action for the entrant to ensure a positive flow of profit under the assumption that the prices charged by the existing firms will not change as a result of the entrance.

Thus, the market is perfectly contestable if entry on the market is perfectly free and if the exit can be carried out without cost. Of course, entering a market for a new firm requires material (premises, machines, etc.) and human investments (acquisition of new skills, staff training, etc.). These investments therefore entail costs associated with entering the market. If the firm can quickly exit the market and reuse its investments for another activity, sell them without loss or redeploy its capital elsewhere, then the costs of entering the market are said to be recoverable. On the other hand, if equipment and skills cannot be redeployed, then the initial costs are sunk costs. The contestable nature of a market does not depend on the number of firms present on the market: a monopoly or an oligopoly can be contestable; a perfectly competitive market is also perfectly contestable.

⁵ Q^e represents the quantity of output produced by the entrant firm, and P^e denotes the price of the output.

I.2.1.2. Properties of contestable markets

The properties of an equilibrium in a perfectly contestable market are then particularly rich. Three aspects should be emphasised:

- First, the selection criterion, namely the minimisation of the total cost of the industry, is satisfied. No other number of firms, distribution size or production, could provide the required output, at a lower cost than that supported by the existing feasible and sustainable configuration. Indeed, since the existing firms do not make losses, a configuration producing the same output at a lower cost would make it possible to make a positive profit at the current price and would entail the entry of new firms.
- A second property is that at equilibrium, no product can be sold at a price other than marginal cost if there are at least two firms in the industry. Indeed, if a firm sells Q output units at a price P lower than the marginal cost, while not making losses, $\pi \geq 0$, it is possible for an entrant to offer a slightly reduced quantity, $Q - \varpi$, and to make a profit: as the price P is lower than the marginal cost, the sale of $Q - \varpi$ units at the price P must indeed provide a profit of $\pi + \varpi(C_m - P) > 0$, π being the profit gained by selling Q units at this price and C_m the marginal cost. It is therefore possible for an entrant to make a profit by renouncing the production of the unprofitable marginal unit of production. Conversely, the price cannot be higher than the marginal cost if there are at least two existing firms. Otherwise, it would again result in the opportunity for profitable entries. In the case of two firms, the entrant can sell at a slightly lower price, seize customers from firm 1, and additionally take units from the other firm. If Firm 1 and Firm 2 sell together $Q_1 + Q_2 > Q_1$, the entrant can obtain an amount $Q_1 + \varpi > Q_1$ for small enough ϖ and earn an additional profit on that amount, that is $\varpi(P - C_m) > 0$.
- Finally, it is clear that if for an existing firm j , $PQ_j < C(Q_j)$ the industrial configuration of which it is part is not feasible and if $PQ_j > C(Q_j)$, it is not sustainable since an entrant

can sell at a lower price, while still making of profit. A feasible and sustainable configuration therefore requires that for any firm $PQ_j = C(Q_j)$.

- Therefore, even in the case of a duopoly, equality between price, average cost and marginal cost must be satisfied at equilibrium, which makes it possible to obtain a first-rank optimum. In this sense, the concept of perfectly contestable equilibrium is a generalisation of the concept of equilibrium of pure and perfect competition. On the one hand, a long-term competitive equilibrium is a sustainable industrial configuration such that a perfectly competitive market is a perfectly contestable market. On the other hand, a perfectly contestable equilibrium does not require the existence of a very large number of firms in the market and includes cases where the technology has significant returns to scale.

However, it should be noted that the theory of contestable markets is very sensitive to the initial assumptions as shown by Schwartz and Reynolds (1983).

In the first place, the production technology adopted by the firms plays the essential role, the demand only serving to determine the size of the industry. The question of product differentiation⁶ (either by quality or by location) is not taken into account by the theory of contestable markets. The demand responds instantly to price differences that may render entry unprofitable and allow the existing firms to sell above marginal cost.

Second, technological differences, the existence of less irreversible tangible and intangible investments and the resulting temporal asymmetries are ignored. This analysis also ignores the role of uncertainty and incomplete information (Tirole, 1988) (incomplete information on the characteristics of the firm in place, incomplete information on the characteristics of the new entrant, imperfect information on the characteristics of consumers, etc.) according to which a firm does not know the exact characteristics of its rivals in terms of preferences and strategy spaces.

I.2.2. Monopolistic competition

The theory of contestable markets generally does not take into account the issue of product differentiation: 1) within a product category, there is perfect substitutability; 2) between the different categories of products, the substitutability is zero. The issue of product

⁶ *The issue of product differentiation and market entry has been analysed within the framework of monopolistic competition theory (Chamberlin model) and oligopolistic competition theory (Salop model, 1979) which shows that firms cannot in case of product differentiation achieve positive profits.*

differentiation and entry have been analysed within the framework of monopolistic competition theory. This characterises a market where companies sell differentiated but substitutable products.

The monopoly competition has characteristics of monopoly in that products are differentiated; it allows a firm to charge prices different from those of other firms without capturing (in the event that it sets a lower price) or losing (in the event that it sets a higher price) the entire demand. It also exhibits competitive characteristics because entry into the market is free, and the firm is subject to pressure from other firms in terms of prices and products.

The concept of monopolistic competition was introduced by Chamberlin (1933). In its model, each company produces a unique product that is differentiated from the rest of the industry. The demand for each business is a decreasing function of the price charged by that business. It also depends on the number, proximity and price of substitutes offered by the rest of the industry. A price change made by a single firm, however, has only a negligible impact on the demand from other firms, which means that firms do not have a direct neighbour in the product space. This model therefore ignores the strategic price interaction between companies to focus on the number of products offered and on the relationship between price, marginal cost and average cost. Firms have an average U-shaped cost curve (increasing then decreasing returns to scale).

Since profits are zero due to the free entry assumption, the equilibrium implies a price equal to the average cost and corresponds to the point of tangency between the firm's demand function and the average cost. Product differentiation therefore does not allow for positive profits in monopolistic competition.

1.2.3. Oligopolistic competition

Salop's oligopolistic competition model that we have already examined allows us to analyse the impact of product differentiation on the price – marginal cost – average cost relationship by taking into account the strategic interaction between firms at the price level. The condition of free entry, however, implies that the number of firms entering the industry is no longer exogenous but is determined by the condition of zero profit. Each firm can only choose one location and incurs a fixed installation cost.

The game takes place in two stages: 1) the potential entrants simultaneously decide whether or not to enter; 2) the locations being chosen; companies compete on price. Each firm takes into account the fact that the demand addressed to it is a function of its own price but also of

the price charged by the neighboring firms (taking into account the strategic interaction). We can then show that firms sell their product at a price higher than marginal cost. The difference is an increasing function of transport costs and a decreasing function of the number of firms in place (it is an inverse function of the fixed cost of installation in the event of free entry). This difference is, however, used to cover fixed costs and companies do not make a profit to the nearest whole number of firms. Product differentiation therefore does not allow for positive profits in oligopolistic competition.

I.3. Models taking into account barriers to entry

From the perspective of contestable markets examined in Section III, we will see how the competitive equilibrium will be determined in the case of free entry even if there are certain asymmetries between existing and entering firms, and even if production is determined by economies of scale. Next, we review the main asymmetries that constitute the barriers to entry and which are linked to the concept of sunk cost. Finally, we introduce into the analysis the role of incomplete or imperfect information, which can dramatically alter the strategic interaction at the entry level.

I.3.1. Price limit and entry

The two-period limit price model of Sylos-Labini (1957) represents the interaction at the price level between the existing firm and the potential entrant. During the first period, only one company occupies the market. However, it faces the threat of entering in the second period a firm with access to the same technology. The entering firm assumes that the existing firm will produce the same quantity in both periods whether it enters or not. After observing the quantity produced in the first period by the existing firm, the entrant determines whether the residual demand and the second period price will be high enough to cover its average cost and allow a profitable entry. In this case, it enters in the second period. Otherwise, it remains out of the market (Tirole, 1988)

The existing firm faces a dilemma: 1) Fix monopoly prices and quantities in the first period knowing that such a strategy causes the entry of a new firm. In this case, profits are high in the first period but low in the second period. 2) Set a price low enough and a quantity high enough in the first period to deter entry into the second period. In this case, the firm records average profits over the two periods. The choice between these two strategies will depend on the firm's used discount rate.

The Sylos-Labini's model shows that the threat of entry can induce the existing firm to behave more competitively, even in times when it is still in a monopoly position. According to the same principle, Gaskins (1971) proposed a dynamic modelling of the limit price. The entry rate for firms in each period depends on the price set by the existing firm. Given this dynamic, the existing firm arbitrates between immediate profitability, which commands a high price and future profitability, which requires a price low enough not to quickly attract new competitors. The existing firm chooses an optimal price path over time to maximise the present value of profits. This trajectory depends on the discount rate of the existing firm and the possible cost asymmetry between the existing firm and the entrants. Sylos-Labini's model has been criticised by the followers of game theory for not constituting a perfect Nash equilibrium in subgames. Indeed, we ask ourselves why the entrant is ready to believe that the existing firm will continue to sell the quantity of the first period in the event of entry when it would be in the interest of reducing its production in order to avoid sharp fall in prices (fixing Cournot quantities would allow the company to maximise profits in the second period if there is entry). The threat of maintaining the level of production for the first period not being credible, the second firm enters the market in the second period regardless of the level of production chosen by the firm in place in the first period. Therefore, the existing firm is likely to set the monopoly price in the first period, with the limit price policy having no impact on entry. We will see, below, that the existing firm can remedy this credibility problem by committing a sunk investment to produce this quantity in the second period.

I.3.2. Entry and sunk costs

Sunk costs are operating expenses, which generate a stream of benefits over a long period, and which cannot be recovered (Tirole, 1988). The sunk cost constitutes a barrier to entry when the company cannot recover its investment either by exiting the market (no second-hand market for the production capacity acquired), or by remaining on the latter (because the cohabitation of the two firms leads to prices that are too low).

In the limit price model, developed above, we assumed that the entrant and the existing firms were equal in terms of cost. However, one can imagine that when entering the market, the new firm suffers a fixed, unique and irrecoverable cost. The existing firm then enjoys a cost advantage that will allow it to charge a higher price without causing the entry of new competitors.

The general idea is that the existing firm can overinvest in its production capacity in order to credibly commit to producing a high quantity and thus make entry unattractive for new firms. Tirole (1988) considers a two-stage capacity model. First, the existing firm makes an irrecoverable investment corresponding to a certain production capacity. Secondly, the potential entrant determines its capacity by knowing the production capacity chosen by the first firm. This is a sequential game with complete information and therefore, we have to find a perfect Nash equilibrium in the subgames. We can show that at equilibrium, the existing firm achieves higher output and profits than the entrant, even though both firms have access to the same technology. The existing firm takes advantage of the temporal asymmetry to set up a capacity greater than the quantities of Cournot and thus forces the entrants to restrict their production capacity. The game we have just considered is akin to Stackelberg's model of quantity leadership in which capacities are substituted for quantities. If the firms fixed their capacity at the same time, or if the investments were not sunk, the entry of the second firm would lead to a Nash Cournot equilibrium in which the two firms set up an identical production capacity. The defining element of this example is that the existing firm was able to make credible (perfect in sub-games) a level of production greater than the quantities of Cournot thanks to the irrecoverable nature of its investment.

The effectiveness of entry blocking strategies through overinvestment must be put into perspective in terms of the sustainability of the production capacity put in place. The models of Eaton and Lipsey (1980) and Maskin and Tirole (1995) show that when the capacity depreciation rate is high and the interaction is repeated, the entering firm is encouraged to enter the market by prospect of becoming a monopoly after a brief loss-making fight with the existing firm (the duration of the fight is a decreasing function of the depreciation rate of the existing firm's production capacity). This threat causes the existing firm to invest just before the entry by a new firm becomes profitable. This moment must occur before the capacity is completely exhausted because otherwise the firm in place would no longer benefit from any commitment effect. The existing firm is therefore forced to hold two production capacities unnecessarily – the depreciation of which is different, which leads to indulgence of monopoly profits. When the rate of depreciation is infinite, profits become zero.⁷

I.3.3. Entry and incomplete information

⁷ This means that the rate of depreciation (amortization) has a direct impact on the company's profitability. Recorded as an expense on the income statement, it reduces taxable profit. Theoretically, if a firm applies a depreciation rate that tends towards infinity in order to prevent the entry of competing firms, this will ultimately result in an erosion of its profitability.

So far, we have considered models with perfect information. Entrants and existing firms were fully informed about the prices, demand and cost structure of their competitors. Consumers could observe at no cost the prices and quantities of products offered by the existing and the entrants.

As we will see, this type of approach suffers from several limitations because the introduction of credibility and incomplete or imperfect information can drastically alter the strategic interaction at the entry level.

- For the existing firm, the assumption of maintaining its initial level of production after entry is unrealistic, especially if the entrant is a large firm with a solid financial base. Not only that this strategy is not optimal for the existing firm because it is certain of no longer maximising its profit, but in addition, it may even have to make losses.
- Credibility and the nature of the information (perfect, incomplete) play an important role. When the information is perfect between the existing firms and the potential entrants, we can think that an entrant will not be fooled and, knowing in particular the costs of the installed firm, will anticipate a reduction in quantities on the part of its competitor and therefore market sharing.
- The situation changes dramatically when incomplete information is introduced. If the potential entrant thinks that the price set by the installed firm really reflects the low level of its cost of production, it might hesitate to enter considering that its strategy has low profitability.

Suppose the case of two firms, one of which exists in the market in a context of certainty with a finite horizon. Through the creation of excess capacity, that is to say by overinvesting in means of production irrevocably, the threat of the existing firm can be made credible. It is the irreversible nature of commitment that ensures the credibility of the strategy of the firm in place. It is possible to view this game in an extensive form. Let us present the optimal strategy of each firm by considering two possible strategies:

- Either the existing firm adopts passive behaviour: it does not seek to affect the expectations of the competing firm;
- Or the existing firm adopts strategic behaviour: in this case it can carry out a credible threat strategy.

Consider first the situation where only passive behaviour is adopted. If the potentially competing firm decides to stay out of the market, the existing firm earns a profit π_m . But if

the entry takes place, the existing firm can choose between sharing the market with a profit π_d (duopoly) or a mutually destructive war where the gains are losses of an amount π_g . We logically assume that $\pi_m > \pi_d > 0 > \pi_g$. These two strategies constitute a Nash equilibrium as neither player wishes to change their strategy given the one chosen by the other. Indeed, war is not a credible threat because it would not be the optimal response of the existing firm in the event of the entry of the competing firm, and this is known to the entrants. Thus, the vector of “enter” and “share” strategies is a Nash equilibrium for the subset in question since $\pi_d > 0 > \pi_g$. However, it is also a Nash equilibrium for all the subsets taken from the initial game.⁸ Therefore, this is the perfect equilibrium. Thus, the only perfect Nash equilibrium is the "enter" and "share" strategy vector.

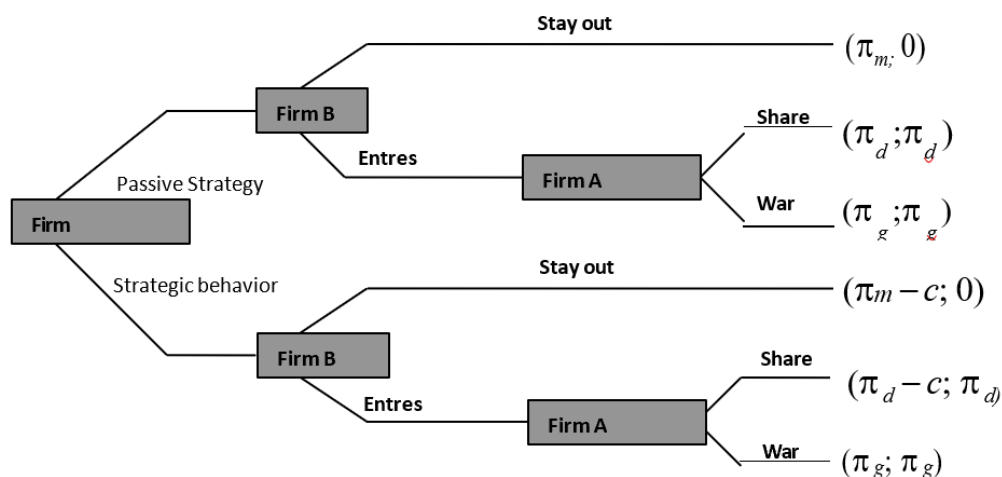


Figure 1: Market dynamics and Nash equilibrium

Now consider the case where the existing firm may have a strategic advantage allowing it to lead a credible threat. Suppose the existing firm decides to make an irrevocable investment of an amount c (additional production capacity). This investment does not affect the profit of the entrant firm because in the event of a price war, its gains will always be π_g . In other cases, its earnings will be reduced by the amount. To determine the solutions of this game, three situations can be distinguished:

- The existing firm decides to go to war (the lower part of the tree) if the loss in case of sharing is greater than the loss in case of war, i.e. if:

⁸ Recall that in Nash's equilibrium, firms consider as given all the possible strategies of their competitors, regardless of these strategies. On the contrary, perfect equilibrium excludes strategies that correspond to non-credible threats.

$$\pi_g > \pi_d - c$$

In this case, the optimal response for the competing firm is to stay out of the market so as not to suffer a loss in the amount of π_g ;

- The existing firm will recursively decide whether its optimal behaviour is to adopt passive behaviour or strategic behaviour. It will only adopt strategic behaviour if its gains are greater than the gains made in the event of a passive commitment, i.e. if:

$$\pi_m - c > \pi_d$$

If the firm chooses passive behaviour, the equilibrium is "split, enter" with duopoly gains for both firms;

- The incumbent firm will use its credible threat and prevent entry if and only if there is a strategic commitment, the cost c of which satisfies the two previous conditions, that is, if:

$$\pi_m - \pi_d > c > \pi_d - \pi_g$$

The adoption of a strategic commitment (credible threat) is not decided until after the succession of arbitrations that Dixit (1980) has highlighted in this model.

Remember that the analysis carried out above is based on the assumption of a finite horizon and that the game between the existing firm and the potential competitor is played only once. Indeed, if the game between the existing firm and the potential competitor were played several times, we might expect that the existing firm would be more tempted to prevent a sequence of entries, given the deterrent effect over several periods: war losses during the first period could be offset by the present value of net monopoly gains resulting from subsequent periods. But in the hypothesis of a finite horizon, the existing firm does not have to adopt at the last date such aggressive behaviour since it is not in its short-term interest and that moreover, there is other possible entry. The potential entrant existing at this final stage is aware of this situation and will therefore decide to enter. We therefore note that in the presence of an end date of the game, entry will never be prevented. To avoid this problem, the game must be repeated indefinitely, and the hypothesis of complete information must be abandoned.

Suppose that the potential competitor has perfect information but with the exception of that concerning the cost of the existing firm. The latter could of course innocently apply its monopoly price, ignoring the threat of entry and thus allow the potential competitor to infer its cost. However, the existing firm knows that the entrant has incomplete information and may seek to deceive it by reducing its price to make it appear that its costs are low (efficient firm) and thus discourage entry. In the case of a single period, the potential entrant can only assign a priori probability to each possible state. Let us define ψ the probability that it will encounter an efficient firm ($\pi_E < 0$) while (π_I) is its profit if it encounters an inefficient firm. For the potential competitor to give up entering, it suffices that its subjectively expected profit is negative: $\psi\pi_E + (1-\psi)\pi_I < 0$, which implies that $\psi > \frac{\pi_I}{(\pi_I - \pi_E)}$. If the game takes

place in two periods, the existing firm chooses its price in the first period, which depends on its cost. The entrant with its a priori probabilities observes this price and, according to a Bayesian process, corrects them by developing a probability distribution on the cost of the existing firm. It then compares its expected profit if it enters with the zero-profit corresponding to no entry. The existing firm is in turn able to infer the decision to enter as a function of the price it chose in the first period. The most general result is a multiplicity of possible solutions and the difficulty of choosing between them.

The existence of exit barriers and the role of predatory competition have not been taken into account (Rey and Tirole, 1997). Indeed, if the firms in place have significant financial resources and are able, after entry takes place, to impose losses on the entrant by adopting predatory pricing policies (Milgrom and Roberts, 1992; Tirole, 1988) (the price is set at a level lower than the cost of production), the losses of existing firms, in the short-term, must be more than offset by the long-term gains resulting from increased market power. This strategy can cause the exit or absorption of certain firms. If the costs of existing firms were sunk, entrants would be forced to adopt the Syslos-Labini postulate since a drop in production would not change these costs.

According to Caves and Porter (1977), these exit barriers constitute an element of market structures that can explain the behaviour of firms and therefore their performance.⁹ For these authors, the structural foundations of barriers to entry can be compared to those of barriers to exit. From the point of view of companies in the market, while the strategic barriers to exit are high, the barriers to entry are low. In this case, the costs associated with exiting the

⁹ See Caves and Porter (1977), p. 241-267.

market become high due to the sustainable investment they made during the production process. From the perspective of potential competitors, the existence of exit barriers effectively offset entry barriers as new entrants have a strong motivation to stay and predatory policies become ineffective. A possible industrial configuration is then that of a market with low exit and high entry implying a tendency towards de-concentration.

I.4. The competition model proposed by Bresnahan

The traditional indicators of concentration and profitability, which fall under descriptive statistics, do not make it possible to reliably measure market power. We therefore move on to the econometric approach, which consists in estimating market power using an econometric model with simultaneous equations specifying the supply and demand of the product under consideration. The econometric approach raises the problem of identifying the equations of the structural model and identifying market power.

The identification of a structural model with simultaneous equations is made from the model in reduced form, whose equations express the endogenous variables as a function of the exogenous variables only. An equation of the structural model is said to be identified when it is possible to calculate all its parameters based on those of the model in reduced form (Greene, 2017).

Bresnahan (1982) and Lau (1982) show that the identification of the structural model is not sufficient for the identification of market power and therefore of the nature of the competitive equilibrium. The identification of this parameter requires the definition of an inseparable demand equation with respect to the vector of exogenous variables. Panzar and Rosse (1987) show, conversely, that even if the structural model is not identifiable, a partial identification of market power remains possible on the basis of the equations in reduced form, provided that the latter take a different form depending on the competitive equilibrium considered (Bresnahan, 1987). This method of partial identification of market power based only on the parameters of the reduced form equation will be used in Chapter 3, as part of an application of the Rosse and Panzar model to the Lebanese banking sector.

I.4.1. Identification of market power

Bresnahan (1982) developed a model to identify and estimate market power within the framework of the structural model formed by the supply and demand in the considered industry.

I.4.1.1. Cases where market power (a_i) is not identifiable

First, Bresnahan considers a linear demand function at the level of the endogenous variable P and the exogenous variable z_i .

The request function can be written as follows:

$$Q = \alpha_0 + \alpha_1 P + \alpha_2 z_1 + \varepsilon$$

(14)

where ε is a random error term.

$$\alpha_1 P = Q - \alpha_0 - \alpha_2 z_1 - \varepsilon \Leftrightarrow P = \frac{Q}{\alpha_1} - \frac{\alpha_0}{\alpha_1} - \frac{\alpha_2}{\alpha_1} z_1 - \varepsilon$$

The derivative of this equation gives:

$$\frac{\partial P}{\partial Q} = \frac{1}{\alpha_1}$$

(14')

We know that the first-order condition at industry level corresponds to the first derivative of the profit function. This function can be written as follows:

$$\pi = P \times Q - C(Q)$$

$$\frac{\partial \pi}{\partial Q} = P + a \cdot Q \cdot \frac{\partial P}{\partial Q} - \frac{\partial C}{\partial Q} = 0$$

The marginal revenue of the enterprise perceived by the representative firm is given by the following relation:

$$RM = P + a \cdot Q \cdot \frac{\partial P}{\partial Q} = \frac{\partial C}{\partial Q}$$

Replacing equation (14') in the marginal revenue function gives:

$$P = -a \frac{Q}{\alpha_1} + MC$$

where a represents market power (conjectural elasticity). The conjectural elasticity is zero in pure and perfect competition and equal to unity in monopoly (see section 1).

The marginal cost at the industry level is defined as follows:

$$MC = \beta_0 + \beta_1.Q + \beta_2.w$$

where β_0 , β_1 , and β_2 are the parameters of the economic model to be estimated, and w represents the price of the input or the price of a production factor. This results in the first order condition or aggregate supply equation for the industry:

$$P = a.(-Q/\alpha_1) + \beta_0 + \beta_1.Q + \beta_2.w + \eta$$

(15)

where η is a random error term.

The structural model defined by (13) and (14) constitutes a system of simultaneous equations. Bresnahan uses the order condition to test the possibility of identifying the structural model.¹⁰

The demand equation clearly meets the order condition: only the endogenous variable P appears on the right side of the demand equation and there is an excluded exogenous variable w . The identification of the supply equation (15) can be examined more easily by rewriting the latter as:

$$P = \beta_0 + \gamma.Q + \beta_2.w + \eta$$

(16)

with $\gamma = \beta_1 - a/\alpha_1$.

We then see that equation (16) also meets the order condition: only the endogenous variable Q appears on the right side of this equation and there is an excluded exogenous variable w .

The identification of the structural model is not, however, sufficient to identify market power (a). The estimated parameter γ in fact depends on (a) both β_1 and α_1 . We therefore cannot determine (a) and β_1 based on γ , even if α_1 is considered known (because determined in the demand equation). More concretely, we do not know whether the estimated supply equation corresponds to equality between marginal cost and price (the case of perfect competition) or simply to equality between marginal revenue and marginal cost (the general case with any market power). This problem arises because the marginal cost, of which β_1 is one of the components, is not directly observable and must be estimated.

¹⁰ According to the order condition, the identifiability of an equation of the structural model requires that the number of exogenous variables excluded is greater than or equal to the number of endogenous variables included in the right-hand side of this equation. The order condition is necessary but not sufficient for identification. A sufficient condition is the rank condition. See Greene (1997), pp. 726-727.

I.4.1.2. Specification of demand allowing identification of market power

Bresnahan shows that the identification problem can be solved if an exogenous variable z_2 interacts with price in the demand function.¹¹ The demand equation is then nonlinear at the level of the variables P and z_2 .

$$Q = \alpha_0 + \alpha_1 P + \alpha_2 z_1 + \alpha_3 P \cdot z_2 + \alpha_4 z_2 + \varepsilon \quad (17)$$

The supply function then becomes:

$$P = \frac{-a}{\alpha_1 + \alpha_3 \cdot z_2} Q + \beta_0 + \beta_1 \cdot Q + \beta_2 \cdot w + \eta \quad (18)$$

The supply equation identifies market power (a). To see it, let us rewrite (18) in the form:

$$P = \beta_0 + a \cdot Q^* + \beta_1 \cdot Q + \beta_2 \cdot w + \eta \quad (18)'$$

$$\text{With } Q^* = \frac{-a}{\alpha_1 + \alpha_3 \cdot z_2} Q.$$

The supply equation (18)' satisfies the order condition. It contains two endogenous variables Q and Q^* in its right part and there are two excluded exogenous variables z_1 and z_2 . The parameters (a) and β_1 are now associated with different variables and can both be identified (Bresnahan, 1982).

The introduction of the exogenous variables interacting with price in the demand function presents a somewhat ad hoc and restrictive character. Lau (1982) has however shown more generally that the problem of identifying market power is solved when the inverse demand function is not separable at the level of exogenous variables.

Bresnahan's model has been applied by Shaffer (1982, 1989, and 1993) to the US and Canadian banking sectors to measure market power in credit activity. Shaffer adopts the intermediation approach in which deposits are considered as one of the factors enabling the production of loans or other interest-bearing investments.¹²

¹¹ In this case, a variation of the exogenous variable implies not only a change in the intercept of the demand function, but also modifies the slope of the latter.

¹² Sealey and Lindley (1977) support this approach of intermediation.

The variables of equations (17) and (18) have the following meaning in Shaffer's studies:

- The demand equation: Q represents the total credits in the United States study and the total investments (credits and securities) in the two Canada studies. The variable z_1 represents the GNP and should have a positive coefficient, the demand for credit being supposed to be an increasing function of the GNP. P corresponds to the average interest rate on loans (United States) or total investments (Canada) and should have a negative coefficient, the demand for credit being in principle a decreasing function of the interest rate. The variable z_2 represents the interest rate of an alternative source of finance for borrowers (commercial paper) and should have a positive coefficient, the demand for credit being assumed to be an increasing function of the cost of other sources of finance.
- The supply equation: Shaffer considers two factors of production: deposits and labour factor. w_1 represents the average interest rate on deposits and w_2 is the average annual salary per employee. Their coefficients should be positive. The affecting coefficient Q is positive, zero or negative depending on whether the marginal cost is increasing, constant or decreasing.¹³

In the study applied to the American banks, estimates are made on the basis of annual data for the periods 1941-1975 and 1941-1983. Shaffer finds insignificant market power (a) (at the significance level 5%) and concludes that the behaviour of banks cannot be distinguished from that which they would have in perfect competition. This result should be interpreted with great caution due to several econometric weaknesses. First, the coefficient α_4 is negative, which means that z_2 (the financing alternative) does not have the expected economic significance, even if it allows the model to be identified. Second, some series used, in particular Q , are not stationary and contain a trend, which reduces the reliability of the significance tests of the coefficients. Third, the calculation of the Durbin-Watson test shows that the residuals are strongly auto-correlated, indicating inappropriate specification. Finally, the estimated parameters vary considerably when one passes from the interval 1941-1975 to the interval 1941-1983.

In his study applied to the Canadian banking system, Shaffer (1993) recognises the problems of autocorrelation. In order to remedy this, he adds a number of interaction factors in the

¹³ In the latter case, the second order conditions of the maximisation process are met if the slope of marginal cost is less steep than that of demand.

demand function, and uses the marginal cost derived from the translog cost function. A dummy variable D is introduced into the supply equation in order to take account of structural changes that have occurred since 1980 and their possible effects on the degree of competition. The specification to be estimated becomes:

$$Q = \alpha_0 + \alpha_1 P + \alpha_2 z_1 + \alpha_3 P \cdot z_2 + \alpha_4 z_2 + \alpha_5 P \cdot z_1 + \alpha_6 z_1 \cdot z_2 + \varepsilon \quad (19)$$

$$P = \frac{-a}{\alpha_1 + \alpha_3 \cdot z_2 + \alpha_5 \cdot Y} Q + \left(\frac{C}{Q} \right) (\beta_0 + \beta_1 \cdot \ln Q + \beta_2 \cdot \ln w_1 - \beta_2 \cdot \ln w_2) - D \cdot \frac{S}{\alpha_1 + \alpha_3 \cdot Z + \alpha_5 \cdot Y} Q + \eta \quad (20)$$

where C represents the total cost (interest, salaries, cost of fixed capital) and represents the transition parameter linked to the dummy variable.

Shaffer finds a market power (a) not significantly different from zero for the period 1965 to 1980, which is compatible with the hypothesis of perfect competition. The transition parameter S is negative and significant and indicates that the banking sector was in disequilibrium during the period 1981 to 1989. The above specification does not however, solve the problem of autocorrelation, the Durbin-Watson test remaining below unity.

In a final attempt, Shaffer uses a first difference model. This transformation generally makes it possible to have stationary series, which increases the reliability of the significance tests of the coefficients. However, the loss of the information contained in the levels causes a decrease in the explanatory power of the model. The first difference estimate, applied to non-deflated data, yields an (a) non-significantly different from zero. This result must be considered with great caution, given the low explanatory power of the estimate of the demand equation (R^2 of 0.06) and the insignificant values of the parameters estimated in the supply equation.

1.5. Panzar-Rosse Competition Model

Rosse and Panzar (1977, 1987) consider that the unavailability of complete data on prices and quantities of different products makes it difficult to estimate the degree of competition in an industry. They derive a reduced-form income equation that links total income with the prices of different factors of production. These authors indicate that the elasticity of total income,

calculated by deriving the equation of income with respect to the prices of production factors, takes on different values depending on the degree of competition. By estimating this elasticity, it becomes possible to determine what type of competitive equilibrium (monopoly, oligopoly, or perfect competition) prevails in a given market (Bresnahan, 1987).

The Rosse and Panzar model has served as the basis for empirical studies of banking sectors in many countries. Based on our theoretical synthesis, we look at the econometric study of banking competition in MENA region over the period 2000-2016 in the following sections. Panzar and Rosse develop a structural model to determine the nature of the competitive equilibrium (monopoly, oligopoly, perfect competitive equilibrium, etc.) in a given market structure. This model integrates the objective function of the firm and the first and second order market equilibrium conditions. The authors show that the firm seeks to maximise its profit by producing at a level which equates marginal revenue with marginal cost. The Panzar and Rosse structural model makes it possible to deduce an equation in reducing form, which links the income and cost functions with a vector of exogenous variables affecting both income and production cost.

Based on the modelling proposed by Panzar and Rosse, we can measure the degree of competition using the statistic which represents the elasticity of income with respect to the prices of the factors of production used in the production process.

I.5.1. Profit maximisation and equilibrium in the event of monopoly

Suppose that the total revenue of a (monopoly) firm depends on the quantity Q produced by the monopoly and on a vector of exogenous variables z . The total cost $C = C(Q, w, t)$ of the firm depends on the output Q , w the factor price vector and t the vector reflecting technological constraints.

We assume that the prices of the inputs are exogenous i.e. the firm has no influence on them. The cost function C depends on the technology since the factors of production must be able to produce the output Q .

This results in a profit function π of the existing firm of the form:

$$\pi = R - C = \pi(Q, z, w, t)$$

The monopoly profit maximisation program corresponds to:

$$\text{Max}_Q \pi(Q, z, w, t) = R(Q, z) - C(Q, w, t) \quad (21)$$

Panzar and Rosse define the reduced form income equation relating total income with input prices as follows:

$$R^* = R(z, w, t) \quad (22)$$

The H statistic¹⁴ is equal to the sum of the elasticities of total income with respect to the prices of the factors of production:

$$H = \left(\frac{\partial R^*}{\partial w_j} \right) \left(\frac{w_j}{R^*} \right) \quad (23)$$

with $H \leq 0$

Rosse and Panzar deduce that the elasticity of total revenue with respect to factor prices w is negative or zero in the case of monopoly.

Intuitively, the reasoning is as follows (Schaffer, 1982). The increase in factor prices leads to an increase in the production cost of the monopoly and a decrease in the equilibrium quantity. The monopoly firm will always have an interest in choosing a level of production for which demand is elastic to price, otherwise producing an additional unit would reduce its total revenue. In a competitive situation, there is no comparable restriction on the sensitivity of demand to equilibrium.

I.5.2. Monopolistic competition model

The determination of the value of H at the monopoly competitive equilibrium can be analysed using Chamberlin's model (1933). In this model, a n number of firms offer differentiated but substitutable products. The demand for a firm depends on the prices and quantities of substitutable products available on the market. We can define the inverse demand function of the firm $P(Q, n, z)$, which under the condition of symmetry, expresses the price as a function of the quantity produced by the firm, the number of competitors and a vector of exogenous variables likely to cause a displacement of the total demand.

The monopolistic competition implies a long-term equilibrium with zero profit since there is freedom of entry of new competitors into the sector. The price is therefore equal to the average cost and the equilibrium corresponds to the point of tangency between the demand

¹⁴ Panzar and Rosse's H statistic is estimated as the sum of the elasticities of bank income in relation to the prices of production factors, and thus describes the way in which banks adjust their income to changes in their costs. The principle is as follows: changes in input prices affect costs, which in turn affect bank income. This price change is fully reflected in bank income.

function and the average cost.

By deriving the inverse demand equation with respect to Q and n , we get:

$$\begin{cases} \frac{\partial P}{\partial Q} \equiv P_Q < 0 \\ \frac{\partial P}{\partial n} \equiv P_n < 0 \end{cases}$$

The elasticity of the demand function perceived by the firm, $\xi(Q, n, z) \equiv -P/(Q\partial P/\partial Q)$, is a non-decreasing function with the number of rival firms ($\partial\xi/\partial n \geq 0$).

We now proceed to a comparative statics analysis of the monopoly competition equilibrium. For this, assume that $R(Q, n, z) = QP(Q, n, z)$ and that market equilibrium can be defined by 1) equality between marginal revenue R_{Q_j} and marginal cost C_{Q_j} ; 2) achieving zero profits. These two conditions are written as follows:

$$R_Q - C_Q = 0 \quad (23)$$

$$\pi = R(Q, n^{\wedge}, z) - C(\hat{Q}, w, t) = 0 \quad (24)$$

These two equations show that at long-run equilibrium, the values of the output \hat{Q} and numbers of rival firms n^{\wedge} are functions of the exogenous variables z, w and t .

The derivation of the model in reduced form shows that in the case of monopoly competition, the elasticity of total revenue with respect to factor prices w is less than or equal to unity, which does not exclude the values ($H \leq 1$).

I.5.3. Long-term equilibrium and perfect competition

In pure and perfect competition, the firm determines the quantity it offers Q_j^c in the long run by choosing it such that its long-run marginal cost is equal to the market clearing price P^c . This equilibrium must ensure:

- Equality of marginal cost and price:

$$P^c - C_Q(Q^c, w, t) = 0 \quad (25)$$

- Equality between total revenue and total cost, i.e. zero profits:

$$P^c Q^c - C(Q^c, w, t) = 0 \quad (26)$$

On the basis of these two expressions, Panzar and Ross derive the model in reduced form and show that under the assumption that the average cost is homogeneous of degree 1, the sum of the elasticities of the total revenue with respect to the prices of the inputs is equal to 1:

$$H = \sum \left(\frac{\partial R^c}{\partial w_i} \right) \left(\frac{\partial R^c}{\partial w_j} \right) = 1 \quad (27)$$

The intuition behind this result is as follows. In a competitive market, many firms will, by hypothesis, be present. In the long run, they all use the same production technique for a given level of output. Indeed, the assumptions of transparency and flexibility guarantee that they have perfect information on existing techniques and that they can freely use them. The minimisation of the production budget on all production factors leads to strategies for purchasing similar factors for all companies. The long-term cost curves will therefore be identical and so will the individual long-term offers. In a competitive market, the firm will make a positive profit if the price of the output is at least equal to the long-term average cost of the optimal supply. The price being equal to the long-term marginal cost and the long-term marginal cost being greater than the average long-term cost, we deduce that the firm will be present in the long term on the market provided that the market price is higher at the minimum of its average long-term cost. As the quantity produced by the firm remains unchanged, the total revenue linked to the production activity must evolve in proportion to the costs of the production factors, which implies a statistic $H = 1$.

Shaffer (1993) shows that during the adjustment process, the quantities supplied are greater than the quantities demanded, so it is optimal for the firm to reduce the quantity it produces. This results in price stability and a drop in the quantity produced in the long-run, which implies that the H statistics are negative in pure and perfect competition during the adjustment phase.

I.5.4. Determination of the H statistic in oligopoly

Unlike pure and perfect competition and monopolistic competition, the oligopoly model represents a situation in which there is no free entry of rival firms into the market and the zero-profit condition is no longer valid. The firm's market power is materialised by a positive profit and not by a greater number of firms. The firm's j maximisation program in the case of the oligopoly with conjectural variations corresponds to:

$$\text{Max}_{Q_j} \pi_j = P(Q, Z) \cdot Q_j - C(Q_j, w, t)$$

where P is the inverse demand function of the firm and $Q = \sum Q_j$ corresponds to the output of the industry. Assuming that the profits π_j satisfy the sufficient conditions of differentiability, the first order condition for the profit maximisation by the firm is written:

$$P + \frac{\partial P}{\partial Q_j} \cdot Q_j = \frac{\partial C(Q_j, w, t)}{\partial Q_j} \quad (28)$$

Based on the reduced form model, Panzar and Rosse show, in the case of the oligopoly, that an increase in input prices results in a decrease in the quantity produced by each firm. The expected effect on total revenue is ambiguous since it depends on the elasticity of demand, i.e. whether it is less or greater than unity and if the marginal revenue is positive or negative.

I.5.5. Summary of the values of H relating to the different equilibria

Rosse and Panzar show that the value of H statistics can only be positive if the firm has a monopoly whose goal is to maximise its total revenue. Indeed, in the case of monopoly, an increase in the price of factors increases the marginal cost, reduces the quantity of output and the total income. On the other hand, the H statistic in a situation of perfect competition is positive but not greater than unity because an increase in the price of inputs increases the marginal cost as well as the average cost without modifying the quantity of the firms' optimal output. Shaffer (1982) shows that the value of H is equal to unity for a natural monopoly in a perfectly contestable market and for a firm seeking to maximise its revenues.

Table (11) presents the different values of the H equilibria of competition examined above:

Values of the H statistic and competitive equilibria

$H < 0$	Monopoly
$0 < H < 1$	monopolistic competition
$H = 1$	Perfect competition in long-term disequilibrium

I.5.6. Application of the Panzar and Rosse Model to the banking industry

The first application of the Panzar and Rosse model to the banking industry was made by Shaffer (1982). This author applies the H statistics of Rosse and Panzar on a sample of American banks operating in New York. The specification estimated by Shaffer includes as dependent variable, total income and as independent variables, the price of labour input, the price of physical capital, the price of bank deposits, the bank size measured by the total balance sheet, the total bank deposits, the liquidity ratio measured by the ratio of net liquid assets to bank liabilities and the asset structure approximated by the ratio of commercial and industrial loans to total loans. The results obtained by Shaffer show that the elasticity of income with respect to factor prices is positive and statistically different from zero and unity, which leads to rejecting the behaviour of monopoly and perfect competition for the banks retained in the estimation.

Nathan and Neave (1989) apply Shaffer's model to 72 Canadian banks for the period 1982-1985 but with some additional considerations. First, while Shaffer ignores bad debts in his model, Nathan and Neave integrate them and observe them as determinants of bank profitability. In addition, total assets are fed into Nathan and Neave's model to detect the presence of economies of scale. The ratio between the number of branches of each bank and the total number of branches in the banking system is also used to estimate possible size effects. The estimation of the model by the OLS method shows that the values of the obtained H statistic are positive and statistically significant at the 5% level. Except for the year 1982 when the H statistics do not deviate considerably from unity, the values obtained for the years 1983 and 1984 are significantly different from zero and from unity, which makes it possible to reject the monopoly hypothesis as well as perfect competition. As competition appears to be more potential than actual, Nathan and Neave conclude that the behaviour of the Canadian banking sector appears to be well described by contestable markets theory.

To determine the type of competitive equilibrium that prevails in the European banking systems, Molyneux et al. (1994) estimate the Panzar and Ross model on German, French,

British, Spanish and Italian banks for the period from 1986 to 1989. The specification adopted by these authors consists in regressing the total income on the price of the labour factor measured by the ratio total expenditures/total assets, the price of physical capital represented by the ratio overheads/fixed assets, the price of deposits approximated by the ratio between interest paid and total deposits, bank size measured by the total balance sheet, capitalisation measured by the capital/total assets ratio and the structure of deposits approximated by the share of interbank deposits in total deposits. The estimate of the specification adopted by the OLS method indicates that for German banks, French banks, British banks and Spanish banks, the elasticities of income with respect to factor prices are significantly different from zero and from 1 at the 5% level. This result therefore leads to rejecting the equilibrium of monopoly and perfect competition in Germany, France, the United Kingdom and Spain except in Italy where the various estimates show a negative and significant link at the 5% level between total income and the prices of the factors used, which does not reject the monopoly hypothesis.

Coccorese (1998) applies the model of Panzar and Rosse on a sample of Italian banks for the period 1988-1996, by evaluating the type of competitive equilibrium prevailing in the Italian banking sector using H statistics. The specification adopted by this author is very close to that adopted by Nathan and Neave (1989). It consists in regressing the total income on the price of labour measured by the ratio of total expenses/number of employees, the price of physical capital represented by the ratio of overheads/number of branches, the price of deposits measured by the ratio between interest paid and total deposits, total deposits, bank size measured by total balance sheet, capitalisation measured by capital/total assets ratio, asset structure approximated by the share of loans to total deposits, the variable BR which is the ratio between the number of branches of each bank and the total number of branches and the variable D8, which takes the value of 1 for large banks and 0 for the other banks in the sample. The values of the Panzar and Rosse H statistic obtained, unlike the results of Molyneux et al. (1994) are significantly different from zero and unity and reject the equilibrium of monopoly and perfect competition over the entire period. The results show that Italian banks operate under the assumption of monopolistic competition with the exception of 1992 and 1994 where the values of H statistics are very close to unity.

Bikker and Haaf (2002) compare the degree of competition of banks in 23 countries for the period 1988-1998 using H statistics from Panzar and Rosse. As in the previous studies, the

authors use total income as the dependent variable and as explanatory variables: the price of labour input measured by the ratio of total expenses/number of employees, the price of physical capital represented by the ratio of overheads/fixed assets, the price of deposits measured by the ratio between the interest paid and the total deposits, the bank size measured by the total balance sheet, the capitalisation measured by the capital/total assets ratio, the structure of the liabilities measured by two ratios, the share of interbank deposits in total customer deposits and the share of sight deposits in total customer deposits. The estimate of the specification using fixed effects model leads to rejecting the equilibrium of monopoly and perfect competition (except in Australia). The values of the obtained H statistics are statistically different from zero and unity for all the countries considered as well as for the different sizes used (large banks, small banks and medium-sized banks).

De Bandt and Davis (2000) study the competitive behaviour of German, French, Italian and American banks over the period 1992-1996. In order for the sample to be homogeneous, these authors make a distinction between large banks and small banks. To calculate the H statistics, they use total income as a dependent variable and as an explanatory variable: the price of labour, the price of physical capital, the price of deposits, bank size measured by total assets, the structure of bank deposits and the share of loans in the total balance sheet.

The estimation of the Panzar and Rosse model by the fixed effects model shows overall values of H less than unity for all the represented banking sectors. The results reveal the existence of strong competition in the USA, a situation of monopoly competition for large and small banks (Italy), for large banks (Germany, France) and a monopoly situation for small banks (Germany, France).

Hempell (2002) attempts to identify the degree of competition in the German banking sector using the Panzar and Rosse model. The specification retained for the calculation of the H statistic is very close to those used above. The estimates show that the overall values of H are between zero and unity and are statistically significant at the 5% level, regardless of bank size and the legal distribution considered (cooperative banks, savings banks, commercial banks, banks under foreign control). The results therefore reject the equilibrium of monopoly and perfect competition. They validate the existence of a situation of strong competition within the German banking industry.

Other applications of the Panzar and Rosse model have been made on the banking systems of emerging and transition countries. Thus, Gaston et al. (2002) study the competitive banking

structure of eight emerging countries (Argentina, Brazil, Chile, Czech Republic, Hungary, Mexico, Poland, Turkey). The estimate of the reduced-form income function by the fixed-effects model shows that the values of the H statistic are statistically different from zero and one. The results obtained generally lead to rejecting the situation of perfect competition and the existence of monopolistic competition for all the banking systems considered.

Some studies have tried to assess the nature of the competitive equilibrium prevailing in the banking sectors of the MENA countries (Anzoategui et al. 2010; Apergis and Polemis, 2016). Their results agree that banking sectors in the MENA region are characterised by the presence of monopolistic competition.

Polemis (2015) applies the model of Panzar and Rosse on a sample of 137 banks operating in the MENA region using panel data econometric techniques. The results of the study reveal that the banking sector in MENA countries is characterised by the presence of strong contestability and a competitive equilibrium of the monopoly type.

I.6. Models of competition in strategic management

The literature emphasises three dominant strategic models that help explain the relationship between competition and corporate performance: the Porter economics approach, the resource-based approach and the relational approach, which was developed from the criticism of the first two. Each of these frameworks had a significant impact in strategy. We highlight their contributions and their limits for the construction of a model of strategic analysis in an internationalised context marked by inter-organisational networks and multi-market competition.

I.6.1. Porter's approach

Industrial organisation economics, and particularly the approach proposed by Porter, starts on the premise of sectoral (i.e. industry level) analysis and proceeds from there to address matters related to the effects that might have on an organisation's competitive position in the marketplace. Within this approach Porter (1980) distinguishes five competitive forces and proposes the concept of "expanded rivalry". The author expanded on this approach (1995) by developing an analysis of inter-organizational relationships in which upstream and downstream interdependent relationships generated by the organisations create value. In addition, the notions of "value chain" and "value system" were introduced into the Porter

model thus further contributing to enhancing our overall understanding of these matters. From these developments we can see that inter-organisation coalitions are clearly a means of influencing the bargaining power of customers and suppliers. Porter's model has been well-received and documented in the literature and is today widely used and appreciated by both academic researchers and practitioners of industrial organization economics alike.

The porter model, despite its undeniable major contributions, is yet to be sufficiently tested in, for example, the banking sector where networks play a heightened role in ensuring success of the organization's strategy. Industrial sectors are, of course, an important element of strategy and these have been sufficiently addressed by the Porter model. Additional features of interest when addressing these matters include networks and their impact in shaping an organisation's competitive strategy in the marketplace. As Porter has correctly pointed out, industrial structure often impacts the way organisations within that structure conduct their business, which, in turn, effects their market performance. But there are also other factors (for example, organizational networks, the way labor within an industry is organized, and so on.) that need to be taken into consideration when addressing issues related to an organisation's strategy and its market performance. These are additional environmental factors in the units of analysis that cannot be ignored.

In summary, therefore, the need to integrate, for example, organisational networks, trade unions, professional associations, various regulatory bodies, and pressure groups into the strategic analysis cannot be overstated. And this, in essence, calls for a thorough understanding of the environment that is not limited primarily to an industrial sector and public authorities.

In view of the preceding discussion therefore, we maintain that it is imperative to exploit the considerable contributions of industrial organisation economics while, at the same time, seeking to go beyond the limits of the model of strategic analysis received particularly in light of the current economic context.

1.6.2. The resource-based approach

The resource-based approach considers that the firm, more than the industry, constitutes the relevant level of analysis to explain performance (Barney, 1991; Rumelt, 1984; Wernerfelt, 1984). From this perspective, firms are able to accumulate resources and skills that turn into an advantage over their competitors if they are rare, value-creating, non-substitutable and difficult to imitate (Barney, 1991; Dierickx and Cool, 1989). This type of approach was

originally interested in the resources of a particular company. The arguments of complementarity of resources and capacities between firms, as well as the availability of certain resources on the market, justified the strategies of cooperation. Since then, some empirical work has gone further by developing the study of resources within the inter-organisational network to eventually consider it as the relevant level for understanding the location of resources and skills (Afuah, 2000). Therefore, the strategic options only concern the definition of the frontiers of the network (Should a new partner be integrated who has resources that the network does not have?). The model then runs the risk of no longer allowing firms' strategic autonomy to be taken into account, which, paradoxically, calls into question the level of analysis retained by the resource-based approach.

I.6.3. The relational approach

This approach (Dyer and Singh, 1998) considers that cooperation and alliances can increase the performance of organisations and reduce costs and risks. These arrangements constitute "relational benefits" that should be considered, along with physical and financial benefits, in determining the market value of a firm (Preston and Donaldson, 1999). From this perspective, the dimensions of competitive advantage is based on the traditional conception of industrial structure and on resource-based approaches. While it is a very interesting approach to understanding inter-organisational relations, the relational approach can be criticised for only considering the cooperative dimension of interactions. In fact, the performance model in this perspective is based on partnership: this what makes it possible to generate exceptional profits. Moreover, as noted by Preston and Donaldson (1999), only relationships with other firms are considered; organisations of a different nature (institutions, regulatory authorities) are not taken into account.

This review of the major strategic models allows us to observe their contributions and some challenges that still remain in simultaneously addressing matters of cooperation and competitive interactions between organisations. Our review demonstrates some challenges that still remain when using certain models as the basis to address situations of confrontation and cooperation between organisations. Of course, both the Porter model and the Resource Based View have enabled us to have a better understanding of interorganizational cooperation and confrontation. And this provides us with a better basis to integrate some of the environmental issues we mentioned above (organizational networks, labor organisations, and so on) in further developing the discourse and thus providing a holistic view of the situation.

In discussing these matters, it is important to note that some authors (for example, D'Aveni, 1994) have preferred an approach in which organisations operating in a typical hyper-competitive environment would behave rather differently. In environments where there are particularly heightened competition (i.e. hyper-competition) rivals would do their utmost to find consonance (rather than dissonance) as a way of maintaining a viable competitive position in the marketplace. This is a new kind of strategic model which is built on the premise of cooperation and networking between organizations (including competitors) for the purpose of achieving a stronger market presence. Other models (e.g. Karnani and Wernerfelt, 1985) are more concerned with the development of new forms of competition (e.g. multi-market or multi-point competition). Other non-classical models of industrial organization economics such as those focusing on the imperative of interaction (Chen, 1996) are primarily concerned with the nature of competition between organizations and as such the notion of cooperation between organizations is often not sufficiently addressed. Similarly, some models of strategy appear to focus primarily on the cooperative aspect between organizations, leaving out the competitive aspect altogether or only providing a cursory treatment of it.

This conflict is not sufficiently considered in most of the strategic models. One of the explanations that can be put forward for these shortcomings relates to the concepts around which the models are based. As we have seen, competition and cooperation are modes of interaction that have been frequently contrasted in literature even though many authors emphasise that they are fundamentally intertwined. Lado et al. (1997) thus emphasise that these two notions differ considerably from a philosophical point of view and that their representation is a paradox. In other words, the use of the concepts of “competitor” or “partner” contributes little to the strategic understanding of the environment of a firm. This remark shows the interest of an approach that mobilises other concepts. It is thus a question, rather than qualifying the interactions between firms, of analysing the interdependencies between organisations before adopting an adequate strategy.

Therefore, as previously discussed, the role of management's strategic choice in explaining performance and the level of risk can be highlighted by strategic management theory (Caves et al., 1980; Porter, 1980; Lippman and Rumelt, 1982).

Porter (1980, 1985, 1987) affirms that the firm can improve its performance through an appropriate strategic choice based on a Cost Leadership strategy, a Differentiation strategy,

and a Focus strategy. Other research has shown empirically that firm success is achieved through a combination of Differentiation and Cost Leadership strategies (Hitt and Ireland, 1985; Miller, 1992). Miller (1992) highlights that the combination of Porter's strategies is fundamental to the performance of industrial organizations in the context of heightened competition.

These propositions have been highlighted empirically by several previous works (Chatterjee et al., 1992; and Isik, 2002).

To analyze the role of the banking firm's strategic choice in explaining its performance, and more specifically the impact of competition on banking efficiency and stability in the MENA region, we propose to analyze, based on Porter's studies, the two dimensions of banks' overall strategy, i.e. risk-taking strategy and cost management strategy (efficiency), taking into account certain specific (size, diversification, liquidity, governance) and environmental (macroeconomic and institutional) factors.

Several previous studies have demonstrated, as discussed below, that these strategic dimensions are in line with the specific characteristics of the banking firm (Williams, 2012; Girardone et al., 2010).

**CHAPTER II: COMPETITION, RISK TAKING AND EFFICIENCY OF BANKS
OPERATING IN THE MENA REGION**

The objectives of this chapter are to enhance the understanding of the impact of competition on efficiency and banking stability, using a sample of 176 banks operating in the MENA region from 1999 to 2020. To investigate this relationship, we employ the GMM-system technique as our methodology. The findings reveal that market power has a positive effect on bank efficiency, but a negative effect on bank stability, consistent with the competition-stability theory. Additionally, the results demonstrate that the economic environment and institutional quality serve as explanatory factors for banking efficiency and stability. These outcomes present significant implications for banking regulation policies in the MENA countries.

II.1. Introduction

The financial liberalization policies implemented in the 1990s brought about significant transformations in the financial systems of MENA region countries. These transformations have manifested in several ways. Firstly, there has been a gradual consolidation of the financial sector, leading to increased concentration. Secondly, banks have witnessed a restoration of liquidity and profitability, fostering sector stability. Thirdly, compliance with capital standards such as Basel I, Basel II, and Basel III have been prioritised. As a result of these changes, the structure of the banking sector in the MENA region has been altered. Despite the emergence of new players and the growth of international and regional banking groups, concentration within the sector still persists. This concentration has given rise to heightened credit risk, primarily due to the presence of information asymmetry, which is a characteristic of the banking market in MENA countries.

Since the financial crisis of 2008, the relationship between the structure of the banking sector and the bank's overall stability has captured renewed attention. The instability arising from the behaviour of banks within the market, has repercussions on the financing of the economy. The literature on the banking market structure has undergone theoretical analyses and empirical investigations, which can be classified into two areas. The first examines the connection between the banking market structure and bank stability, where the theoretical studies conducted in this regard have yielded conflicting results. Based on the franchise value or expected future profit paradigm, some authors contend that banking competition leads to instability (Keeley, 1990; Hellman et al. 2000). In particular, banking competition raises interest rates on deposits and lowers those on credit, thereby diminishing a bank's franchise

value and increasing the incentive to take riskier projects. In contrast, adopting the risk-shifting paradigm, Allen and Gale (2004) and Boyd et al. (2006) argue that greater competition fosters banking stability. Increased competition lowers borrowing interest rates, which enhances businesses' profitability and reduces the incentive to take risks (Allen and Gale, 2004). Empirical evidence in this regard is also mixed, with Boyd and De Nicolo (2006) and Yeyati and Micco (2007) finding a positive effect, while Hellmann et al. (2000), Beck, Demirgüç-Kunt, and Levine (2006), and Jimenez et al. (2013) observe a negative relationship between competition and stability.

Regarding the relationship between risk, market power, and efficiency, studies on the competition-banking efficiency link present conflicting findings. The Quiet Life Hypothesis (QLH) supports a negative relationship between market power and efficiency (Hicks, 1935; Boyd et al. 2005; Turk Ariss, 2010). According to this hypothesis, high market power is associated with lower efficiency in the production and provision of banking services. On the other hand, an analytical framework based on the Structure-Behavior- Performance theory (Bain, 1951; Demsetz, 1973; Peltzman, 1977; Smirlock, 1985) which considers the unique characteristics of the banking market, including information asymmetry, reveals that strong competition leads to short-term and less stable banking relationships, as well as reduced information production. However, banking efficiency relies on banks' ability to collect and monitor information at lower costs. By facilitating information acquisition, market power, enables efficient resource allocation (Dell'Ariccia, 2001; Shaffer, 1999). Therefore, the hypothesis of banking specificities supports a negative relationship between competition and banking efficiency. A competitive market (i.e. less concentrated) prevents the reduction of information asymmetry, increases risk, and may have adverse effects on banks' efficiency. These theoretical divergences regarding the impact of competition on efficiency are also reflected in empirical studies, thus underscoring the importance of conducting a study on the banking sectors of MENA countries.

The objective of our chapter is to reevaluate the impact of market structure on bank efficiency and stability, considering the effects of the macroeconomic situation, institutional environment, and ownership structure. Specifically, we aim to assess the relative contributions of market structure and specific environmental factors in explaining bank efficiency and stability.

This study will provide a threefold contribution. Firstly, it explicitly and simultaneously incorporates variables representing the economic and institutional environment and ownership structure into the traditional model, linking market power with efficiency and bank stability. Secondly, it examines the relationship between market power and bank efficiency, as well as the relationship between market power and bank stability, within a dynamic framework. Previous studies have primarily utilised pooled panel data models and fixed-effects models, which suffer from endogeneity issues as the lagged dependent variable is often correlated with the error term (Altunbas et al. 2007; Tan & Floros, 2013). Thirdly, this study focuses on the choice of the sample. It empirically analyses a sample of commercial banks operating in the MENA region. Previous studies have predominantly been conducted within the context of developed countries (Demirgüç-Kunt et al., 2008; Casu and Girardone (2010); Berger et al. 2010). Exploring the relationship between market power, efficiency, and bank stability in MENA countries is particularly interesting due to the significant role played by the banking sector in economic growth and development.

This chapter is structured as follows: In Section 2, we provide a comprehensive review of the existing literature. Section 3 outlines the methodology and describes the variables used. The main findings and the robustness tests are presented in Section 4. Lastly, in Section 5, we conclude and discuss the implications of the results obtained in relation to economic policy.

II.2. Literature review and hypotheses development

II.2.1. Relationship between market power and banking efficiency

In the banking literature, the relationship between market power and efficiency is often discussed from three different perspectives. The first perspective, known as the Quiet Life Hypothesis (QLH) proposed by Hicks (1935), assumes that market power has a negative impact on bank efficiency. According to the QLH, when banks possess market power, they tend to enjoy a more relaxed environment, which leads to a decrease in their efforts to maximise efficiency. Building upon Hicks' study, Berger and Hannan (1998) suggest that bank managers may exploit market power to generate profits without putting in significant efforts to control costs. Consequently, higher market power is associated with lower efficiency, whereas increased competition tends to enhance banking efficiency. On the contrary, the Efficient Structure Hypothesis, introduced by Demsetz (1973), suggests that

efficiency has a negative influence on competition. According to this hypothesis, highly efficient banks utilise their cost advantage to expand their market share and size, thereby leading to increased market concentration at the expense of less efficient banks. In this scenario, the causal relationship operates in reverse, with performance (efficiency) driving changes in market structure (competition). However, it is important to note that these two hypotheses are not exclusive to the banking sector. The presence of a negative relationship between competition and banking efficiency has been highlighted in previous research (Carbó-Valverde et al. 2017). The theoretical literature on banking emphasizes that imperfect competition in banking markets can give rise to information asymmetries between banks and borrowers, particularly in credit activities. This strand of literature focuses on the unique characteristics of the banking industry, such as the heterogeneous nature of its services and the significant presence of information asymmetries between banks and their customers. Within this analytical framework, it is assumed that these specific characteristics alter the competitive behaviour of banks, distinguishing it from that of firms in other sectors of the economy (Sharpe, 1990; Rajan, 1992).

Indeed, the various approaches developed in industrial economics assume the homogeneity of products in the banking market. However, this assumption is unlikely to hold in the banking sector for two main reasons. Firstly, bank credit, by its very nature, is not a homogeneous good but is closely tied to the quality of borrowers and their projects. Additionally, banks can differentiate themselves and compete on different grounds. Factors such as a bank's reputation, the geographic reach of its network, and the range of products it offers can become crucial elements of competition among banks. This literature argues that the presence of information distortions and the non-homogeneity of banking services lead banks to adopt competition strategies specific to the sector. Thus, long-term customer relationships, cross-subsidisation, and inter-temporal subsidies are seen as responses by banks to the informational imperfections that characterise the banking industry. Therefore, it is important for this literature to focus on the specific characteristics of the banking sector when analysing the effects of competition on efficiency and stability. Some theoretical analyses support this approach, where for instance, Dell'Ariccia and Marquez (2004) demonstrate that the level of information asymmetry in the credit market influences the impact of bank competition on credit production. However, the works of Petersen and Rajan (1995) and Boot and Thakor (2000) remain the foundational theoretical models upon which most empirical studies examining the effect of competition in the banking industry are based.

Building upon this theoretical groundwork, a considerable body of empirical literature has examined the impact of competition on banking efficiency and stability. However, the analysis of these diverse empirical investigations yields conflicting conclusions. For instance, Berger and Humphrey (1994) examine the relationship between market power and cost efficiency of American banks during the period 1980-1988. Their findings indicate that market power has a negative effect on the cost efficiency of US banks. Consequently, their results support the theory of the Quiet Life Hypothesis. Similarly, Koetter and Vins (2008) employ the Lerner index to measure competition and the stochastic frontier method to estimate the efficiency scores of German banks. Their findings reveal a negative correlation between cost efficiency and the Lerner index, thus aligning with the QLH. However, in contrast, the relationship between profit efficiency and market power demonstrates a significant positive association. Delis and Tsionas (2009) obtained a similar result in the context of European banks. Notably, their estimates provided clear evidence of a negative relationship between market power and cost efficiency of banks, which supports Hicks' (1935) Quiet Life Hypothesis. Tan and Floros (2013) conduct an analysis to examine the relationship between risk and efficiency, as well as the relationship between concentration and efficiency of Chinese banks from 2003 to 2009. By employing simultaneous equation models, they discover a positive correlation between risk and concentration, supporting the competition-stability hypothesis. Additionally, their findings demonstrate a negative association between concentration and technical efficiency, thus validating Hicks' (1935) Quiet Life Hypothesis. Similarly, Khan et al. (2017) investigates the link between market power and cost efficiency of Asian banks spanning from 1999 to 2014. By utilising the GMM technique and Panel Vector Autoregression, they observe a negative relationship between cost efficiency and market power, thereby supporting the Quiet Life Hypothesis. However, contrary to the aforementioned studies, other research presents evidence in favour of a positive relationship between market power and banking efficiency. Maudos and Fernández de Guevara (2007) examine the connection between market power measured by the Lerner index and cost efficiency estimated through the stochastic frontier approach for a sample of European banks between 1994 and 1999. Their results indicate a positive relationship between market power and cost efficiency, thereby rejecting the Quiet Life Hypothesis. Similarly, Casu and Girardone (2009) investigate the relationship between market power and cost efficiency of European banks from 2000 to 2005. They find a negative causality, as indicated by Granger tests, between efficiency and competition, further rejecting Hicks' (1935) Quiet Life Hypothesis. Likewise, Phan et al. (2019) analyse the relationship between

competition, efficiency, and stability of Asian banks spanning from 2004 to 2014. Their results reveal a positive correlation between market power and efficiency, as well as a positive correlation between market power and banking stability, which is in line with the Efficient Structure and Concentration Stability Hypotheses. Furthermore, Kuessi et al. (2023) utilize ordinary least squares to examine the relationship between competition and efficiency of African banks from 2000 to 2019. Their findings indicate that competition has a negative impact on efficiency, thereby contradicting Hicks' (1935) Quiet Life Hypothesis.

Based on the discussions above, our testable hypothesis is stated as follows:

H1: In a concentrated market, market power (competition) is positively (negatively) associated with cost efficiency

II.2.2. Relationship between market power and banking stability

The examination of the connection between bank competition and bank risk relies on two prominent theories: Competition-Fragility Theory and Competition-Stability Theory. The first theory advocates the notion that competition within the banking industry results in excessive risk-taking and instability. Conversely, the second theory states that increased competition serves as a means to enhance banking stability.

The theoretical literature concerning the impact of competition on banks' risk-taking draws significant inspiration from Marcus (1984) and Keeley (1990). The theory of franchise value explores the connection between monopoly rents and the risks undertaken by banks. Hence, these authors provided theoretical support for the competition-fragility hypothesis. According to their argument, the multitude of bank failures witnessed in the United States during the 1980s can be partially attributed to deregulatory measures that diminished monopoly rents. In the view of these authors, intense competition among banks has an adverse effect on market power and profitability. Consequently, bank managers resort to risky investments in order to increase their profits, leading to a decline in the quality of credit portfolios and a decrease in bank stability.

According to Keeley's (1990) research, several theoretical works have reached the conclusion that banking competition diminishes monopoly rents and consequently increases the level of risk. Edwards and Mishkin (1995) investigate that the excessive risk-taking observed in the United States was a response to declining profits caused by intensified competition in

financial markets. This competition reduces the benefits for banks in attracting savings and weakens their position in the credit market. Similarly, the study conducted by Besanko and Thakor (1992) demonstrates that increased competition pushes banks to adopt riskier portfolio strategies. They explain this behavior by highlighting the diminishing advantages of long-term bank-firm relationships, which generate profits for banks through informational superiority, as soon as the banking sector becomes more competitive.¹⁵ Consequently, banks no longer have an incentive to mitigate their risks since they no longer reap the benefits of their relationships with firms. Similar findings have been obtained by Boot et al. (1993) using a two-period model that incorporates the potential for banks to gain reputational advantages and enhance their profits through monitoring. The relationship between competition and credit risk has also been explored by Shaffer (1998), who reveals that in the face of intensified competition, banks tend to extend a larger volume of credit. However, this comes at the expense of an elevated risk of non-performing loans, ultimately leading to a deterioration in the quality of bank loan portfolios.

Cordella and Yeyati (2002) focus on examining the influence of competition on banks' incentive to engage in monitoring activities, which helps determine the level of risk in their portfolios. They employ a spatial competition model wherein banks select their risky portfolios. Their findings indicate that increased competition reduces banks' investment in monitoring and results in higher interest rates on deposits, as well as heightened risk due to low product differentiation and narrow net profit margins. Furthermore, Hellman et al. (2000) utilise a dynamic model in which banks, operating within a competitive environment, determine the level of asset risk. Their research demonstrates that competition erodes bank profits, thereby compelling banks to undertake excessive risks as competition intensifies. Matutes and Vives (2000) investigate the connections between competition for deposits, risk-taking, and deposit insurance within a static model of imperfect competition. Similar to the findings of Hellmann et al. (2000), the authors argue that competition, particularly in the

¹⁵ In their 1992 study, Besanko and Thakor explore how increased competition in the banking sector can influence banks' risk-taking behaviors. The central argument is that as competition intensifies, banks are incentivized to adopt riskier portfolio strategies. This shift happens because of the diminishing benefits that banks typically derive from maintaining long-term relationships with their clients. In a less competitive environment, banks can establish strong, long-term relationships with firms. These relationships offer banks informational advantages over competitors, as they accumulate unique knowledge about the firms' financial health, operations, and risk profiles. This information allows banks to price loans more effectively, manage risks better, and maintain profitability through their "informational superiority." However, when the banking sector becomes more competitive, the value of these long-term relationships decreases. Competitors can undercut the established banks by offering better loan terms, forcing banks to either accept lower profits or take on riskier lending strategies to remain profitable. To sustain their market share and profitability in this more competitive environment, banks may move toward riskier portfolios, which include higher-risk loans or investments that offer higher returns to compensate for the reduced informational advantages. In summary, the study suggests that increased competition reduces the profit potential of traditional, safer banking practices like relying on long-term relationships, pushing banks to seek higher returns through riskier strategies.

presence of a flat-rate deposit insurance mechanism, leads to excessive deposit rates. To ensure their solvency, banks are then compelled to invest in riskier assets. Repullo (2004) builds upon the model proposed by Hellmann et al. (2000) by explicitly incorporating competition in deposit markets. The author demonstrates that, in the absence of capital requirements, equilibrium is only established with risky investments under highly competitive environments or in monopolistic markets. However, Giannetti (2007) challenges the relevance of competition models in deposit markets for emerging economies. In these countries, the liberalisation of the capital account implies a great availability of deposits for the banking system due to the entry of foreign capital. As emerging economies are relatively small compared to the potential funds available, the supply of funds becomes perfectly elastic. In such a scenario, competition for deposits does not impact the cost of bank resources. Consequently, banks are not incentivised to take excessive risks in order to restore their intermediation margins.

In addition to the arguments related to the competition-fragility hypothesis, a growing body of literature supports a contrasting perspective that considers competition as a mechanism for enhancing stability in the banking industry. This viewpoint is primarily framed within the risk-shifting paradigm and is based on the notion that, in the presence of information asymmetries, a decrease in competition leading to an increase in lending interest rates tends to deteriorate the quality of the bank's portfolio, thereby generating additional risks. This occurs because the upward movement in interest rates results in ex-ante substitution of good agents with bad agents (i.e. adverse selection), and ex-post encourages agents to engage in riskier behavior (i.e. moral hazard).

The Competition-Stability Hypothesis was introduced by Boyd and De Nicolo (2005), which highlights that intense competition among banks results in lower loan interest rates and reduced moral hazard, thereby mitigating credit risk. To address the challenges posed by information asymmetry, Boyd and De Nicolo (2005) extended the model developed by Allen and Gale (2000) through incorporating entrepreneurs into the framework. In this context, the level of risk taken by the bank is no longer determined solely by its own decisions; it depends exclusively on the behaviour of the borrowers, which is influenced by the lending interest rates offered by the banks. The Moral Hazard Hypothesis suggests that when competition is low, as indicated by a smaller number of banks in the market, and interest rates become higher, entrepreneurs are inclined to choose riskier projects. Consequently, competition between banks tends to diminish banking risks. However, despite the undeniable

contributions of the model, it is not free from weaknesses. Firstly, the modeling approach assumes that banks are external to moral hazard issues. However, Caminal and Matutes (2002) reject this hypothesis and present a formalisation that acknowledges the ability of banks to ration credit and monitor the behaviour of borrowers as a means to mitigate moral hazard. Secondly, in their model, Boyd and De Nicolo (2005) assume a perfect loan correlation, which posits that all loans in a bank's portfolio are perfectly correlated. This means that the performance of each loan in the portfolio moves in exactly the same direction—if one loan defaults, all loans default, and if one loan performs well, all loans perform well. This assumption is highly restrictive because, in reality, loans in a bank's portfolio are generally not perfectly correlated. Banks typically extend loans to various sectors, regions, and types of borrowers, which diversifies risk. For instance, if loans in one sector (like real estate) underperform, loans in other sectors (like manufacturing or technology) may still perform well, thus spreading the risk. By assuming perfect correlation, Boyd and De Nicolo's model simplifies the analysis but does not reflect the diversification benefits banks usually achieve. This assumption leads to a more extreme view of the relationship between competition and bank risk-taking, as it disregards how diversification can mitigate risk in the real world.

Martinez-Miera and Repullo (2010) challenge the assumption of perfect loan correlation and propose that both viable and non-viable loans can coexist within the banking book. By modifying this single assumption, the results of Boyd and De Nicolo (2005) undergo significant changes, as the previously assumed monotonic relationship between competition and risk is no longer upheld. According to Martinez-Miera and Repullo (2010), this situation arises due to the dual effects of increased competition. On one hand, competition reduces the probability of bankruptcy through risk-shifting, similar to the findings of Boyd and De Nicolo (2005). On the other hand, competition diminishes the capacity to absorb losses, thus elevating the likelihood of bankruptcy. The impact of competition on the ability to absorb losses is attributed to its negative influence on the profitability of viable loans, subsequently affecting the bank's capacity to absorb losses from defaulting loans. Despite the dual effects of competition on risk, Martinez-Miera and Repullo (2010) demonstrate that the relationship is not indeterminate. They conclude that there exists a U-shaped relationship between risk and competition. This non-linear relationship implies the existence of an optimal competitive structure.

Several empirical studies provide evidence for a negative association between competition and banking stability. Keeley (1990), analysing a sample of large American banks from 1971 to 1986, concludes that an increase in competition is linked to a decrease in bank profits, an increase in risk premiums, and a heightened fragility of the banking system during the 1980s. Turk Ariss (2010) focusing on developing countries, supports the competition-fragility hypothesis and demonstrates that market power affects both production efficiency and value creation. Consequently, efficiency emerges as one of the channels through which the impact of market power spreads. These findings are in line with the conclusions drawn by Schaeck et al. (2014), who investigate the relationship between competition and stability using the Boone indicator (Boone, 2008). Their analysis reveals that competition strengthens banking stability in Europe. However, it is important to note that within the framework of the Boone indicator, it is the efficiency gains generated by high levels of competition that contribute to enhanced financial stability.

In a study on Russian banks covering the period 2001-2007, Fungáčová and Weill (2013) demonstrate a negative correlation between the market power index (Lerner index) and bank failures, aligning with the competition-fragility hypothesis. Yeyati and Micco (2007) examine the relationship between competition (measured by the Lerner index) and risk (proxied by the Z-score) using a sample of commercial banks across eight Latin American countries during the period 1993-2002. Their study reveals that increased competition has a detrimental impact on bank stability.

Similarly, Kabir and Worthington (2017) conduct an empirical investigation on Islamic and conventional banks, covering the period 2000-2012 and provide further evidence supporting the competition-fragility hypothesis, as the results indicate a negative association between competition and banking stability measured by the Z-score.

In line with prior research, several empirical studies have presented evidence supporting a positive correlation between competition and banking stability. De Nicolo and Kwast (2002) took a significantly different approach from Keeley (1990) in examining the relationship between stability and market structure. Their findings indicate that the expansion of market share among large banks in the United States has contributed to an increase in systemic risk. This challenges the assumptions of the franchise paradigm, suggesting that banking concentration may actually generate more risks. Similar research has been conducted for European countries.

For instance, on Spanish banking data, Salas and Saurina (2003) investigated the impact of market power, measured by Tobin's Q, on the capital ratio and the proportion of defaulting loans. Their findings align with those observed by Keeley (1990) in the United States. In a similar vein, Schaeck, Cihak and Wolfe (2009) expanded on previous studies by utilising the H-statistic developed by Panzar and Rosse (1987). This statistic provides a more accurate reflection of the competitive intensity in a banking market compared to qualitative variables. The results obtained from a duration model highlight the stabilising role of competition.

Likewise, Uhde and Heimeshoff (2009) adopted a macroeconomic approach by using an aggregated Z-score, which combines individual Z-scores of banks, to examine the impact of concentration in Europe. Their findings suggest that concentration has a detrimental effect on banking stability. On the other hand, Akins et al. (2016) conducted a study on a sample of 7351 US banks to explore the relationship between competition and banking stability. Their results indicated that competition, measured by the Panzar and Rosse (1987) H-statistic, has a positive influence on banking stability, aligning with the competition-stability hypothesis.

Similarly, Guidi (2021) observed a positive association between competition and banking stability in the context of South-Eastern European countries. In their study, the market power, measured by the Lerner index, was found to be positively correlated with credit risk, supporting the concentration-fragility hypothesis.

Finally, several empirical studies have shed light on the presence of a nonlinear correlation between competition and banking stability. Jiménez et al. (2013) examined the Spanish banking market and investigated the impact of various concentration measures (CR5, HHI, number of banks) and the Lerner index (a measure of market power) on stability. Their empirical analysis revealed that structural competition measures exhibit a non-linear effect on risk-taking behaviour. Similarly, Brei et al. (2020) explored the relationship between banking competition and stability in sub-Saharan Africa. Utilising financial statements from 221 banks across 33 countries during the period of 2000-2015, the authors provided evidence of a U-shaped relationship between banking competition (Lerner Index) and credit risk (non-performing loans). This relationship suggests that the initial development of banking competition yields positive effects such as lower credit costs and operational gains, contributing to an improvement in loan quality. However, as competition intensifies, it leads to a decline in loan quality due to reduced profit margins and increased risk-taking by banks.

Based on the discussions above, our testable hypothesis on this issue is stated as follows:

H2: In a concentrated market, market power (competition) is positively (negatively) associated with banking stability

II.2.3. Relationship between risk, competition and banking efficiency

There are four basic hypothesis that aim to explain the causal interaction between risk and efficiency. These hypotheses are inspired by the approaches proposed by Berger and DeYoung (1997), Gorton and Rosen (1995), Hughes (1999), and Koutsomanoli-Filippaki and Mamatzakis (2009). The initial hypothesis suggests that when the risk of banks defaulting increases, their inefficiency also increases. This hypothesis is based on the concept of bad luck (BL) and applies to both conventional banks (CBs) and Islamic banks (IBs). In the case of CBs, a rise in default risk leads to reduced cost and profit efficiency because managers incur expenses to manage risk.

On the other hand, IBs face Islamic regulations that prohibit changes in loan terms or penalties in case of default, which may contribute to a higher default rate. This default risk introduces inefficiency as IBs incur additional costs to ensure their safety and stability. In summary, according to this hypothesis, higher default risk leads to inefficiency in both CBs and IBs. The second hypothesis suggests that a decrease in bank inefficiency leads to an increase in bank default risk. The Moral Hazard (MH) Hypothesis proposes that managers of efficient banks may engage in excessive risk-taking because they do not bear the consequences of the risks. This behaviour can be observed in expansionary strategies that prove to be excessively risky in the long run. The "skimping" hypothesis aligns with this notion, as banks may appear efficient by cutting costs, rolling over bad loans, or expanding their balance sheets. Islamic banks also face moral hazard, where investment account holders act as quasi-liability holders and are expected to bear losses unless the bank is negligent or engages in misconduct. This creates an incentive for Islamic banks to attract more account holders than they can handle, potentially leading to riskier investment decisions and higher default risk. In Islamic banking, moral hazard refers to a situation where one party (the bank or the investment account holders) may have an incentive to take undue risks or act in ways that the other party cannot easily monitor or control. Islamic banks operate on principles that avoid interest (riba) and emphasize profit-and-loss sharing. Investment account holders (IAHs) deposit their money with the bank, and the bank invests it in various projects or assets. The key distinction from conventional banks is that IAHs do not receive a fixed return

(like interest); instead, they share in the profits or losses from these investments. The term "quasi-liability holders" describes how IAHs are in a somewhat unique position. Like liability holders (depositors in conventional banks), they provide funds to the bank, but they are also expected to bear any losses from the investments, unless the bank is proven to have been negligent or engaged in misconduct. In conventional banking, depositors are protected from losses, while in Islamic banking, IAHs are exposed to investment risks unless the bank acts improperly. Moral hazard arises in this context because, knowing that IAHs will bear the investment losses, the bank might be tempted to take on riskier investments, since it does not bear the full consequences of failure. IAHs, on the other hand, may lack sufficient oversight or control over the bank's investment decisions, leading to potential misalignment of incentives and an increased likelihood of risky behavior by the bank. In essence, the bank might act less cautiously if it believes the consequences of poor investment performance fall mostly on IAHs, unless there are strong governance and monitoring mechanisms in place to prevent negligence or misconduct.

The third hypothesis suggests that an increase in bank inefficiency leads to a decrease in bank default risk (referred to as the "Risk-Averse Management" (RAM) Hypothesis by Hughes (1999)). The RAM hypothesis proposes that risk-averse managers tend to limit their involvement in risky activities, which results in reduced profits and increased costs for risk monitoring. This risk-averse approach may lead to lower default risk but could make managers appear inefficient. Islamic banks, despite promoting profit-and-loss sharing, are reluctant to engage in such arrangements due to monitoring costs, low risk appetite, and issues with market transparency. Banks respond to the risk aversion of depositors by minimising risk, which may lead to decreased default risk in the long term. The final hypothesis suggests that an increase in bank inefficiency leads to an increase in bank default risk. The Bad Management Hypothesis states that low-cost efficiency indicates poor management practices, including inadequate risk monitoring. This hypothesis applies to both conventional banks and Islamic banks. For Islamic banks, adherence to Sharia principles may result in neglect of crucial functions such as loan screening and risk monitoring, leading to higher default risk.

Numerous studies have been conducted on the subjects of risk and efficiency, with a focus primarily on America, Europe, and developing countries. For instance, Tan et al. (2013) conducted a study to examine the relationship between bank efficiency, risk, and capital in the Chinese commercial banking industry. The study analysed data from 2003 to 2009.

The researchers explored three different efficiency and productivity indexes, along with four bank risk indicators. The empirical evidence revealed significant findings, including a negative relationship between risk and capitalisation, as well as a significant positive impact between risk and efficiency. The study also found that larger banks exhibited higher levels of technical and pure technical efficiencies,¹⁶ while banks with greater liquidity levels displayed lower levels of technical and pure technical efficiencies. Moreover, Chinese banks operating in more concentrated markets tended to have lower levels of technical and pure technical efficiencies. Saeed et al. (2020) investigated the relationship between risk, capital, and efficiency in Islamic and conventional banks across 14 countries. The study revealed interesting differences between the two types of banks. When faced with increased insolvency risk, Islamic banks showed a more significant response in terms of capitalisation compared to conventional banks. However, the effect on risk-taking behaviour was approximately five times smaller for Islamic banks. Islamic banks also demonstrated a stronger reliance on investment account holders, who played a crucial role in monitoring the banks' activities, contributing to their resilience. Both Islamic and conventional banks benefited from reducing risk in terms of cost efficiency, although the impact was less pronounced for Islamic banks. The relationship between increased cost efficiency and risk levels differed between the two bank types, with conventional banks experiencing lower risk with higher cost efficiency, potentially leading to a more lenient regulatory approach. On the other hand, Islamic banks exhibited a complementary relationship between higher cost efficiency and increased capitalisation. Van Anh (2022) conducted a study focusing on five emerging countries in the ASEAN region to examine the relationship between bank risk, capital, and efficiency from 2005 to 2015. The study utilised panel VAR analysis and found a bidirectional causal relationship between capital and credit risk, indicating the crucial role of capital requirements in controlling bank risk. The impact of capital on risk was consistent across various measures, except when using the z-score as proxy for risk, which suggested the presence of moral hazard behaviour among banks in ASEAN countries. In terms of

¹⁶ "Technical efficiency" and "pure technical efficiency" are concepts used to measure how well an organization or firm uses its resources to produce outputs. These concepts are particularly common in efficiency studies, including in banking, manufacturing, and other industries.

- Technical efficiency refers to the ability of a firm to produce the maximum output with a given set of inputs, or alternatively, to produce a given level of output with the minimum inputs. In other words, it assesses whether a firm is operating on the "production frontier," which represents the best possible production given the resources.
- Pure technical efficiency isolates the managerial aspect of efficiency by measuring efficiency under the assumption of variable returns to scale (VRS). It reflects how well the firm manages its operations without being affected by the scale (size) of its production.
- Pure technical efficiency differs from scale efficiency, which refers to the efficiency related to the size of operations. Scale efficiency indicates whether a firm is operating at an optimal size—whether it benefits from increasing or decreasing returns to scale. A firm can be purely technically efficient but still suffer from scale inefficiency, meaning that it could perform better if it operated at a different scale.
- The term "non-pure technical efficiency" is not commonly used in the literature, but it can refer to overall technical efficiency that includes both pure technical efficiency and scale efficiency. In this context, if a firm is not purely technically efficient, it means that there is inefficiency either in its managerial operations or in its scale of production. Therefore, "non-pure technical inefficiencies" may imply inefficiencies that result from a combination of poor management and suboptimal scale of operation.

efficiency, the study found that high-efficiency banks tended to maintain lower levels of capital, aligning with the efficiency-risk hypothesis. Low-efficiency banks, on the other hand, were more inclined to preserve their franchise value and maintain higher capital ratios. The study provided weak evidence for the bad management hypothesis. The impact of efficiency on capital was consistent across different types of ownership and bank sizes, both before and after the 2008 global crisis. Saeed and Izzeldin (2016) conducted a study to investigate whether achieving efficiency gains and maintaining financial stability are mutually exclusive objectives, focusing on Islamic banks and conventional banks in Gulf Cooperation Countries (GCC) and three non-GCC countries from 2002 to 2010. The researchers employed a VAR approach to assess the dynamic interaction between risk and efficiency. The findings revealed intricate interdependencies between efficiency measures and default risk. In the case of GCC and conventional banks, a decrease in risk was associated with lower efficiency levels. However, for Islamic banks, the causality between profit efficiency and default risk showed an inverse relationship across all categories. The findings suggested the presence of a trade-off between efficiency and risks, except for Islamic banks, where no such trade-off was observed.

In a study encompassed data from over 1000 commercial banks operating in 39 emerging economies across Central and Eastern Europe, Latin America, and Asia from 2000 to 2016, Wu et al. (2020) investigate the influence of business diversification on bank risk, taking into consideration the role of efficiency. The authors find a negative relationship between the diversification of banks' revenue and funding sources and their efficiency, suggesting that a wider range of activities has a detrimental impact on efficiency. However, when controlling efficiency, an increase in business diversification was found to have a direct stabilising effect. The study also highlighted that while expanded diversification of banking activities can have some favorable effects on bank stability, there is a counteracting force arising from reduced bank efficiency when banks venture beyond their traditional areas. Moreover, the study emphasised that diversifying income and funding sources alone does not guarantee enhanced financial stability for banks.

Mester (1996) employed the stochastic cost frontier approach to analyse the efficiency of banks operating in the Third Federal Reserve District, considering the quality and riskiness of their output. The findings indicated that these banks were operating at cost-efficient levels in terms of both output levels and product mixes. However, a significant level of X-

inefficiency¹⁷ was observed among the banks, indicating room for improvement in their cost-effectiveness. The study also found that inefficient banks in the Third District faced a greater threat from banks that were efficient producers, rather than from banks focused on specific output volumes or product mixes. Additionally, the study indicated that there were fewer cost savings to be gained from adjusting output size or mix compared to utilizing inputs more efficiently. Kuessi et al. (2023) conducted a study focusing on the impact of competition on bank efficiency in the West African Economic and Monetary Union (WAEMU). The study took into consideration the presence of multinational banks and the quality of institutions, analysing data from 2000 to 2019. By employing linear and non-linear models, the researchers examined the relationship between competition and bank efficiency. The results indicated that competition decreases bank efficiency within the current structure and environment of the WAEMU banking system. The study also revealed the non-linear nature of this relationship, with the negative impact of competition on efficiency being more pronounced when competition reaches a high threshold. Furthermore, the study found that bank diversification or multi-nationalisation can mitigate the adverse effects of competition on bank efficiency. Corruption and political instability were also identified as having a detrimental effect on banking efficiency, amplifying the negative influence of competition on efficiency in more corrupt and unstable environments. Phan et al. (2019) conducted a study examining the relationship between competition, efficiency, and stability in the banking systems of four East Asian countries: China, Hong Kong, Malaysia, and Vietnam. The study analysed data from 2004 to 2014 and its findings supported the traditional view that increased competition can have a negative impact on bank stability, suggesting that greater competition among banks in East Asia may lead to decreased stability. However, the impact of cost efficiency on bank stability was not clearly established. Additionally, factors such as credit risk, bank size, and market concentration were found to potentially influence bank stability positively. The study also found that listed banks may be less stable compared to their non-listed counterparts. Moreover, macroeconomic factors were identified as important determinants of bank stability. Altunbas et al. (2007) analysed the relationship between capital, risk, and efficiency using a large sample of European banks from 1992 to 2000,

¹⁷ *X-inefficiency refers to the inefficiency that arises when a firm or organization fails to produce the maximum output possible given its inputs, or when it produces the same level of output using more inputs than necessary. Essentially, X-inefficiency occurs when a firm is operating inside its production frontier rather than on it, meaning that it is not fully utilizing its resources (like labor, capital, or technology) in the most productive or cost-efficient manner. The concept of X-inefficiency was first introduced by economist Harvey Leibenstein in 1966. It contrasts with traditional concepts of efficiency in economics, which assume that firms always operate on the production frontier (i.e., they are technically efficient). X-inefficiency suggests that various internal factors, such as poor management, organizational slack, lack of competition, or low worker motivation, can prevent a firm from achieving maximum efficiency.*

aiming to compare the findings with existing evidence from the United States. The results revealed contrasting patterns, as there was no positive relationship observed between inefficiency and bank risk-taking in European banks, unlike the evidence from the US. In fact, inefficient European banks tended to maintain higher levels of capital and exhibit lower risk-taking behaviour. Furthermore, the study found a positive association between risk and the level of capital (as well as liquidity), indicating that regulators may prefer capital as a means of constraining risk-taking activities. Additionally, the study identified a positive impact of the financial strength of the corporate sector on reducing bank risk-taking and increasing capital levels. The study also examined the relationships between capital, risk, and efficiency in different types of banks. While no significant differences were found between commercial and savings banks, notable distinctions were observed for co-operative banks. Lower capital levels were associated with higher risks in the case of co-operative banks, and inefficient banks tended to maintain lower levels of capital. Moreover, some of these relationships varied depending on whether banks were among the most or least efficient operators, suggesting that efficiency played a role in shaping these dynamics.

II.3. Methodology, data and definition of variables

In order to examine the linkage between competition, cost efficiency, and banking risk, we have developed two specifications that draw heavily from existing research (De Nicolo et al., 2006; Soedarmono, Machrouh and Tarazi, 2011; Agoraki, Delis and Pasiouras, 2011; Fu, Lin and Molyneux, 2014; Brei et al., 2020). The primary specification aims to assess the impact of competition and risk on the cost efficiency of commercial banks in MENA countries. Conversely, the second specification investigates the influence of competition and efficiency on banking stability in the MENA region. In both specifications, we have taken precautions to account for the interplay between competition, efficiency, and risk by incorporating several bank-specific control variables, which were obtained from the Orbis Bank Focus database, along with macroeconomic and institutional data sourced from the World Bank's World Development Indicators (WDI) database. Thus, the two specifications can be presented as follows:

$$Efc = \alpha_0 + \alpha_1 Comp + \alpha_2 Risk + \beta X_{i,t} + \gamma Z_{j,t} + \varepsilon_{i,t}$$

$$Risk = \alpha_0 + \alpha_1 Comp + \alpha_2 Efc + \beta X_{i,t} + \gamma Z_{j,t} + \varepsilon_{i,t}$$

where i , j and t stand for bank, country and time. The variables Efc , $Risk$, and $Comp$ represent respectively cost efficiency, banking risk and competition. The variable $X_{i,t}$ is a vector of

variables specific to each bank and $Z_{j,t}$ represents a vector of variables specific to each country included in our sample. Finally, $\varepsilon_{i,t}$ is the error term.

Two dependent variables are considered in our empirical study: cost efficiency and banking risk. Furthermore, we incorporate numerous control variables that relate to both the individual characteristics of banks and the macroeconomic conditions of the countries under study.

II.3.1. Dependent Variables

II.3.1.1. Cost efficiency

In our study, similar to many empirical research endeavors, we employ a parametric frontier known as a stochastic cost frontier (Aigner et al. 1977; Cornwell et al. 1990; Battese and Coelli, 1995) to gauge the level of cost efficiency among banks operating in the MENA region. This approach differs from the nonparametric method, specifically the data envelopment analysis (DEA) introduced by Charnes et al. (1978), which measures the efficiency of decision-making units by assuming a production technology characterised by constant returns to scale (CRS). Subsequently, Banker et al. (1984) introduced a DEA model with variable returns to scale (VRS) to assess productive efficiency. The advantage of the DEA method lies in its ability to avoid assumptions about the functional form of the production and cost frontier.

Indeed, non-parametric methods offer the advantage of simultaneously incorporating multiple outputs and do not necessitate assumptions regarding the functional form of the production or cost frontier. Despite these benefits, the DEA technique has certain weaknesses that may undermine the results obtained. It exhibits sensitivity to outliers, necessitating the identification and removal of such outliers from the sample studied, as their presence can shift the efficient frontier and result in an underestimation of banking efficiency.

On the other hand, the parametric approach holds two primary advantages over the DEA method. Firstly, it enables the differentiation between the impacts of noise (measurement errors) and inefficiency, thereby accounting for the presence of exogenous shocks. This is achieved by breaking down the error term into two components: an inefficiency component and a random component that combines measurement errors and exogenous shocks. Secondly, it demonstrates lower sensitivity to outliers. However, the parametric method also entails two key limitations when compared to the non-parametric method. Firstly, it requires the selection of the functional form of the cost function (such as Cobb-Douglas, Translog, etc.). Secondly, it is not well-suited for studies with small sample sizes.

In our empirical analysis, similar to the approach employed by Mester (1996), Maudos and Fernandez de Guevara (2007), and Fu et al. (2014), we utilise the stochastic cost frontier to evaluate the cost efficiency of banks operating within the MENA region. Formally, the stochastic frontier modeling involves the assumption that the error term consists of two distinct and independent factors. The first component represents pure randomness and thus serves as a random error term v_{it} , assumed to be independently and identically distributed (iid) with a mean of zero, $v_{it} \sim N(0, \sigma^2)$, and independent of the explanatory variables. The second component, denoted as μ_{it} , captures inefficiency. We further assume that this inefficiency component is also independently and identically distributed (iid), with a mean of zero and independent of the error term v_{it} , where $\mu_{it} \sim N(0, \sigma^2)$. Additionally, we assume that it follows a normal distribution, with zero mean. Inefficiency term (μ_{it}): This captures how inefficient the firm is in using its resources. A higher value of μ_{it} indicates greater inefficiency (i.e., the firm is producing less output than it could, given the resources it has).

- This inefficiency term is also assumed to be iid (independently and identically distributed), meaning that the inefficiency of one firm or at one time point does not influence the inefficiency of other firms or other time points.
- It is also assumed to follow a normal distribution ($N(0, \sigma^2)$), but typically with a positive value since inefficiency should reduce output, although this depends on the specific model being used.
- Like the random error term, the inefficiency term is assumed to be independent of v_{it} (random shocks), meaning that inefficiency is not influenced by external randomness.

One important assumption in the stochastic frontier model is that the random error term (v_{it}) and the inefficiency term (μ_{it}) are independent of each other. This means the model assumes that inefficiency is a separate issue from randomness; inefficiency does not interact with or depend on the random fluctuations that firms experience.

In line with Battese and Coelli (1993, 1995), we assume that the μ_{it} are independently distributed according to a truncated normal law (at zero) with mean $Z_{it} \cdot \delta$ and variance σ_{μ}^2 . Z_{it} is the vector (1 x m) of the explanatory variables of bank inefficiency and δ is the vector (m x 1) of the coefficients of these variables. This type of modeling allows integrating certain criticisms made of the so-called “two-step” approach (Battese and Coelli, 1993). In the first step of this method, the inefficiency terms are assumed to be independently and identically

distributed to be estimated. Then the efficiency scores are regressed on the zit variables, either by OLS or in a Tobit or Logit model to consider the truncated nature of the endogenous variable between 0 and 1. In this second step, we therefore consider that the inefficiency terms depend on a number of bank-specific parameters, which implies that they are not identically distributed (unless all the coefficients are zero). Simultaneous estimation proposed by Battese and Coelli (1995) is likely to limit the scope of this criticism. Inefficiency can be written $\mu_{it} = Z_{it} \cdot \delta + W_{it}$, where the random variable W_{it} is defined by a truncated normal distribution with mean zero and variance σ_{μ}^2 . We also assume that W_{it} is independent of v_{it} . The error terms being assumed to be independent of each other and of the inputs, it is possible to estimate the function by the maximum likelihood method. The parameters associated with v_{it} and μ_{it} are $\sigma^2 = \sigma_v^2 + \sigma_{\mu}^2$ and $\gamma = \sigma_{\mu}^2 / (\sigma_v^2 + \sigma_{\mu}^2)$.

The stochastic cost function can be specified as follows:

$$\begin{aligned} Ln(TC_{it}) = & \alpha_0 + \sum_{i=1}^2 \beta_i Ln(y_{it}) + \sum_{j=1}^3 \eta_j Ln(w_{j,it}) + \frac{1}{2} \sum_{k=1}^3 \sum_{l=1}^3 \phi_{kl} Ln(w_{k,it}) Ln(w_{l,it}) \\ & + \frac{1}{2} \sum_{i=1}^3 \sum_{m=1}^3 Ln(y_{it}) Ln(y_{mt}) + \sum_{k=1}^3 \theta_{ik} Ln(w_{it}) Ln(w_{jt}) + \varepsilon_{it} \end{aligned}$$

where: TC_{it} is the total bank cost; y_{it} represents the outputs of the bank; w_{it} represents the prices of the factors of production; and $\varepsilon_{it} = \mu_{it} + v_{it}$ represents the error term.

Based on the work of Berger and Master (1997), Turk Ariss (2010), Rakshit and Bardhan (2022), two outputs are retained to define the production activity: total earning asset (y_1) and off-balance sheet activities (y_2). These two outputs are achieved from the use of three inputs, namely interest expenditure, personnel expenditure and administrative expenditure. The prices of these three inputs are: the price of financial capital (w_1) measured by the ratio between interest expenditure and deposits; the price of the labor factor (w_2) is approximated by the ratio between personnel expenditure and total assets; finally, the price of physical capital (w_3) is measured by the ratio between administrative expenses and total assets.

II.3.1.2. Measurement of banking risk

The theoretical and empirical literature proposes two indicators for measuring the risk of banking activity (Tan and Floros, 2013; Albaity et al. 2019; Tarazi et al. 2020; Lepetit et al., 2021):

- credit risk (NPL) measured by the ratio between non-performing loans and total loans
- the Z-score indicator which reflects the probability of bank insolvency. This indicator can be calculated as follows: $Z\ Score = \frac{(ROA+CAR/TA)}{\sigma_{ROA}}$.

Where (ROA) designates the return on assets, (CAR/TA) represents the ratio of equity to total assets and (σ_{ROA}) the standard deviation of ROA.

II.3.2. Independent Variables

II.3.2.1. Banking competition

Banking competition is measured in our study using the Lerner index which provides a measure of the market power of banks. This indicator, which measures the difference between the price and the marginal cost, has been widely used in theoretical and empirical literature (e.g. Beck et al. 2013; Fu et al., 2014; Tan, 2016). The Lerner index to be estimated is a function of time (t) and of the banking entity (i) and can take the following form:

$$Lerner_{it} = \frac{p_{it}-mc_{it}}{p_{it}}.$$

where (p_{it}) is the average price of total assets approximated by the ratio of total revenues (interest income and non-interest income) to total bank assets and (mc_{it}) the marginal cost of bank (i) at date (t). In order to estimate marginal cost, the conventional approach is to estimate a translog cost function and calculate its derivative.

In line with the majority of studies, we specify a production technology with three production factors and a single product (see, among others, Angelini and Cetorelli, 2003; Guevara et al. 2005; Turk-Ariss, 2010). This approach corresponds to the intermediation approach, which differs from the production approach. The latter, which considers deposits as a product and not as a factor of production, nevertheless has a much weaker resonance in literature. The translog function that we specify thus has the following form:

$$\begin{aligned}
Ln(TC_{it}) = & \alpha_0 + \alpha_1 Ln(TA_{it}) + \frac{1}{2} \alpha_2 Ln(TA_{it})^2 + \sum_{k=1}^3 \gamma_k Ln(W_{k,it}) \\
& + \sum_{k=1}^3 \varphi_k Ln(TA_{ij}) Ln(W_{k,it}) + \sum_{k=1}^3 \sum_{j=1}^3 \frac{1}{2} \phi_{kj} Ln(W_{k,it}) Ln(W_{j,it}) + \varepsilon_{it}
\end{aligned}$$

In this equation, (TC_{it}) represents the total costs of bank (i) observed at time (t), defined as the sum of interest expenses and general expenses (staff costs, administration expenses and other operating expenses). The variable (TA_{it}) corresponds to the total assets of the bank. The variables $(W_{1,it})$, $(W_{2,it})$ and $(W_{3,it})$ correspond to the costs (prices) of the factors of production; respectively the price of deposits, labor and fixed assets. We define $(W_{1,it})$ as the ratio of interest expense to total deposits; $(W_{2,it})$ as the ratio of staff costs to total assets; and $(W_{3,it})$ as the ratio of other operating expenses to total assets.

Furthermore, it is crucial for the translog cost function to exhibit homogeneity of degree one. This requirement necessitates adherence to the homogeneity constraints: $\sum_{k=1}^3 \gamma_{k,t} = 1$, $\sum_{k=1}^3 \varphi_k = 0$, and $\sum_{k=1}^3 \sum_{j=1}^3 \phi_{k,t} = 0$.

Under these conditions, marginal costs can then be directly obtained from the estimated parameters of the translog function, by calculating the first derivative of total costs (TC) with respect to total assets:

$$mc_{it} = \frac{TC_{it}}{TA_{it}} \left[\alpha_1 + \alpha_2 + \sum_{k=1}^3 \varphi_k \ln(W_{k,it}) \right]$$

The estimation of the translog function on panel data can be carried out in several distinct ways. We can, indeed, use the Ordinary Least Squares or specify a stochastic frontier (Koetter, Kolari and Spierdijk, 2012). This last approach allows considering inefficiencies in the production process.

II.3.2.2. Bank-specific control variables

In both of our specified models, we incorporate variables specific to each individual bank to effectively control the relationship between risk and efficiency, as well as market power and banking stability. We have carefully selected six bank-specific control variables that have the potential of influencing the level of bank efficiency and stability. These variables have been chosen based on insights from existing literature, including Schaeck and Čihák (2012), Schaeck et al. (2009), Berger et al. (2009), Fu et al. (2014), and Risfandy et al. (2022).

To begin with, a substantial body of research suggests that the "too-big-to-fail" doctrine can impact efficiency and risk-taking (Mishkin, 1999). Consequently, we include a variable in our regression analysis that accounts for the size of the banks. In this context, we consider the logarithm of total assets (*SIZE*) for the banks in our sample. We anticipate that size will have a negative (positive) effect on bank stability (efficiency).¹⁸ Additionally, the risk-taking behaviour of banking firms can be influenced by national banking reforms, emphasising the significant role of banks' business models. To capture differences in business models among banks, we introduce the ratio of non-interest income to total income (*DIVER*) as a variable. The expected effect of this diversification variable is uncertain (Wagner, 2010; Wu et al., 2020).

Furthermore, we incorporate variables to account for bank profitability and liquidity. Similar to Wu et al. (2020) and Risfandy et al. (2022), we assess our specifications using the liquidity ratio (*LIQ*), which measures the ratio of liquid assets to total assets. Additionally, we consider the profitability ratio (*ROA*), which measures the ratio of net profits to total assets. The impact of these two variables on banking stability and efficiency remains uncertain.

Lastly, to address the influence of capital regulations on bank stability and efficiency, we include the capital ratio (*CAR*), measured as the ratio of capital to total assets, as a control variable in our models. The effect of the capital ratio on bank efficiency and stability is ambiguous (Tan and Floros, 2013; Risfandy et al., 2021).

II.3.3. Macroeconomic and institutional variables

To ensure the adequacy of our specifications and account for the macroeconomic and institutional environment we follow Tan and Floros (2013), Wu et al. (2020) and Kuessi et al. (2023) and include five additional variables. These variables serve as controls and enable us to examine the relationship between stability, efficiency, and banking competition. Specifically, we consider the growth rate of per capita gross domestic product (*GDPC*) and the inflation rate (*INF*), which measures the growth rate of the consumer price index. The growth rate of the economy reflects the impact of the economic cycle, while inflation serves as an indicator of macroeconomic instability. In addition, we incorporate three institutional variables to control for their influence on the relationships under examination: control of

¹⁸ We assume here that larger banks tend to take on more risk, which make them less stable.

corruption (*COCR*), political stability (*POLS*), and quality of regulation (*QREG*). Enhanced institutional quality is expected to correspond with increased banking stability and efficiency.

Furthermore, both specifications include two dummy variables to assess the impact of foreign ownership (*FORG*) and public ownership (*PUBL*) on banking stability and efficiency (Iannotta et al. 2013; Mutarindwa et al. 2021). Empirical findings have demonstrated that the expected effects of bank ownership on stability and efficiency are ambiguous.

Table 1 presents the definitions of the different variables used in our study to test the relationship between stability, efficiency and banking competition.

Table 1 : Variables definition

Variables	Explanations	Source(s)
The natural logarithm of total Cost ($LnTC$)	Interest expense + personnel expenses + other administration expenses + other operating expenses	Orbis Bank. Authors' calculations
TA	Total Asset	Orbis Bank. Authors' calculations
Output 1 (y_1)	Total earning asset	Orbis Bank. Authors' calculations
Output 2 (y_2)	Off Balance Sheet	Orbis Bank. Authors' calculations
Price of financial capital (w_1)	Interest expenses to total deposit	Orbis Bank. Authors' calculations
Price of labor (w_2)	Personnel expenses to total assets	Orbis Bank. Authors' calculations
Price of physical capital (w_3)	Ratio of non-interest expenses (operating cost net of personnel expenses) to total asset	Orbis Bank. Authors' calculations
Banking Stability (Z -score)	The rate of the sum of ROA and equity ratio to the standard deviation of ROA	Orbis Bank., Authors' calculations
Lerner index ($Lern$)	A proportion of the difference between price and marginal cost to price	Orbis Bank., Authors' calculations
SFA cost efficiency (Eff)	Cost efficiency scores are estimated using the SFA approach	Orbis Bank., Authors' calculations
Capitalization (CAR)	Equity to Total Assets	Orbis Bank., Authors' calculations l'auteur
Credit risk (NPL)	Ratio of non-performing loans to total gross loans	Orbis Bank., Authors' calculations
Liquidity (Liq)	Ratio of liquid assets to total assets	Orbis Bank., Authors' calculations
Bank size ($Size$)	Natural logarithm of total assets	Orbis Bank., Authors' calculations
Profitability (ROA)	Return on Assets	Orbis Bank., Authors' calculations
Revenue diversification (Div)	Non-interest income / total revenue	Orbis Bank., Authors' calculations
Inflation (Inf)	Annual inflation rate	World bank.
GDP per capita ($GDPC$)	Annual GDP per capita growth rate	World bank.
Control of Corruption	Control of corruption captures perceptions of the	Worldwide

(<i>COCR</i>)	extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	Governance Indicators
Political Stability (<i>POLS</i>)	Political stability and absence of violence measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism.	Worldwide Governance Indicators
Regulatory Quality (<i>QREG</i>)	Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	Worldwide Governance Indicators
Public Banks (<i>PUBL</i>)	A dummy which is equal to 1 if more than 50% of the bank capital is owned by domestic government, public institutions or state-owned firms	Annual report
Foreign banks (<i>FORG</i>)	A dummy which is equal to 1 if more than 50% of the bank capital is owned by foreign banks	Annual report

Note: This table summarises the description of main variables and source of data. More details about the variables are provided in Section 2.

Table 2 presents the descriptive statistics of the variables used to test the relationship between stability, competition and efficiency of banks in the MENA region.

Table 2: Variables descriptive statistics

	Mean	Median	Maximum	Minimum	Std. DEV	Observations
LNZ	1.476	2.092	5.118	-8.168	1.875	3872
CAR	0.119	0.105	0.929	-0.314	0.078	3872
EFF	0.671	0.675	1.000	0.190	0.134	3872
LIQ	0.316	0.252	7.806	0.002	0.243	3872
LERNER	0.274	0.266	28.640	-40.232	0.919	3872
ROA	0.012	0.011	0.322	-0.396	0.018	3872
NPLG	0.078	0.048	1.152	0.000	0.111	3872
DIVER	0.013	0.011	0.185	-0.353	0.017	3872
SIZE	15.206	15.170	19.456	7.376	1.673	3872
FOREIGN	0.653	1.000	1.000	0.000	0.476	3872
PUBLIC	0.204	0.000	1.000	0.000	0.403	3872

GDPC	0.019	0.023	0.262	-0.211	0.047	3872
INF	0.039	0.031	0.849	-0.938	0.184	3872
POLS	-0.529	-0.622	1.599	-2.117	0.846	3872
REQU	0.065	0.015	1.576	-1.303	0.564	3872

Notes: See Table 1 for the definition of variables.

In Table 3, we present the correlation matrix for the variables. The matrix reveals a weak correlation among the specific and macroeconomic variables, indicating the absence of multicollinearity issues. However, Table 3 highlights also a strong correlation among the institutional variables. Therefore, it is advisable to avoid including them simultaneously in the different estimated models.

Table 3 : Correlation matrix of the variables used in the main regression

	LNZ	CAR	EFF	LIQ	LER	ROA	NPLG	DIVER	SIZE	FORG	PUBL	GDPC	INF	POLS	REQU	COCR
LNZ	1.00															
T. stat	-----															
CAR	0.17	1.00														
T. stat	10.54	-----														
EFF	0.39	0.24	1.00													
T. stat	26.69	15.26	-----													
LIQ	-0.33	0.13	-0.14	1.00												
T. stat	-22.04	8.19	-8.84	-----												
LER	0.00	-0.01	0.03	0.03	1.00											
T. stat	-0.08	-0.37	1.94	1.91	-----											
ROA	0.17	0.32	0.11	-0.02	0.00	1.00										
T. stat	11.05	21.12	7.00	-1.48	0.06	-----										
NPLG	-0.08	0.12	0.02	0.10	0.02	-0.06	1.00									
T. stat	-4.88	7.57	1.06	6.44	1.17	-3.82	-----									
DIVER	0.07	0.27	0.03	-0.01	-0.04	0.37	0.10	1.00								
T. stat	4.50	17.12	2.00	-0.52	-2.38	24.53	6.25	-----								
SIZE	0.32	-0.29	0.00	-0.35	-0.03	0.04	-0.20	-0.09	1.00							
T. stat	20.84	-19.20	-0.19	-22.98	-1.81	2.38	-12.56	-5.41	-----							
FORG	0.05	-0.14	-0.02	-0.05	0.01	-0.04	-0.04	-0.05	0.34	1.00						
T. stat	2.97	-8.54	-1.29	-2.96	0.87	-2.77	-2.52	-3.23	22.39	-----						
PUBL	0.15	-0.04	0.15	-0.08	-0.02	0.03	-0.06	-0.01	0.24	0.35	1.00					
T. stat	9.75	-2.40	9.36	-4.86	-1.41	1.97	-3.70	-0.82	15.24	23.46	-----					
GDPC	0.05	0.03	0.15	0.06	0.01	0.14	-0.02	0.14	-0.14	-0.07	0.02	1.00				
T. stat	3.03	1.80	9.68	3.73	0.49	8.79	-1.14	9.01	-8.56	-4.52	1.40	-----				
INF	0.00	-0.16	0.07	0.10	0.01	-0.11	0.10	-0.17	0.09	0.08	-0.02	-0.11	1.00			
T. stat	0.09	-10.33	4.32	6.02	0.75	-6.94	6.18	-10.86	5.38	5.05	-1.34	-7.13	-----			
POLS	0.41	0.13	0.34	-0.11	0.04	0.10	-0.02	0.06	-0.02	0.04	0.20	0.05	0.09	1.00		
T. stats	28.25	7.94	22.47	-6.75	2.25	6.31	-1.32	3.56	-1.28	2.40	13.02	3.12	-5.87	-----		
REQU	0.43	-0.02	0.24	-0.21	0.02	0.00	-0.04	0.01	0.21	0.16	-0.02	0.05	0.08	0.56	1.00	
T. stat	29.25	-1.10	15.35	-13.60	1.12	0.16	-2.31	0.80	13.61	10.24	-1.31	3.32	5.29	41.95	-----	
COCR	0.53	0.11	0.36	-0.27	0.00	0.11	-0.08	0.07	0.21	0.11	0.12	0.04	0.04	0.70	0.82	1.00
T. stat	39.22	6.86	23.96	-17.21	0.18	6.70	-4.74	4.53	13.20	6.69	7.30	2.44	-2.37	60.95	88.32	-----

Notes: See Table 1 for the definition of variables.

II.3.4. Methodology

The methodology employed to examine the relationship between competition, efficiency, and banking stability is the GMM (Generalized Method of Moments) approach. This choice stems from the presence of time-invariant variables (such as institutional variables) that pose challenges when using fixed-effects models to test our econometric specifications. Additionally, employing traditional econometric techniques for estimation can lead to biased results due to the correlation between lagged variables and individual fixed effects (Nickell, 1981), as well as the endogeneity issue between efficiency, market power, and banking stability.

Theoretical considerations suggest that market power and risks are potentially endogenous. For instance, Schaeck et al. (2009) indicate that the level of risk-taking could influence bank competitiveness and, subsequently, the assessment of market power. Banks facing a high likelihood of default may consciously reduce their product pricing or increase the remuneration of raised resources to attract new customers and funds, thereby impacting the perceived level of market power. To address these challenges and obtain efficient estimates for the dynamic model, we employ the system GMM method developed by Arellano and Bover (1995) and Blundell and Bond (1998).

This method combines first-difference equations with level equations, instrumenting the variables using the first differences of lagged variables. The system of equations is then simultaneously estimated using the generalized method of moments. The efficacy of the GMM estimator relies on two assumptions: (1) the chosen instruments are valid, and (2) there is no autocorrelation in the error terms. We employ two specification tests to validate these conditions. Firstly, the Sargan/Hansen over-identification test assesses the validity of lagged variables used as instruments. Secondly, the second-order serial autocorrelation test proposed by Arellano and Bover (1995) examines the absence of autocorrelation in the difference equation. Since the first-difference error term exhibits first-order correlation, the autocorrelation test is conducted at the second order. In both tests, successful validation of the instruments is indicated by not rejecting the null hypothesis.

II.4. Empirical results

II.4.1. The estimated results for competition, cost efficiency, and stability

Table 4 presents the average values for market power, cost efficiency, and banking stability. In terms of the Lerner index, the outcomes from estimating the Translog cost function indicate an average value of approximately 0.32 between 1999 and 2020. These values suggest that the banking sectors in the MENA countries exhibit a market structure that is close to monopolistic competition. However, it is important to note that the Lerner index values did not significantly vary during the studied period, as the calculated standard deviation is close to 0.08. When compared to other countries, the banking sectors in the MENA region demonstrate a moderate level of market power. For instance, Brei et al. (2020) discovered a market power index of around 0.5 for African banks, while Phan et al. (2019) found a Lerner index of approximately 0.30 in their study on Asian banking sectors.

Table 4: Descriptive statistics of cost efficiency, market power, and banking stability over the period 1999-2020

	Mean	Minimum	Maximum	Standard Deviation	Coef. Of Variation
EFF	0.67	0.19	1.00	0.13	0.20
EFFNPL	0.79	0.21	1.00	0.10	0.12
EFFCORNPL	0.82	0.12	0.98	0.13	0.16
EFFPOLSNPL	0.77	0.07	0.97	0.14	0.18
EFQUARENPL	0.80	0.09	0.97	0.12	0.15
EFFZ	0.81	0.15	1.00	0.11	0.14
EFFCORZ	0.82	0.11	0.98	0.13	0.16
EFFPOLZ	0.82	0.19	1.00	0.12	0.14
EFFQUARZ	0.81	0.08	0.97	0.13	0.16
EFFPUB	0.71	0.25	1.00	0.11	0.16
EFFFORG	0.77	0.21	1.00	0.10	0.13
Z-SCORE	4.38	0.00	167.00	6.52	1.49
LERNER INDEX	0.27	-40.23	28.64	0.92	3.36

Author's calculation. EFF represents the stochastic frontier model which does not take into account specific and environmental variables. EFFNPL, EFFCORNPL, EFFPOLSNPL, EFQUAEENPL represent the cost efficiency scores obtained by integrating into the stochastic frontier the ratio of non-performing loans, control of corruption, political stability and quality of regulation respectively. EFFZ, EFFCORZ, EFFPOLZ, EFFQUARZ represent the cost efficiency scores obtained by integrating into the stochastic frontier the Z-score, the control of corruption, political stability and the quality of regulation respectively. Finally, EFFPUB and EFFFORG represent the cost efficiency scores obtained by integrating into the stochastic frontier the public and foreign ownership structure respectively.

The results presented in Table 4 include the efficiency scores obtained through a stochastic cost frontier approach. The analysis of cost efficiency scores reveals efficiency levels ranging from 77% to 82% for models that consider specific and environmental factors, and from 71% to 77% for models incorporating ownership structure (public banks and foreign banks) in the cost frontier. Furthermore, it is observed that the banks in the sample exhibit lower average levels of cost efficiency (around 68%) when the cost frontier is estimated without taking specific and environmental factors into account. Overall, the findings in Table 4 indicate that, on average, banks in the MENA region could achieve the same output levels by reducing their costs by nearly 30%. In comparison to efficiency scores observed in other countries, the cost efficiency of banking sectors in the MENA region closely aligns with those recorded in other banking sectors. For instance, Anh (2022) reports efficiency scores close to 80% for Asian countries, while Williams (2012) obtains cost efficiency scores around 78% for Latin American banks.

Regarding the banking stability indicator (Z-score), the obtained results indicate that the sampled banks recorded an average indicator of approximately 4.38 over the studied period. This score is lower than the figures obtained by Phan et al. (2019) for Asian banks (30.22) and by Baziki et al. (2023) for a sample of European banks (40.1). Lastly, it is worth noting that the Z-score indicator exhibits minimal variation between 1999 and 2020, ranging from 12.80 in 1999 to 13.14 in 2020.

II.4.2. The results of the estimation of the relationship between market power and banking efficiency

Table 5 shows the outcomes of the six estimations conducted using the GMM-system method, examining the relationship between market power and bank efficiency in the MENA countries. Model M1 presents the results of a specification that do not include the institutional control variables. Models M2, M3, and M4 incorporate institutional variables to control the relationship between market power and cost efficiency of banks in the MENA countries. Lastly, models M5 and M6 investigate the impact of ownership structure on the cost efficiency of banks operating in the MENA region.

The results indicate that, across all estimated models, the Hansen test supports the hypothesis of the validity of lagged variables, both in level and in differences, used as instruments to address potential issues of endogeneity bias and simultaneity between the dependent variable and certain explanatory variables. Additionally, the Arellano-Bond autocorrelation test

supports the hypothesis of the absence of second-order autocorrelation.

The results presented in Table 5 reveal a positive influence of the Lerner index on the cost efficiency of banks in MENA countries, providing support to Hypothesis H1, and contrary to the predictions of Hicks' Quiet Life hypothesis (1935). Our findings are consistent with those of Maudos and Fernandez de Guevara (2007), Phan et al. (2019), Kuessis et al. (2023), indicating a positive relationship between market power and efficiency, suggesting that banks with greater market power tend to exhibit higher levels of efficiency. The findings of Table 5 also demonstrate a positive association between the equity ratio and cost efficiency across all estimated specifications. Consequently, well-capitalised banks exhibit greater strength and operational efficiency compared to less capitalised ones. This relationship can be explained by the fact that increased equity ratios can mitigate moral hazard between shareholders and creditors, as well as reduce managerial incentives to engage in excessive risk-taking, ultimately leading to enhanced efficiency. Our findings consist with those of Fiordelisi et al. (2011) on European banks, Lešanovská and Weill (2016) on Czech banks, and Anh (2022) on Asian banks. These studies found a positive relationship between equity and a bank's level of efficiency. In line with our expectations, our results indicate a negative association between credit risk and cost efficiency. This relationship holds across all the estimated models, emphasising its robustness concerning the choice of control variables specific to the banking firm.

Therefore, when banks excessively engage in credit risk, this leads to the deterioration of their asset portfolios and the accumulation of non-performing loans. Consequently, banks experience increased losses on granted loans, heightened costs, and a subsequent decrease in efficiency. These findings support the "bad (good) management" and "bad (good) luck" hypotheses, respectively. Specifically, lower (higher) cost efficiency is associated with higher (lower) risk-taking, and increased (decreased) risk-taking diminishes (enhances) cost efficiency. This is in line with the findings of Berger and DeYoung (1997) and Fiordelisi et al. (2011), who also found evidence supporting these hypotheses in their respective samples of US and EU banks respectively.

Table 5: The regression estimates of the impact of market power on cost efficiency of MENA banks

	M1	M2	M3	M4	M5	M6
C	0.0785*	-0.3133*	-0.6224*	-0.5173*	0.5829*	0.1143*
CAR	1.8885*	1.8215*	2.6430*	2.5929*	1.3753*	1.8828*
ROA	-0.8947*	-0.3184*	-0.8904*	-0.7514*	-0.7813*	-0.7620*
LIQ	-0.3022	-0.2424*	-0.4133*	-0.3745*	-0.2346*	-0.2843*
NPL	-0.1147	-0.2798*	-0.2662*	-0.2249*	-0.1228**	-0.1479**
LERN	0.0352*	0.0506*	0.0541*	0.0531*	0.0273*	0.0353*
SIZE	0.0264	0.0212***	0.0394**	0.0214	0.0691*	0.0306
DIVER	-0.0158	0.3277	0.3033	0.1326	0.2830*	-0.2260
GDPC	1.3374**	1.4356*	2.4553*	1.9269*	0.8587*	1.2954*
INF	-0.3367*	-0.2126*	-0.1081	-0.3291*	-0.2627*	-0.3302*
COCR		0.5987*				
POS			0.2402*			
QREG				0.3061*		
PUBL					0.0538*	
FORG						0.0021
Sigma-squared	0.098	0.121	0.199	0.133	0.138	0.979

Gamma	0.260	0.487	0.756	0.552	0.576	0.258
Nbr of Banks	176	176	176	176	176	176
Nbr of Observations	3872	3872	3872	3872	3872	3872

Notes: (*), (**), (***) denote statistical significance at the 1%, 5% and 10% respectively.
C represents the constant of the regression equation.

The results presented in Table 5 demonstrate that the coefficients associated with bank profitability are consistently negative across all estimated specifications. In theory, good cost efficiency, which reflects effective production organization, should correspond to favourable profitability. However, our findings reveal an unexpected relationship between cost efficiency and bank profitability in MENA countries. This outcome can be explained in two ways. First, it is consistent with the X-inefficiency hypothesis (Leibenstein, 1966) derived from managerial theory. According to this hypothesis, cost inefficiency signifies organisational issues. A recent version of this hypothesis, inspired by contract theory, suggests that these problems are incentive related. Consequently, organisational problems explain why some banks, despite being well-positioned in their markets (exhibiting good profitability), struggle to address the challenges of restructuring inherent in the banking industry during periods of innovation and reorganisation. Furthermore, banks with substantial profits or market power may not be as motivated as others to make productivity efforts and control production costs. The second explanation draws from imperfect competition theory. Specifically, in cases where competition is intense, banks with favorable cost positions may choose, or be forced, to adopt a commercial policy (possibly "aggressive") that prevents them from increasing their profitability. Consequently, certain banks that make efforts to enhance productivity and better manage costs encounter difficulty in expanding their margins due to competitive conditions and lack of market power necessary for significant profit generation.

Our results indicate a positive relationship between size and cost efficiency, indicating that larger banks promote greater efficiency in the MENA region. This finding is consistent with the study conducted by Tan and Floros (2013) on Chinese banks, but contrasts with the results of Altunbas et al. (2007) on European banks. Therefore, the presence of a positive association between size and efficiency suggests that larger banks achieve cost efficiency advantages through economies of scale. This finding suggests that banks operating in the

MENA region could enhance their cost efficiency by pursuing strategies such as mergers and acquisitions to increase their size.

Regarding the impact of diversification on cost efficiency, the results presented in Table 5 reveal a mixed and insignificant relationship between diversification and the cost efficiency of banks in MENA countries across the estimated models. The literature on the impact of diversification on efficiency often yields conflicting results. Vander-Vennet (2002) finds that financial conglomerates in Europe exhibit greater cost efficiency than specialised banks, with only weak effects of diversification on profit efficiency. Deng et al. (2007) find that diversified bank holding companies have lower costs of debt, consistent with the findings of Lozano-Vivas and Pasiouras (2010), who observe increased cost efficiency with non-traditional activities. On the contrary, several other studies present contradictory evidence against the efficiency-enhancing impact of diversification. Ferrier et al. (1990) find that banks with diversified product lines demonstrate higher cost inefficiency, supporting the hypothesis of diversification diseconomies. Berger et al. (2010) observe higher operating costs in more diversified banks in China, while Rossi et al. (2009) discover a negative impact of diversification on cost efficiency but a positive influence on profit efficiency.

In terms of macroeconomic variables, our empirical results indicate that economic growth and inflation are significant determinants of bank efficiency in MENA countries. We observe a positive (negative) and significant relationship between economic growth (inflation) and the cost efficiency of banks in the region. This significant relationship between the economic environment and efficiency confirms the findings of several previous studies (Tan and Floros, 2013; Wu et al., 2020; Saeed et al., 2020). This result can be attributed to the fact that an improved macroeconomic environment, characterized by high economic growth and effective inflation control, encourages bank managers to allocate resources to the most profitable investment projects. As a result, they can minimize operating costs while enhancing performance and efficiency.

Our results highlight that the quality of the institutional environment affects cost efficiency. The findings in Table 5 indicate a positive relationship between the quality of the institutional environment and the cost efficiency of banks in the MENA region. Prior research has shown that countries with deteriorated institutional quality, corruption, regulatory degradation, and political instability, especially in the financial and banking sectors, prioritise the financing of riskier projects rather than the most profitable ones. This decline in institutional quality can lead to a deterioration in bank portfolio quality, accumulation of non-performing loans, and

increased costs. Therefore, political stability, rule of law, rights protection, and effective corruption control are crucial factors that enhance investors' anticipation of the future, thus favouring bank financing, reducing risk and costs borne by banks, and ultimately increasing efficiency (Bermpei et al., 2018; Wu et al., 2020).

Finally, our results clearly demonstrate that the ownership structure (public, foreign) significantly influences bank efficiency. Two key findings emerge from our econometric analysis. Firstly, the relationship between foreign ownership and cost efficiency is positive but not statistically significant. Secondly, the results indicate a positive and significant relationship between public ownership and cost efficiency. These findings can be explained by the fact that the advantages of managerial practices possessed by foreign banks, which lower their operational costs, are offset by the beneficial effects of state banks in terms of loan production, low cost of production factors (such as physical assets), and cost-effective monitoring. The positive relationship between public ownership and efficiency aligns with the findings of Berger et al. (2009) based on Chinese data. It does not imply that state banks excel in managing costs, but rather suggests their competence lies in managing revenues (Berger and DeYoung, 1997). This is due to the limited resources allocated by state banks to loan monitoring and borrower selection, which helps reduce costs in the short term but leads to lower interest income on long-term loans.

II.4.3. Results of the estimation of the relationship between market power, efficiency and banking stability

This section aims to examine the association between market power, efficiency, and banking stability in the MENA region. Table 6 presents the impact of market power and various explanatory factors, both specific and environmental, on banking stability. Model (M7) presents an econometric specification that incorporates specific and macroeconomic control variables. The regressions reported in models (M8), (M9), and (M10) control the relationship between market power, efficiency, and banking stability by considering the macroeconomic and institutional environment, as well as bank-specific variables. Lastly, models (M11) and (M12) provide the estimation results that consider the bank-specific variables, macroeconomic environment, and ownership structure (public or foreign).

Table 6: The regression estimates of the impact of market power on banking stability of MENA banks

	M7	M8	M9	M10	M11	M12
C	-2.1393 *	-2.4977 *	-2.4617 *	-1.6542 *	-2.2368 *	-2.0923 *
LNZ (-1)	0.6064 *	0.3790 *	0.4251 *	0.5407 *	0.5841	0.6201 *
CAR	1.0611 *	1.9457 **	1.9546 *	0.9136 **	1.1836 *	1.0057 **
ROA	6.3456 *	2.1445	4.0139 *	7.1502 *	6.1557	6.2040 *
LIQ	0.8723 *	1.3345 *	1.1650 *	-0.8797	0.9058 *	0.8329 *
EFF	1.8520 *	2.1973 *	1.7771 *	1.7878 *	1.9618 *	1.7899 *
LERNER	-0.1870	-0.2947 **	-0.3157 *	-0.1303	-0.2397 **	-0.2951 *
SIZE	0.1068 *	0.1515 *	0.1621 *	0.0838 *	0.1101 *	0.1054 *
GDPC	0.1761	0.9923 *	0.8979 *	0.8221 *	0.2297	0.1630
INF	0.2339 *	0.2386 **	0.2680 **	-0.0005	0.2395 *	0.2267 *
COCR		0.7203 *				
POLS			0.3844 *			
REQU				0.4717 *		
PUBL					0.0585 *	
FORG						-0.0109
AR(1)	0.034	0.055	0.0542	0.0531	0.0361	0.0372
AR(2)	0.1322	0.1412	0.1514	0.1859	0.1376	0.13
Prob(J-statistic)	0.1322	0.3174	0.5751	0.7484	0.3920	0.4260
N° of Banks	176	176	176	176	176	176
N° of Observations	3696	3696	3696	3696	3696	3696

Notes: (*),(**),(***) denote statistical significance at the 1%, 5% and 10% respectively.

From the results in Table 6, it is evident that the coefficients for the one-period lag of the Z-score consistently show positive and significant values across all models. This indicates that previous periods' bank stability has a positive impact on the current bank stability. Examining the results presented in Table 6, it is obvious that the Lerner index has a negative effect on bank stability, rejecting Hypothesis H2, and contradicts the theory of franchise value. According to this theory, banks with market power should limit their risk-taking. The observed negative relationship between market power and stability suggests that banks with greater market power tend to have higher levels of risk. It is worth noting that our findings are consistent with previous literature, e.g. Boyd and De Nicolo (2005), De Nicolo et al. (2006), Schaeck et al. (2009), Fiordelisi and Mare (2014), and Clark et al. (2018). Furthermore, additional observations can be drawn from the regressions reported in Table 6. An important finding pertains to the equity ratio, as all estimated specifications show that capital regulation significantly reduces risk. In other words, the positive relationship observed

between the capital ratio and banking stability suggests that stricter prudential regulations increase the stability of banks in MENA countries. This result is in line with the moral hazard hypothesis and previous studies by Coval and Thakor (2005), Allen et al. (2011), Jiang et al. (2020), Lee and Hsieh (2013), and Mehran and Thakor (2011), while contradicting the findings of Mateev et al. (2022) in the MENA region.

Additionally, we observe that the size of the bank positively affects banking stability, and larger banks tend to be less risky. These findings support Boyd and Prescott's (1986) arguments, which suggest that larger banks are more resilient due to their ability to achieve economies of scale and scope, higher market share and power, and advantages in risk diversification. These factors enable larger banks to generate higher profits compared to smaller banks, as noted by Bordo et al. (2016) and Bermpei et al. (2018). Regarding bank regulation and supervision, the coefficients of the capital ratio are positive and significant in all estimates, indicating that stronger capital regulations effectively promote bank stability. This is consistent with the arguments of Beck et al. (2013) and Bermpei et al. (2018) who suggest that capital regulations encourage banks to hold more capital buffers to withstand economic shocks.

The findings presented in Table 6 demonstrate that cost efficiency has a positive effect on the stability of banks in the MENA region. Efficient utilization of production factors, accompanied by reduced operating expenses, leads to a decrease in bank insolvency and an increase in banking stability. These results are consistent with previous studies, e.g. Assaf et al. (2019), Chen et al. (2017), and Fiordelisi et al. (2011) who highlight a similar relationship. The findings suggest that inefficiency resulting from poor management may lead to excessive risk-taking by managers, supporting the good management hypothesis. Furthermore, the analysis reveals that profitability, as measured by ROA, is positively and significantly associated with banking stability. This is an expected conclusion since higher profits are likely to be associated with lower risk. This finding is consistent with Louzis et al. (2012) who provide evidence that higher profitability corresponds to a lower probability of financial distress and, therefore, less fragility for banks. Moreover, the results in Table 6 indicate a positive and significant correlation between liquidity and Z-score, indicating that higher liquidity results in greater stability for banks. The literature suggests that liquidity levels may impact bank return volatility depending on the state of the economy. During a recession, banks tend to hold excessive liquidity, while during an expansion, banks invest more to

maximise profits. These findings are consistent with Tabak et al. (2012) who found that Latin American emerging economies experienced increased business activity, leading banks to engage in more transactions rather than holding excessive liquidity.

In addition to bank-specific variables, the analysis highlights the impact of economic growth and inflation on stabilising the banking sector. The positive and significant effect of GDP growth (GDPC) on bank stability is observed in most models. A growing economy generates higher and more stable returns, contributing to enhanced bank stability. Furthermore, the results indicate a positive relationship between inflation and banking stability. Inflation, aside from reflecting certain medium-term imbalances, primarily represents a positive pressure on demand, which benefits banks.

Overall, the analysis reveals a positive and significant effect of political stability (POLS) on bank stability. This finding is consistent with Ghosh (2016), who shows that recent political turmoil in the Middle East, resulting from the "Arab Spring," had a detrimental effect on bank stability. Political instability can increase informational asymmetries due to uncertainty, exacerbating adverse selection problems that negatively impact the stability of the banking system. Additionally, a positive and significant relationship is observed between regulatory quality and banking stability. Poorer regulations lead to increased risk-taking, supporting the findings of Kaufmann et al. (2010) and Ashraf (2017). Furthermore, the results reveal a positive relationship between corruption control and bank stability. This finding suggests that effective control of corruption plays a crucial role in determining banking stability. This finding aligns with a research by Chen et al. (2015), which indicates that banks in corrupt economies tend to be more risk-taking and have higher non-performing loans (NPLs). Additionally, in a country setting framework, Lízal and Kocenda (2001) found that corruption in the Czech Republic led to an increase in bad loans and contributed to bank failures.

Another significant variable in the analysis of banking stability in the MENA region is ownership structure. The results indicate that public ownership has a positive effect on banking stability. Conversely, the findings reveal a negative but not significant relationship between foreign ownership and banking stability. This result is somewhat surprising as it is not consistent with the findings of Tacneng (2015), which suggest that banks with majority foreign ownership tend to maintain a prudent credit policy and exert greater control over loans. The reasons include foreign banks potentially having a comparative advantage in data collection, evaluation, and quantitative analysis, as well as being less susceptible to political pressure. On the other hand, according to the political hypothesis, public banks can be inefficient due to resource transfers made by politicians in favour of their supporters.

Moreover, Banerjee (1997) suggests that managers of public banks exert less effort compared to those of private banks. However, Hossain et al. (2013) demonstrate that Asia-Pacific banks with significant public ownership experienced fewer losses during the financial crisis and performed better in normal times. According to their research, the state, as a shareholder of a bank, would enforce prudence and encourage investment in less risky projects at lower interest rates.

II.5. Robustness tests

To ensure the reliability of our findings, we conducted several robustness tests. Firstly, we incorporated the Ln(Z-score) variable into various stochastic cost frontier models. The results consistently demonstrated a positive and significant effect of banking stability on the cost efficiency of banks in the MENA countries across all considered specifications, as shown in Table 7.

Table 7: The regression estimates of the impact of market power and banking stability on cost efficiency of MENA banks

	R1	R2	R3	R4
C	-0.075	-0.140	0.060	-0.328
CAR	1.894 *	1.550 *	1.821 *	2.085 *
ROA	-2.104 *	-1.288 ***	-1.526 **	-2.091 *
LIQ	-0.245 *	-0.208 *	-0.244 *	-0.285 *
LNZ	0.069 *	0.039 *	0.048 *	0.087 *
LERN	0.040 *	0.050 *	0.038 *	0.053 *
SIZE	-0.017	0.005	0.020	0.010
DIVER	0.522	0.502	0.730	0.749
GDPC	1.407 *	1.261 *	1.409 *	1.687 *
INF	-0.348 *	-0.226	-0.254 *	-0.357 *
COCR		0.460 *		
POS			0.109 *	
QREG				0.271 *
N° of Banks	176	176	176	176
N° of Observations	3872	3872	3872	3872

Notes: (*), (**), (***) denote statistical significance at the 1%, 5% and 10% respectively.

Second, as part of our robustness analysis, we chose to substitute the Lerner index, which measures market power, with the H-statistic developed by Panzar and Rosse (1987). Unlike the Lerner index, the value of the H-statistic nearing unity (or zero) indicates a state of pure and perfect competition (or monopoly) in the market. The results from different estimations consistently show that the H-statistic of Panzar and Rosse (1987) has a negative impact on the efficiency of banks operating in the MENA region, as presented in Table 8.

Table 8: The regression estimates of the impact of market power (H-statistic) on banking efficiency in MENA region

	R5	R6	R7	R8
C	-1.757 *	-1.136 *	-1.607 *	-1.393 *
CAR	3.827 *	2.897 *	3.498 *	3.490 *
ROA	-2.289 *	-0.523	-1.676 *	-1.092 **
LIQ	-0.544 *	-0.366 *	-0.521 *	-0.480 *
NPL	-0.048	-0.240 *	-0.101	-0.065
PANZ	-1.277 *	-0.917 *	-1.182 *	-1.098 *
SIZE	0.150 *	0.112 *	0.151 *	0.123 *
DIVER	0.724	0.350	0.718	0.722
GDPC	2.678 *	2.017 *	3.054 *	2.521 *
INF	-0.586 *	-0.239 *	-0.133	-0.401 *
COCR		0.713 *		
POS			0.308 *	
QREG				0.465 *
N° of Banks	176	176	176	176
N° of Observations	3872	3872	3872	3872

Notes: (*), (**), (***) denote statistical significance at the 1%, 5% and 10% respectively.

Lastly, we conducted an additional test by substituting the bank stability variable with the non-performing loan ratio (NPL) to examine the influence of market power and efficiency on bank risk, as presented in Table 9. The outcomes of various specifications align with our previous findings. Specifically, the estimations indicate a positive correlation between the

Lerner index and the NPL ratio, thereby validating either the concentration-fragility thesis or the competition-stability thesis. Furthermore, we observed a negative association between the equity ratio, size, and risk.

Table 9: The regression estimates of the impact of market power and bank efficiency on bank credit risk

	R9	R10	R11	R12	R13
C	0.0238 *	0.0257 *	0.0259 *	0.0260 *	0.0256 *
NPL (-1)	0.8310 *	0.8376 *	0.8272 *	0.8230 *	0.8251 *
CAR	-0.0025	-0.0027	-0.0024	-0.0035	-0.0026
ROA	-0.1820 *	-0.1814 *	-0.1839 *	-0.1709 *	-0.1810 *
LIQ	-0.0026	-0.0025	-0.0024	-0.0028	-0.0026
EFF	-0.0115 *	-0.0118 *	-0.0123 *	-0.0127 *	-0.0127 *
LERN	0.0248 *	0.0226 *	0.0229 *	0.0236 *	0.0203 **
SIZE	-0.0006 ***	-0.0007 *	-0.0006 **	-0.0006 **	-0.0033 *
GDPC	-0.0486 *	-0.0477 *	-0.0468 *	-0.0474 *	-0.0468 *
INF	0.0078 *	0.0073 *	0.0075 *	0.0072 *	0.0077 *
COCR	-0.005 *				
POLS		-0.001 *			
REQU			0.003 *		
PUBL				-0.0018 *	
FORG					-0.004 *
AR(1)	0.0578	0.0467	0.0461	0.0512	0.0515
AR(2)	0.5036	0.7317	0.5293	0.4552	0.4463
Prob(J-statistic)	0.8319	0.8305	0.9006	0.8751	0.7125
N° of Banks	176	176	176	176	176
N° of Observations	3696	3696	3696	3696	3696

Notes: (*), (**), (***) denote statistical significance at the 1%, 5% and 10% respectively.

II.6. Conclusion

The purpose of this study was to examine two aspects: first, the association between efficiency and market power; and secondly, the relationship between competition, efficiency, and stability of the commercial banks operating in the MENA region. Additionally, we assessed the impact of specific variables related to the environment and ownership structure on bank efficiency and stability. Using the GMM-system technique, our study yielded three

key findings. Firstly, we demonstrated that market power has a positive impact on the cost efficiency of commercial banks in MENA countries. Consequently, the Quiet Life Hypothesis does not hold true for banks operating in this region. Secondly, our results, revealed a negative association between market power and banking stability. This outcome supports the notion that competition has a stabilizing effects and indicates that increased market power prompts banks to raise interest rates, thereby encouraging borrowers to take on more risks through the moral hazard effect. Thirdly, our findings demonstrate that bank-specific variables, economic and institutional environment, and ownership structure play crucial roles in explaining bank efficiency and stability. Specifically, our study emphasises the significance of capitalisation, profitability, and size in enhancing bank efficiency and stability. Furthermore, our results highlighted the importance of macroeconomic factors (economic growth and inflation) and institutional variables (control of corruption, political stability, and the quality of regulation) in determining bank efficiency and stability. Lastly, we revealed that the ownership structure (public shareholding and foreign shareholding) significantly impacts the cost efficiency and stability of banks operating in the MENA region.

The study's outcomes have notable policy implications for designing and implementing banking regulations that foster the right incentives to maintain stability, while considering the relationship between competition and stability. A better understanding of the association between competition and stability is crucial not only for banks, bank regulators, and policymakers in MENA countries, but also for other developing nations. Competition in the banking sector has implications for risk levels and banking stability. While a concentrated banking system can offer advantages to banks, such as diversification (especially geographically), cost reduction, and increased productivity, it also embeds the risk of reduced competition, leading to riskier asset portfolios and decreased performance. Therefore, a significant consolidation process in the banking industry can expose banks to risk, potentially weakening their financial position and increasing the probability of default. Encouraging measures that strengthen the implementation of international capital standards is necessary to promote bank efficiency and prevent recreation of major banking risks in the MENA region. Additionally, banks can enhance risk diversification without incurring higher risk of insolvency.

Banking regulators and policymakers have the authority to shape the level of banking competition in order to achieve the desired levels of stability. In this regard, regulators must ensure that banks adhere to capital requirements. Our findings highlighted the positive role of

equity in enhancing cost efficiency and banking stability. Therefore, capital requirements can contribute to financial stability by directly increasing the capital buffer against losses and by improving banks' efficiency through reducing moral hazard problems between shareholders and creditors. Furthermore, regulators must be aware of consolidation activities in the banking sector to prevent excessive risk-taking by banks and the subsequent increase in banking instability. When banking systems become concentrated in few groups, they can become excessively large, complex, and interconnected, leading to failures and long-term damage to the financial system and the real economy. This is commonly referred to as the problem of "too big to fail" institutions. For a bank, knowing that it will be rescued by the government creates an implicit subsidy and a kind of public insurance, reducing its cost of financing and creating moral hazard and competitive advantage. In the absence of appropriate resolution and safeguard mechanisms, a government may be compelled to intervene and use public funds for direct bailouts to prevent adverse effects on the broader financial system and the real economy. Lastly, regulators should be able to identify systemic risk sources and develop regulatory tools capable of addressing various types of risks. Indeed, internal governance failures have been identified as a significant source of instability in the banking sectors of many MENA countries.

Finally, there is potential to extend this study by considering legal variables for exploration. Specifically, analysing the relationship between prudential regulation, banking stability, and governance presents a promising avenue for further research.

**CHAPTER III: THE IMPACT OF CORPORATE GOVERNANCE FRAMEWORK
ON BANK RISK: EVIDENCE FROM MENA BANKS**

The international financial crisis has highlighted the repercussions of weak corporate governance structures and practices on bank performance and stability. In particular, the board of directors' composition and structure has been identified as a major pillar of the adopted corporate governance framework. Consequently, academic literature has focused on studying the association between bank board composition and bank risk profile. Previous studies tried to detect the impact of board of directors' structure on bank stability, in order to suggest an optimal structure that mitigates risk taking and boosts bank stability. Nonetheless, the results obtained by those studies are contradictory. This chapter aims to participate in the continuous debate on the impact of board characteristics on banks stability and risk, by studying a sample of 150 banks operating in the MENA region over the period 2009-2020. By adopting a system GMM method, the empirical results reveal that larger boards, with higher gender diversification, and containing a risk committee, result in higher stability and lower credit risk. In contrast, the combination of chairperson and CEO roles may result in power concentration, potentially leading to excessive risk taking.

III.1. Introduction

The 2007-2009 international financial crisis highlighted the need for strengthening corporate governance mechanisms of banks and financial institutions (Addo et al., 2021), and the weaknesses in the risk governance structures and the excessive risk-taking practices by banks have been recognised as key factors behind the crisis (Erkens et al., 2012; Battaglia and Gallo, 2015). Sound governance mechanisms are able to change the willingness of managers to take excessive risk (John et al., 2008), but in financial institutions in particular, stronger corporate governance frameworks could result in more risk-taking (Erkens et al., 2012).

BCBS (2010) states that the international financial crisis is attributed to the weaknesses of the corporate governance mechanisms of financial institutions and changes in corporate governance codes or guidelines over time had a substantial impact on corporate governance practices. This has led the international regulatory bodies to issue new principles for enhancing bank corporate governance practices within at the global level (BCBS, 2015).

During the last few decades, the Basel Committee on Banking Supervision advocated the prominence of "market discipline" aside from strengthening bank prudential regulation and

supervision, in order to tackle bank risk-taking. Specifically, market discipline in deposit markets can be considered as the ability of bank depositors and investors to “penalise” bank risk-taking conduct (Martinez-Peria and Schmukler, 2001). This bank market discipline occurs when growth of deposits drops as a result of an increase in bank riskiness (Martinez-Peria and Schmukler, 2001; Hasan et al., 2013; Soedarmono and Tarazi, 2016), or when the cost of deposits (i.e. required interest) increases in response to higher riskiness (Hadad et al., 2011). Risk governance is a subdivision of corporate governance practices and actions, which ensures effective management of risks. Following the global financial crisis, policymakers and bank regulators have stressed improving risk governance and risk management in banks and enhancing the governance of risk management systems (Lundqvist, 2015). The weak operational performance of many banks has been associated with weak governance practices, mainly the failure of boards of directors to work in the best interests of stakeholders (Aebi et al. 2012; Beltratti and Stulz 2012). Consequently, the failure of many banks during the crisis led to focus on the necessity for banks to strengthen their internal governance frameworks.

Risk management and bank governance depend on the corporate culture, which is based on the vision of management responsible behaviour and risk awareness. The efficiency of governance plays here an essential role, because the main causes of the financial crisis were due to high-risk exposure and poor risk management (Diamond and Rajan, 2009; Shin, 2010; Van den End and Tabbae, 2012; Minton et al., 2014; Berger and Bouwman, 2017). Indeed, weak corporate governance practices increase bank risks by affecting the quality of assets and might be associated with lack of transparency, and the failure of many banks post-crisis have boosted the debate over the conditions of their governance frameworks and their impact on risk-taking activities (Kirkpatrick, 2009; Mülberr, 2010; Adams and Mehran, 2012).

Corporate governance in banks has specific challenges, which include high level of regulation, high leveraged capital structure, opacity, complexity, information asymmetries, and adverse selection (Caprio and Levine, 2002; Demirgüç-Kunt and Detragiache, 2002; Levine, 2004; Laeven, 2013). Bank balance sheets are indeed opaque and consequently, bank managers have an ability to take on risk very quickly that is not immediately observable to supervisors or investors (Becht et al., 2011; Morgan, 2002), with considerable implications for corporate governance of financial institutions, as well as for their ownership, control and supervision (Caprio et al., 2007; Haan and Vlahu, 2016). Furthermore, the implicit and

explicit government guarantees, and the too-big-to-fail doctrine may encourage banks to take excessive risks (Acharya et al. 2016; Abdelbadie and Salama, 2019). Consequently, banks not only increase their specific risk, but also generate negative externalities for the entire financial system through boosting systemic risk and undercapitalising the entire system (De Haan and Vlahu, 2016; Brownlees and Engle, 2017). One additional point in this regard is represented by the fact that the international financial crisis has highlighted the procyclicality of the banking systems, where problems in the corporate governance frameworks of banks have been recognised as major determinants of that problem.

A large body of research has been conducted to examine the effectiveness of banks' corporate governance and its relationship with bank risk-taking and risk level. In fact, a large number of theoretical and empirical studies have tried to find out how sound (poor) corporate governance frameworks and practices can lead to good (poor) performance of banks and low (high) levels of risk-taking. Nonetheless, although those studies covered different markets, periods, and legal frameworks, there still lack of a consensus on the "real" association between corporate governance and bank risk profiles in particular. Consequently, this study aims at participating in this continuous debate by aiming to detect the possible impact of the adopted governance structures in the MENA banking sectors. In particular, the study exploits a sample of 150 banks operating in the MENA region between 2009 and 2020, and tests how their board of directors' structure impact their level of risk. By adopting a dynamic GMM system, the study finds that larger size of the board of directors results in higher bank stability and lower credit risk. A similar result was obtained for the proportion of female board member, where more women on the board results in higher stability and lower credit risk. In contrast, combining the roles of the chairperson and the CEO results in conflict of interest, resulting in lower stability and higher credit risk. As for the existence of a board-level risk committee, it was found that MENA banks that have such committee do enjoy superior stability, but not necessarily lower credit risk.

This chapter is structured as follows. The following section sheds light on the relevant literature and the theoretical aspects of corporate governance. Section 3 highlights the exploited variables and the adopted empirical methodology. The dataset is detailed in Section 4. The empirical results and the interpretation of these results are included in Section 5. A robustness tests are presented in Section 6. Finally, the conclusions and the policy implications of the chapter are presented in Section 7.

III.2. Literature review and hypotheses development

III.2.1. Risk governance and bank risk-taking

The association between governance structures and risk management has received considerable attention from policy makers and researchers (Berger et al., 2014; Koirala et al., 2020) and prior studies have stressed the significance of risk management, risk governance and risk identification in financial institutions (Stulz, 2008; Ellul and Yerramilli, 2013). Corporate governance emerged in academic literature in order to control for agency problems, which might result from a separation between ownership and management. It is assumed that a lack of sound rules in applying governance mechanisms gives bank managers considerable opportunity to engage in illegal practices at the expense of stakeholders. It is agreed that governance mechanisms in banks are designed to achieve the following two objectives: improve the financial stability of banks during crises, via different risk and financing policies, and ensure that banks maintain central banks' minimum capital requirement to reduce risks and maintain stability (Peni and Vähämaa 2012). Thus, banks with effective governance structures are expected to have management bodies that can reduce the occurrence of risky financial decisions, which ultimately lead to an acceptable level of financial stability (Karamanou and Vafeas 2005).

The literature has emphasised the important functions of risk governance and the necessity for risk identification, in addition to avoiding excessive risk-taking in financial institutions, because these risks cannot be managed totally by external market discipline or supervisory rules. Nonetheless, the empirical evidence on the association between strong governance mechanisms and banks' financial stability is mixed.

For instance, Jiang et al. (2012) show that banks that adopt corporate governance principles are more competitive in the long run because they apply reasonable level of transparency within their financial operations as well as their accounting and auditing procedures, which gives them greater financial stability. Ellul and Yerramilli (2013) argue that banks with higher risk management indices have had lesser risk exposures during the international financial crisis, and those with stronger risk-management functions had lower credit risk (nonperforming loans). Laeven and Levine (2009) add that when internal governance mechanisms are applied, conflict risks between bank managers and shareholders has many different effects on bank financial stability, depending on the relative power of its shareholders in the management structure. Schlich and Prybylski (2009) state that since the international financial crisis, banks have modified their risk governance structures to better manage their risks. As a result of the crisis, bank regulators have focused on strengthening the

oversight role of the risk management function in order to discourage bank management from engaging in excessive risk-taking (Sun and Liu, 2014). Finally, Anginer et al. (2016) reveal that banks with well implemented internal governance mechanisms are associated with higher financial instability, resulting from limiting the personal privileges of board of directors' members at the expense of banks' shareholders. In contrast, Dong et al. (2017) validate that a defective implementation of corporate governance in banks has many repercussions, such as creating higher volatility and lower assets quality.

In the following we shed light on the literature on the association between the composition of bank board of directors and its risk taking. Regarding banks composition, we consider the following four variables: board size, board gender diversity, the role duality of the chairperson and CEO, and the existence of board-level risk committee.

III.2.2. Board of directors' composition

III.2.2.1. Board Size

The role of the board of directors is indeed an important corporate governance tool that impacts bank performance and riskiness. Accordingly, policymakers and bank regulators have been working on updating governance principles in the banking systems since the eruption of the 2007-09 international financial crisis, which raised serious concerns about the effectiveness of bank board mechanisms in internal monitoring (BCBS, 2015). The primary reason for such concerns has been the bad practices of boards in many financial institutions, which led to significant repercussions on their profitability and stability post- crisis (Fernandes et al., 2018).

Banks present unique challenges that make their corporate governance distinct from other non-financial firms (such as being subject to high levels of regulation, highly leveraged, complex, has high information asymmetries adverse selection problems, etc.), all of which may prevent bank boards from meeting their responsibilities in adequately monitoring the management functions, while at the same time maximising shareholders' and other stakeholders' interests, which increases agency problems (Adams and Mehran, 2003; Macey and O'Hara, 2003; Levine, 2004; John et al., 2016). An efficient board emphasises the alignment of management interests with those of the owners (Denis and McConnell, 2003; Coles et al., 2008).

The role of the board as a major governance mechanism is predominantly important in the banking sector. Adams and Mehran (2012) argue that banks with more effective supervisory boards are better at applying governance mechanisms, which improve their performance,

maintains financial stability and creates higher shareholder value. In line with this argument, international bank regulators stress the importance of strengthening the role of boards of directors, with special emphasis on their risk management responsibilities (BCBS 2006, 2010, 2015).

The board of directors plays the role of a defense against managerial inefficiency, based on its advisory and monitoring roles (Hermalin and Weisbach, 2003). In this regard, Jensen (1993) argues that the effectiveness with which the board roles are undertaken depends partly on its size (Jensen, 1993). Consistent with this view, the agency theory stresses that a bank board is more effective when it has relatively small number of directors (Fama, 1980; Fama and Jensen, 1983). An alternative view is the resource dependence theory, which suggests that larger boards have more resources, are more knowledgeable, and have more highly skilled directors (Pfeffer and Salancik, 1978). These theoretical rationales provide opposing insights regarding the effectiveness of board governance.

In fact, larger boards can indeed provide a wider pool of expertise, which allows executing the board's advisory and supervisory roles. Nonetheless, larger boards may result in lack of coordination and control, free-riding problem, and lower flexibility in the decision-making process (Fernández et al., 1997; Eisenberg et al., 1998; Adams and Mehran, 2012). With the growing complexity and opacity of banking operations, effective coordination, timeliness of decision making, and efficient control are very important for effective control and alignment of managers and shareholder interests (Fosu et al. 2017). Several previous studies showed that during the international financial crisis, banks with bigger boards have been riskier (Pathan, 2009; Peni and Vähämaa, 2012; Wang and Hsu, 2013; Battaglia et al., 2014). Anginer et al. (2016) add that large boards may be less effective in supporting shareholders' interests, due to the free riding problem by board members. Finally, Hermalin and Weisbach (2003), Karamanou and Vafeas (2005) and Pathan and Faf (2013) reveal a negative association between board size and of board oversight effectiveness.

In contrast, other studies that examined the association between board size and bank riskiness pre-crisis, found a negative relationship between board size and risk-taking (Akhigbe and Martin, 2008; Faleye and Krishnan, 2017). Additionally, Switzer and Wang (2013), show that larger boards are associated with significantly lower credit risk. Klein (2002) and De Andrés and Vallelado (2008) report that larger boards are better than smaller ones in improving the effectiveness of control and monitoring roles with better assessment of risk. Berger et al.

(2016) and Sarkar and Sarkar (2018) also reported a positive relationship between board size of and bank financial healthiness.

Even though the above studies show a clear divergence in the opinion on the association between board size and bank risk-taking and stability, we will try to test the impact of board of directors' size on bank stability and risk-taking in the MENA countries. Consequently, we propose the following hypothesis:

Hypothesis 1 (H1): larger board size is positively (negatively) associated with MENA bank stability (risk).

III.2.2.2. Chairman-CEO role duality

From theoretical perspective, combining the roles of the chairperson and CEO in the same person (known as CEO-chairman role duality) enables using such authority by the executives to serve their own interests. Thus, CEO duality is supposed to result in poorer performance by banks with negatively impact on their financial stability (Dey et al. 2011; Dong et al. 2017).

Past literature on the consequences of combining or separating the CEO and Chairman roles underlines how the personal-level incentives of individuals in these roles differ. Šilingienė et al. (2015) summarise the relevant literature and report that firm performance is a major factor in determining CEO remuneration, suggesting that CEOs may prioritise return over risk management in their decisions. Lu and Boateng (2017) argue that role duality increases credit risk exposure of UK banks. Duru et al. (2016) reveal that role duality poses adverse effects on firm's profitability. In contrast, Pathan (2009) examines the effects of combining the CEO and Chairman roles and finds that duality has a negative influence on banking risks. Akbar et al. (2017) also reported that duality lowers risk-taking in the UK financial services industry, because more concentrated power results in decreasing risk-taking incentives by the CEO due to reputational and employment considerations. On the other hand, Carty and Weiss (2012) find no significant association between bank financial stability and duality.

Despite the divergence in findings regarding the impact of Chairman-CEO duality, we propose the following hypothesis:

Hypothesis 2 (H2): CEO duality is negatively (positively) associated with MENA bank stability (risk).

III.2.2.3. Board gender diversity

The “Glass Ceiling” phenomenon, which is an obstructive force against the inclusion of women on board of directors, has been considered as a main reason behind the underrepresentation of women as executives and directors (Eagly and Carli, 2003). Different perspective of this phenomenon provides theoretical explanation why female directors have been considered as influential on the organisational outcomes in existing literature (Adams and Ferreira, 2009). Consequently, women are forced to prove exceptional capabilities in order to reach directorship positions. Moreover, they are likely to be highly diligent, proficient and even better monitors of top managers than their male counterparts (Dunn, 2012).

Previous studies examined the impact of board gender diversity on banking performance and risk, where some provided evidence that differences in gender can indeed influence bank risk-taking (e.g. Berger et al., 2014). In particular, Farag and Mallin (2017) show that higher proportion of female board member boosts bank’s stability during a financial crisis, and female directors tend to be more risk-averse. In a similar vein, De Cabo et al. (2012) hypothesise that women are more conservative and more risk-averse than men and their presence on the board of directors is associated with lower risk-taking.

Moreover, it has been argued that the presence of women on the board of directors may enhance oversight and supervisory roles, including monitoring the CEO and other top executives, approving the firm’s strategy and observing the control system. Thus, higher proportion of female board members could lead to reduction in agency costs resulting from the separation between ownership and management. Empirically, Adams and Ferreira (2009) study the association between governance and performance of a sample of US firms and reveal that higher gender diversity results in allocation of more efforts to monitoring. De Cabo et al. (2012) also find that bank risk is likely to decrease in with higher proportion of female executives.

In contrast, Adams and Funk (2012) demonstrate that female directors are inclined to take on risks more than their male counterparts. Berger et al. (2014) also reveal that a higher proportion of female board members increases two measures of portfolio risk, which has been attributed to lower job experience of female executives.

Following the belief that the existence of higher proportion of female directors improves the monitoring and controlling role of the board, we propose the following hypothesis:

Hypothesis 3 (H3): a higher proportion of female board members is positively (negatively) associated with MENA bank stability (risk).

III.2.2.4. The existence of a board risk committee

The necessity of board of directors' committees emerged from the need to adopt the best practices in corporate governance and risk committees have been established to better analyse the risky area and ensure bank stability. To solidify the safety measures and determine risk limits, the bank management must have a proper risk culture, which is adjustable to changes during stress situations (Sheedy and Griffin, 2018). The board risk committee's responsibilities include: advising the board on the overall risk tolerance, risk appetite, and risk policies. Moreover, the risk committee also monitors the senior management's implementation of risk strategies set by the board. Because banks are subjected to various types of risks and due to their higher exposure to different risks, the existence of a separate risk committee has become more common in the banking sector (Andres and Vallelado, 2008) and boards can use a risk committee as an effective risk governance mechanism to oversee risk-taking activities. This risk committee is supposed to discuss the business unit's performance, their compliance with the set risk appetite, and risk restrictions set by the board of directors with senior management through regular meetings, and is also responsible for providing the board with recommendations related to the optimal risk strategies and overseeing the implementation of the risk management framework. The function of a board-level risk committee is to identify, manage, and minimise the different risks faced by banks (Hines and Peters, 2015; Cerasi et al., 2020) and improve bank level risk governance through integrating enterprise risk management approach and making policy recommendations on risk strategy, appetite and tolerance level (Brown et al., 2009; Malik et al., 2021). The establishment of risk committee could ensure for regulators and rating agencies that the bank's risk profile is within the acceptable limits (Bugalla et al., 2012).

Empirically, Brancato et al. (2006) provide evidence of the positive effect of a risk committee in reducing bank risk. Pathan (2009) argues that negative association between the existence of risk committee and risk level is augmented by the possibility that the risk committee members work on reducing legal liability in case of bank default. Battaglia and Gallo (2015) reveal that the risk committee enhances risk management. Keys et al. (2009) show that the more powerful the risk departments, the less risk exposure. Lee and Hooy (2020) reveal that the board monitoring committee reduces the risk-taking of state-owned banks. Finally,

Aljughaiman and Salama (2019) and Bhuiyan et al. (2020) found evidence that the existence of risk committee can indeed reduce bank risk.

Based on the above arguments, we expect that the presence of a risk committee will enhance bank risk management and profile, and propose the following hypothesis:

Hypothesis 4 (H4): The existence of a board-level risk committee is positively (negatively) associated with MENA bank stability (risk).

III.3. Variable specifications and empirical methodology

III.3.1. Variable specifications

This study aims at detecting the impact of corporate governance on MENA bank stability and risk-taking decision. Firstly, to proxy for bank stability (the dependent variable), we follow Laeven and Levine (2009), Lepetit and Strobel (2013), and Samet et al. (2018) and adopt the natural log of bank Z-score (LNZ). To proxy for bank risk-taking (also as alternative dependent variable), we follow Samet et al. (2018), Risfandy et al. (2022), and Saheruddin and Soedarmono (2022) and exploit bank non-performing loans ratio (NPL).

To proxy for bank MENA bank corporate governance structures, we exploit the following four variables. Firstly, we follow Safiullah (2020) and Saheruddin and Soedarmono (2022) and use the natural log of the size of board of directors (BOZ). Secondly, to proxy for CEO-chairperson role duality, we follow Battaglia and Gallo (2015) and Abid et al. (2021) and use a dummy variable taking the value of 1 in case of role duality, zero otherwise (DUAL). Thirdly, we follow Dong et al. (2017) and Ibáñez-Hernández et al. (2019) and use the proportion of female board members to proxy for board gender diversity (WOB). Fourthly, to proxy for the presence of a board-level risk committee, we follow Battaglia and Gallo (2015) and Galletta et al. (2022) and use a dummy variable taking the value of 1 in the presence of such committee, zero otherwise (RIC).

To complete the adopted model, we add the following control variables.

To detect the impact of ownership concentration on bank stability and risk, we follow Gonzalez (2009) and Gupta et al. (2022) and use the percentage of ownership of the largest three shareholders (OWN). The bank capital adequacy ratio (CAR) is exploited to proxy for the impact of capitalisation on bank stability, following Safiullah (2020) and Saheruddin and Soedarmono (2022). To examine the impact of profitability on bank stability, we follow Harkin et al. (2020) and Galletta et al. (2022) and use the return on assets (ROA). To reveal the association between bank size and stability, we follow EL Moussawi and Mansour (2022)

and, Ibáñez-Hernández et al. (2019) and use the natural log of total assets (SIZE). The impact of cost efficiency (CE) on bank stability will be examined, following Phan et al. (2019) and EL Moussawi and Mansour (2022). We follow Doan et al. (2018) and Safiullah and Shamsuddin (2019) and use the GDP per capita annual growth rate (GDPC) to proxy for the impact of economic growth on bank stability. Also, the impact of annual inflation rate (INF) on bank stability is used following Phan et al. (2019) and Rakshit and Bardhan (2022). To detect the impact of institutional quality on MENA bank stability, we follow Kaufmann and Kraay (2008) and Sok-Gee et al. (2021) and include three variables: control of corruption (COCR), regulatory quality (REQU), and political stability (RLAW). We follow Iannotta et al. (2013) and Harkin et al. (2020) to proxy for the impact of foreign ownership on bank stability by using a dummy variable (FOR), taking the value of 1 for majority foreign ownership, zero otherwise. Finally, to proxy for the impact of government ownership on bank stability, we follow Iannotta et al. (2013) and Harkin et al. (2020) and exploit a dummy variable (PUB), taking the value of 1 for majority government ownership, zero otherwise.

Table 10 presents all the exploited variables, their description, and their sources.

Table 10: Variable explanations

Variable	Explanations	Source(s)
LNZ	Log of $Z\text{-score} = \frac{ROA+CAR}{\sigma_{ROA}}$	Orbis Bank Focus; Authors calculation
NPL	Non-performing Loans to total asset ratio to proxy of credit risk	Orbis Bank Focus; Authors calculation
BOZ	Total number of directors on the bank's board (Board size)	Annual report; Authors calculation
DUAL	A dummy variable that was given the value of 1 if the CEO is also chairman of the board of directors and 0 otherwise (CEO Duality)	Annual report; Authors calculation
WOB	Women on board (WOB) represents the proportion of board directors who are females	Annual report; Authors calculation
RIC	The presence of risk committee (RC) is a dummy variable equal to 1 if the bank has a dedicated board-level risk committee and 0, otherwise	Annual report; Authors calculation
OWN	Ownership concentration (top 3 shareholders) is the percentages of common shares held by three major shareholders	Annual report; Authors calculation
CAR	Equity to total asset ratio	Orbis Bank Focus; Authors calculation
ROA	Net income to total asset ratio	Orbis Bank Focus; Authors calculation

SIZE	Logarithm to banks total asset to proxy bank size	Orbis Bank Focus; Authors calculation
CE	Cost efficiency using Data Envelopment Analysis (DEA)	Orbis Bank Focus; Authors calculation
GDPC	Growth rate of per capita GDP	World Bank Data
INF	Inflation rate	World Bank Data
COCR	Control of Corruption	Worldwide Governance Indicators, World Bank Data
REQ	<i>Regulatory Quality</i>	Worldwide Governance Indicators, World Bank Data
PST	Political Stability	Worldwide Governance Indicators, World Bank Data
FORG	Majority foreign ownership	Annual report; Authors calculation
PUB	Majority government ownership	Annual report; Authors calculation

Based on Table 10, the following equation linking the explained, explanatory, and control variables is proposed:

$$LNZ_{it}/NPL_{it} = \beta_0 + \beta_1 BOZ_{it} + \beta_2 DUAL_{it} + \beta_3 WOB_{it} + \beta_4 RIC_{it} + \beta_5 OWN_{it} + \beta_6 CAR_{it} + \beta_7 ROA_{it} + \beta_8 SIZE_{it} + \beta_9 CE_{it} + \beta_{10} GDPC_{it} + \beta_{11} INF_{it} + \beta_{12} COCR_{it} + \beta_{13} REQ_{it} + \beta_{14} PST_{it} + \beta_{15} FORG_{it} + \beta_{16} PUB_{it} + \varepsilon_{it}$$

Subscripts i and t represent bank and year, successively.

III.3.2. Empirical methodology

To estimate Equation 1 expressing the relationship between corporate governance and bank stability and risk-taking, the Blundell and Bond (1998) GMM system will be adopted. This method has the advantage of taking into consideration the correlation between the endogenous variable and the error term. The validity of the estimated regression equations using the system GMM will be tested using two tests: the Hansen instruments validity test and the Arellano and Bond autocorrelation.

III.4. Data

The exploited sample includes 150 banks operating in the MENA region over the period 2009-2020. The included countries and the number of banks for each country are: Algeria (eight banks), Bahrain (six banks), Egypt (fifteen banks), Israel (eight banks), Jordan (ten

banks), Kuwait (five banks), Lebanon (twenty-one banks), Morocco (eleven banks), Malta (five banks), Oman (five banks), Qatar (four banks), Saudi Arabia (five banks), Tunisia (thirteen banks), Turkey (twenty-two banks), and United Arab Emirates (twelve banks).

The bank-level data are annual and extracted from the Orbis BankFocus database and bank annual reports. The institutional and macroeconomic variables are extracted from the World Bank database. For an overview of the variables, Table 11 presents their descriptive statistics and Table 12 contains their correlation matrix.

Table 11: Variables descriptive statistics

	Mean	Maximum	Minimum	Std. Dev.	Observations
LNZ	3.2021	5.1584	-2.0390	0.7384	1789
CAR	0.1177	0.8161	0.0181	0.0591	1789
ROA	0.0112	0.0899	-0.1148	0.0110	1789
NPL	0.0720	0.2362	0.0014	0.1028	1789
SIZE	15.8398	23.7890	11.9846	1.5936	1789
CE	0.6186	1.0000	0.0300	0.2388	1789
INF	0.0400	0.8486	-0.6778	0.1444	1789
GDPC	0.0038	0.0951	-0.2112	0.0462	1789
BOZ	9.6842	18.0000	3.0000	2.3133	1789
DUAL	0.1656	1.0000	0.0000	0.3717	1789
RIC	0.7496	1.0000	0.0000	0.4334	1789
WOM	0.0887	0.5000	0.0000	0.1294	1789
OWN	0.7353	1.0000	0.0500	0.2599	1789
COCR	-0.0657	1.5672	-1.1451	0.6314	1789
PST	-0.7254	1.2840	-2.0091	0.8687	1789
REQ	0.1238	1.4309	-1.3034	0.5955	1789
PUB	0.2269	1.0000	0.0000	0.4190	1789
FORG	0.4427	1.0000	0.0000	0.4968	1789

Source: done by author based on Orbis Bank Focus data.

Table 12: Variables correlation matrix

	LNZ	CAR	ROA	NPL	SIZE	CE	INF	GDPC	BOZ	DUAL	RIC	WOM	COCR	PST	REQ	PUB	FORG	OWN	
LNZ	1.000																		
CAR	0.264(a)	1.000																	
ROA	0.295(a)	0.355(a)	1.000																
NPL	-	-	-	1.000															
SIZE	0.192(a)	-	-	-	1.000														
CE	-	-	-	-0.022	0.226(a)	1.000													
INF	-	-	-	-	0.000	0.185(a)	1.000												
GDPC	0.011	-0.005	0.159(a)	-	-0.001	0.036	-	0.337(a)	1.000										
BOZ	0.141(a)	-	-0.038	-0.021	0.284(a)	0.142(a)	0.104(a)	0.011	1.000										
DUAL	-	-	-	-	0.083(a)	0.043(b)	-0.030	0.002	0.064(a)	1.000									
RIC	0.025	0.063(a)	0.068(a)	-0.027	0.021	0.052(a)	0.025	0.221(a)	0.080(a)	0.062(a)	1.000								
WOM	0.008	0.133(a)	0.074(a)	0.075(a)	0.020	0.029	0.062(a)	0.094(a)	0.065(a)	0.002	0.109(a)	1.000							
COCR	0.263(a)	0.080(a)	0.093(a)	-	0.151(a)	0.219(a)	0.073(a)	0.143(a)	0.130(a)	0.074(a)	0.363(a)	-0.006	-0.013	1.000					
PST	0.192(a)	0.124(a)	0.101(a)	-	0.118(a)	0.122(a)	0.206(a)	0.159(a)	0.069(a)	0.113(a)	0.238(a)	0.134(a)	-0.157(a)	0.739(d)	1.000				
REQ	0.184(a)	-	-	-	0.135(a)	0.232(a)	0.049(b)	-0.025	0.098(a)	0.198(a)	0.359(a)	0.002	0.044(b)	0.811(d)	0.528(d)	1.000			
PUB	0.050(a)	0.024	0.093(a)	0.042(c)	0.268(a)	0.046(b)	0.110(a)	0.054(a)	0.140(a)	0.110(a)	0.118(a)	0.083(a)	0.178(a)	0.229(a)	0.018	1.000			
FORG	-	0.108(a)	0.061(a)	-0.039	0.073(a)	0.230(a)	0.085(a)	-0.010	0.162(a)	-0.018	0.161(a)	0.042(c)	0.036	0.070(a)	0.099(a)	0.063(a)	0.230(a)	1.000	
OWN	-	0.161(a)	-0.012	-0.010	0.049(a)	0.158(a)	0.020	0.020	0.171(a)	0.127(a)	0.037	0.324(a)	0.155(a)	0.254(a)	0.380(a)	0.208(a)	0.001	0.226(a)	1.000

Notes: (a), (b), (c) denote statistically significant at 1%, 5% and 10% levels respectively. Source: done by author based on Orbis Bank Focus data

III.5. Empirical results

The impact of corporate governance mechanisms on the stability of banks operating in the MENA region is performed using the GMM-system method. Table 13 presents the regression estimates considering the natural log of bank Z-score (LNZ) as proxy for stability. We run 11 different models to test the impact of different combinations of explanatory variables on the MENA bank stability.

The empirical results show non-significant values of the Hensen test, suggesting the validity of the instruments used. Furthermore, the Arellano and Bond autocorrelation test (AR2) indicates the absence of second-order autocorrelation. The significant values of the one period lagged log Z-score [LNZ (-1)] confirm the persistence of banking stability and the dynamic nature of the exploited model. Now turning to the impact of explanatory variables on MENA bank stability, we observe the following.

Firstly, the board size captured a positive and significant impact on bank stability in all presented models at the 1% level. This reveals that larger board of directors are associated with higher bank stability, thus providing support for H1, which hypothesised that larger boards have a positive impact on MENA bank stability. In fact, these results present support to the resource dependence theory, which suggests that larger boards have more resources, are more knowledgeable, and have more highly skilled directors. Similar results have been obtained by several studies e.g. Klein (2002), Akhigbe and Martin (2008), De Andrés and Vallelado (2008), Switzer and Wang (2013), Berger et al. (2016), Faley and Krishnan (2017) and Sarkar and Sarkar (2018).

Secondly, the CEO-Chairperson duality proves to be a destructive element for bank stability, which is shown by the negative and statistically significant impact of DUAL on LNZ in all presented models in Table 13. These results that are in line with the findings of the survey done by Šilingienė et al. (2015) and the empirical results of Duru et al. (2016) and Lu and Boateng (2017) and provide support to H2. Consequently, we may conclude that MENA banks that combine the roles of the chairperson and the CEO suffer lower stability.

Table 13: Regression estimates on the impact of corporate governance mechanisms on MENA bank stability. Dependent variable: LNZ

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Constant	0.684*** (0.155)	0.580*** (0.112)	0.543*** (0.109)	0.590*** (0.108)	0.680*** (0.152)	0.873*** (0.182)	0.676*** (0.151)	0.547*** (0.104)	0.517*** (0.107)	0.479*** (0.087)	0.528*** (0.104)
LNZ (-1)	0.366*** (0.133)	0.422*** (0.101)	0.450*** (0.096)	0.499*** (0.085)	0.411*** (0.117)	0.388*** (0.122)	0.382*** (0.128)	0.479*** (0.094)	0.486*** (0.094)	0.612*** (0.068)	0.471*** (0.087)
BOZ	0.043*** (0.009)	0.036*** (0.007)	0.035*** (0.007)	0.036*** (0.007)	0.030*** (0.007)	0.039*** (0.009)	0.041*** (0.009)	0.032*** (0.007)	0.032*** (0.007)	0.024*** (0.005)	0.034*** (0.007)
DUAL	- 0.126*** (0.027)	- 0.120*** (0.023)	- 0.115*** (0.023)	- 0.079*** (0.017)	-0.022* (0.013)	-0.029* (0.015)	- 0.129*** (0.026)	- 0.115*** (0.021)	- 0.114*** (0.022)	- 0.098*** (0.018)	- 0.115*** (0.022)
WOB		0.260*** (0.083)	0.225*** (0.079)	0.238*** (0.074)	0.317*** (0.084)	0.355*** (0.096)		0.228*** (0.075)	0.207*** (0.076)	0.128** (0.051)	0.192*** (0.073)
RIC			0.026*** (0.009)	0.005 (0.008)	0.056*** (0.014)	0.020** (0.010)			0.020** (0.009)	0.037*** (0.010)	0.030*** (0.009)
CAR	2.193*** (0.426)	2.067*** (0.335)	1.978*** (0.316)	1.726*** (0.274)	2.343*** (0.438)	1.952*** (0.379)	2.080*** (0.409)	1.796*** (0.312)	1.801*** (0.305)	1.398*** (0.237)	1.887*** (0.284)
NPL	- 0.727*** (0.184)	- 0.756*** (0.182)	- 0.725*** (0.172)	- 0.558*** (0.155)	- 0.704*** (0.183)	- 0.988*** (0.241)	- 0.771*** (0.179)	- 0.757*** (0.174)	- 0.747*** (0.166)	- 0.527*** (0.144)	- 0.719*** (0.169)
ROA	4.056** (1.654)	3.112** (1.356)	2.980** (1.318)	3.879*** (1.267)	5.236*** (1.561)	5.460*** (1.695)	4.609*** (1.693)	3.126** (1.303)	3.164** (1.325)	2.140** (0.958)	2.839** (1.267)
SIZE	0.049*** (0.010)	0.049*** (0.008)	0.046*** (0.008)	0.034*** (0.006)	0.038*** (0.007)	0.033*** (0.007)	0.044*** (0.009)	0.039*** (0.007)	0.039*** (0.007)	0.028*** (0.005)	0.044*** (0.007)
CE	- 0.121*** (0.036)	- 0.125*** (0.029)	- 0.133*** (0.029)	-0.065** (0.025)	- 0.088*** (0.025)	-0.076** (0.030)				- 0.106*** (0.024)	- 0.139*** (0.028)
GDPC	0.471** (0.232)	0.300 (0.278)	0.424 (0.263)	0.200 (0.256)	-0.358 (0.415)	1.361** (0.560)	0.288 (0.224)	0.086 (0.258)	0.147 (0.252)	0.676*** (0.187)	0.488* (0.266)
INF	- 0.619***	- 0.631***	- 0.600***	- 0.337***	- 0.484***	- 0.567***	- 0.691***	- 0.655***	- 0.653***	- 0.379***	- 0.566***

	(0.144)	(0.137)	(0.130)	(0.102)	(0.125)	(0.140)	(0.145)	(0.132)	(0.131)	(0.096)	(0.121)
PST				0.054*** (0.010)							
REQ					0.134*** (0.032)						
COCR						0.142*** (0.033)					
FORG										- 0.055*** (0.012)	
PUB											0.021** (0.010)
R-squared	0.826	0.851	0.865	0.883	0.893	0.848	0.838	0.871	0.88	0.908	0.868
Prob (J-statistic)	0.816	0.896	0.845	0.591	0.192	0.382	0.883	0.906	0.698	0.257	0.776
Prob. AR(1)	0.004	0.011	0.001	0.032	0.057	0.032	0.007	0.005	0.003	0.002	0.042
Prob. AR(2)	0.694	0.484	0.663	0.404	0.624	0.605	0.48	0.537	0.573	0.181	0.489
Observations	1641	1637	1637	1637	1637	1637	1641	1637	1637	1637	1637

Notes: Standard error in parentheses. ***, **, * denote significant at the 1%, 5%, and 10% level respectively. For the definition and computation of variables, see Table 1.

Thirdly, the variable representing the proportion of female board members (WOB) captures a positive impact on bank stability (LNZ), and significant at the 1% level in the models included in Table 13. This reveals the productive influence of having more woman on MENA bank board of directors and provide support to H3. Consequently, our results are consistent with those of Adams and Ferreira (2009), De Cabo et al. (2012) and Farag and Mallin (2017) and reveal that MENA banks that have higher number of women board members would enjoy higher stability due the higher influence of women on risk taking decisions.

Regarding the last corporate governance variable, the results show a positive and significant impact (ranging between 5% and 1%) on the presence of the risk committee on MENA bank stability. This result is in line with those of Brancato et al. (2006), Pathan (2009), Keys et al. (2009), Battaglia and Gallo (2015), Aljughaiman and Salama (2019), Bhuiyan et al. (2020) and Lee and Hooy (2020), and provide support to H4, thus showing that the existence of a risk committee in MENA bank does improve risk management, control and monitoring.

Regarding the impact of the control variables on the MENA bank's stability, we observe the following. Higher capital adequacy does indeed enhance MENA bank stability, shown by the positive and significant impact of CAR on LNZ. Therefore, higher capitalisation allows banks to have higher ability to absorb shocks, especially during crises. Higher credit risk is a major impediment of MENA bank stability, shown by the negative and significant association between NPL and LNZ. This result suggests that the inability to manage and mitigate credit risk results in a deterioration of bank stability. In contrast, higher profitability supports MENA banks profitability, since ROA shows to have a positive and significant impact on LNZ. Hence, we conclude that MENA banks could improve their profitability, without suffering higher instability, i.e. there is no trade-off between profitability and stability.

Larger MENA banks show to have higher stability than their smaller counterparts, which is shown by the positive impact captured by SIZE and statistically significant in all models. This may suggest that larger banks have better risk management capabilities and can dedicate more resources to mitigate and control risks, in addition to higher diversification capacity. The cost-efficiency variable (CE) captures a negative influence on bank stability and is statistically significant in all models. This result may suggest that efficient MENA banks tend to take more risks, based on their cost control advantage. The macroeconomic conditions prove to be a major determinant of MENA bank stability, which is shown by the positive and significant

impact recorded by GDPC and the negative and significant impact recorded by INF. Therefore, better (worst) economic conditions result in higher (lower) bank stability. This is due to the fact that in light of economic growth, banks tend to record higher profits and have better ability to boost their capital bases, which eventually pour in higher Z-score. In parallel, lower (higher) inflation rates result in better (worst) bank stability. This may be due to the fact that in line of higher inflation, interest rates increase resulting in a decline of demand for loans, and potential drop-in business activities.

The three variables representing the prevailing institutional quality (or the overall governance) play a major role in shaping bank stability in the MENA region. Consequently, stricter control of corruption, better quality of regulation, and political stability, all result in a healthier operational environment, more dynamic business activities, and higher investment confidence.

Finally, bank ownership also shows to have a significant influence on MENA stability. In particular, it was found that domestic banks have superior stability over foreign banks, which is shown by the negative association between FORG and LNZ. This may suggest that national banks have better ability to deal with domestic operational environment and withstand shocks than foreign banks. On the other hand, government ownership shows to improve bank stability, shown by the positive impact of PUB on LNZ, suggesting that state ownership may present support for banks and government may even inject the necessary capital when needed.

III.6. Robustness Test

In order to check the persistence of the impact of the corporate governance variables listed above on the stability and risk-taking behaviour of MENA banks, we replace the natural log of Z-score as proxy for riskiness with the non-performing loans ratio (NPL). We run three different regression models considering NPL as explained variables, and as explanatory variables, those listed in Table 10. The results obtained from the regression estimates using a system GMM method are presented in Table 14. The Hensen test reveals the validity of the used instruments, and the Arellano and Bond autocorrelation test (AR2) indicates the absence of second-order autocorrelation.

Regarding the impact of the corporate governance mechanisms on the MENA banks, it is obvious that the four adopted variables have confirmed their impact on bank credit risk.

Specifically, board size is negatively associated with NPL, providing support to H1 that a larger board of directors helps controlling banking risks and more board members is an advantage that provides additional skills and expertise that help in the board risk governance. Role duality captured a positive impact on NPL, providing support to H2 that hypothesised that combining the roles of CEO and the chairperson may result in taking excessive risk by the bank management. WOB showed to have a negative impact on NPL, suggesting that higher proportion of female board members results in more risk-averse conduct by the board, thus giving addition support to H3. Finally, the existence of a risk committee does not show itself to have a direct effect on credit risk, as RIC does not record a significant influence on NPL, which prevents obtaining additional support to H4. As for the control variable, the results are – overall – in line with those in Table 13.

Table 14: Regression estimates on the corporate governance factors on MENA bank risk – Robustness Check. Dependent variable: NPL

Variables	Model 1	Model 2	Model 3
Constant	0.116*** (0.045)	0.131*** (0.046)	0.104** (0.042)
NPL (-1)	0.504*** (0.130)	0.482*** (0.132)	0.539*** (0.124)
BOZ	-0.003*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)
DUAL	0.016* (0.009)	0.019** (0.009)	0.011 (0.009)
WOB	-0.027 (0.019)	-0.039*** (0.015)	-0.028** (0.014)
RIC	-0.006 (0.006)	-0.007 (0.006)	-0.005 (0.006)
CAR	0.045 (0.078)	0.041 (0.078)	0.031 (0.074)
ROA	-0.887*** (0.325)	-0.917*** (0.333)	-0.870*** (0.301)
SIZE	-0.007*** (0.002)	-0.007*** (0.002)	-0.006*** (0.002)
CE	0.002 (0.008)	0.003 (0.009)	0.002 (0.009)
GDPC	0.147 (0.099)	0.110 (0.093)	0.151 (0.092)
INF	-0.094** (0.041)	-0.097** (0.040)	-0.088** (0.042)
COCR	-0.004**		

	(0.002)		
PST		-0.003 (0.001)	
REQ			-0.008*** (0.002)
R-squared	0.67	0.657	0.69
Prob(J-statistic)	0.282	0.544	0.269
Prob. AR (1)	0.025	0.032	0.029
Prob. AR (2)	0.339	0.496	0.388
Observations	1640	1640	1640

Notes: Standard error in parentheses. ***, **, * denotes significant at the 1%, 5%, and 10% level respectively. For the definition and computation of variables, see Table 10.

III.7. Conclusion

The literature on the impact of banks' corporate governance mechanisms on their stability and risk-taking, and in particular those studying the association between board of directors' composition and stability, reports contradicting results. Specifically, there is still no consensus on how board size, gender diversity, CEO-chairperson duality, and the existence of a risk committee impact bank stability and riskiness.

To participate in this ongoing debate, this study detected the impact of a board composition on bank stability and riskiness by exploiting new dataset composed of a sample of 150 banks operating in fifteen MENA countries between 2009 and 2020. Regarding the empirical methodology, this study adopted a system GMM method. The findings show the following. Firstly, the size of the board of directors reports a positive impact on bank stability (represented by Z-score) and negative impact on credit risk (represented by NPL ratio). This reveals that larger boards present more skills and expertise and better monitoring and control practices for MENA banks. Secondly, the combination of chairperson and CEO roles is negatively associated with stability and positively with credit risk. This is an alarming result showing that this practice results in power concentration in one person, thus creating a potential conflict of interest between bank owners and managers who take tend to increase bank risks, even at the expense of bank owners. Thirdly, having more women on the MENA board of directors' shows to have positive outcome for preserving stability and controlling risks. Therefore, higher proportion of female board members allows them playing more active role in the decision-making process in the bank, which is reflected eventually in higher stability and lower risk. Finally, the presence of a board-

level risk committee is crucial for preserving MENA bank stability, and the lack of such committee may result in deterioration of bank stability.

From regulatory and supervisory perspectives, these findings introduce the following policy recommendations. Firstly, encouraging larger sizes of boards may be necessary, as this allows banks to have more skilled and expert board members, which supports the decision making process. Secondly, higher gender diversity should be encouraged and maybe even enforced through regulations. Thirdly, a power concentration through combining the roles of the CEO and chairman should be avoided. Finally, having a risk committee should be a must.

CHAPTER IV: CONCLUSION

General conclusion

IV.1. Conclusion concerning the approach and the empirical results

Economic and financial changes and deregulation of the banking sector have led to increased competition within the financial sector in general and between banks due to the role that banks play in the economic and financial structure nationally and internationally. In order to meet the requirements of economic agents and adapt to these changes, the restructuring of the banking system has become a priority in order to ensure its sustainability and strengthen its capacity to face competition. Finally, it remains necessary to find the appropriate structure that ensures the stability and efficiency of the banking sector. However, this restructuring of the financial system must be accompanied by an adequate restructuring of the institutional and regulatory framework which takes into consideration the intensification of competition as well as the efficiency gains and the costs incurred. This ever-increasing competition has pushed banks to take more risks in order to increase their profits, which, in turn, has led to a deterioration in the stability of the banking sector. As a result, banks find themselves faced with a dilemma of ensuring their efficiencies while maintaining their stability.

In light of the different positions and observations raised about the impact of competition on banking efficiency and stability, our work aimed to study, on the one hand, the interaction between competition, cost efficiency, and banking stability; and on the other, the impact of governance on banking stability in the banking systems of MENA countries. To do this end, we examined the main theoretical concepts of competition, productive efficiency and governance and then applied these to commercial banks operating in the MENA region.

The starting point of this work refers to the theoretical hypothesis which states that the concentration of the banking market should have a positive effect on banking efficiency and stability. This relationship is explained by the fact that restructuring through concentration leads to the creation of banks with greater size and market power which allows banks to diversify their income by diversifying their activities. Thus, concentration presents the path to banking stability and makes it possible to improve the quality of cost and income management and to achieve economies of scale which, in turn, ensure the gains in efficiency.

Given the importance of the banking structure in explaining performance, we devoted Chapter 1 to the study of the relationship between structure, behavior and performance. In this chapter, we have seen that the literature recognizes two major indicators of market power: the conjectural elasticity H , which measures the degree of correspondence between the marginal revenue of the firm and that of the market; 2) the Lerner index, which corresponds to the relative difference between price and marginal cost. We then studied four major models of competition: the structure-behavior-performance (SCP) model, the efficient structure theory, the theory of contestable markets and models taking into account barriers to entry.

In Chapter 2, we analyzed the effects of competition on the efficiency and stability of banks in the MENA region, which have, in recent years, experienced profound changes in their banking landscape. For this, using the banking intermediation approach, we measured banking efficiency by cost efficiency and competition using both the Lerner index and the H statistics of Panzar and Rosse in order to test the stability of the results. The results of our study are that whatever the measure of competition is used, when the market power of banks increases, their cost efficiency also increases. On the other hand, our results show that the increase in the market power of banks leads to a decline in banking stability.

Finally, the empirical results show a significant effect of the economic and institutional environment on the efficiency and stability of banks in the MENA countries. In view of these results, it is necessary to question, on the one hand, the optimal level of competition that regulatory authorities should seek, and on the other, the impact of governance on banking stability in the MENA region.

In Chapter 3, we focused on the impact of governance on banking stability in the MENA region. It was a question of addressing the relationship between governance mechanisms (size of the board of directors, presence of women on the board of directors, duality, etc.) and banking stability through the consideration of factors specific to the banking firm (size, profitability, equity ratio, etc.), macroeconomic and environmental (economic growth rate, inflation, control of corruption, quality of regulation, etc.).

The empirical results obtained using dynamic panel data models and more precisely from the system-generalized method of moments (system-GMM) show that the variables reflecting banking governance are considered as explanatory factors of the stability of banking. Indeed, our results show a positive relationship between the size of the board of directors, the presence of women on the board of directors, and the risk committee with banking stability. On the other hand, the results reveal the existence of a negative relationship between duality and banking stability. Finally, the empirical results show that the factors specific to the banking firm and environmental factors (equity ratio, profitability, size, growth rate of the economy, political stability, control of corruption, quality of regulation, public ownership, credit risk, cost efficiency, inflation and foreign ownership) positively (negatively) affect banking stability.

From the regulatory and supervisory perspectives, these findings introduce the following policy recommendations. Firstly, encouraging larger size boards may be necessary as this will allow banks to have more skilled and expert board members, which supports the decision making process. Secondly, higher gender diversity should be encouraged and maybe even enforced through regulations. Thirdly, a power concentration through combining the roles of the CEO and chairman should be avoided. Finally, having a risk committee should be a must.

IV.2. Conclusion regarding estimation methods

We would like to provide some clarifications relating to the notion of efficiency, stability and competition on the one hand, and on the estimation instruments and methods which were the subject of our research, on the other. At the same time, these details summarize the limits of our work.

The different methods of estimating the degree of competition that we used did not correctly reveal market power in the banking sector of MENA countries. Firstly, the values of the Lerner index do not reveal any market power in the banking sector of the MENA region. Indeed, the endogenization of the market structure has made it possible to call into question the conclusions of the SCP approach. By reversing the usual relationship between concentration and performance, the efficiency differential hypothesis attributes the improvement in performance

not to a withdrawal of monopoly rent but rather to greater efficiency of the banking firm. On the other hand, the theory of contestable markets calls into question the conclusions of the conventional SCP model and therefore the hypothesis of market power. Third, the application of the Ross and Panzar model encourages us to reject the hypothesis of monopoly and perfect collusion in the banking systems of MENA countries. These results can be interpreted as confirmation of the theory of contestable markets, according to which concentration has no significant impact on market power. However, the results also demonstrate that the empirical methods we used do not make it possible to correctly identify and estimate market power in the banking sector.

Despite the progress of work on the evaluation of the impact of market power on banking stability and efficiency, this relationship is still ambiguous. This ambiguity is due to the measurement of the degree of concentration and the construction of a relevant indicator of banking efficiency. On the other hand, this relationship depends on the structure of the banking sector (entry barriers, regulations, etc.). In this regard, two approaches can be used to measure the degree of competition in the banking sector: the descriptive approach based on traditional competition indicators and the modeled approach. Measuring market power using traditional indicators of concentration and profitability has the advantage of simplicity and transparency. This descriptive approach, however, is the subject of significant criticism at a theoretical level and encounters numerous difficulties in empirical application due to the lack of statistics on prices and costs.

The modeled approach makes it possible to derive an indicator of market power based on more solid theoretical bases, but it nevertheless poses numerous application problems and only results in a partial measurement of market power which poses problems of interpretation. With regard to possible future research on banking competition, an analysis of the degree of competition relating to products would be interesting to carry out since it makes it possible to identify the segments of the banking sector likely to be subject to restriction; or, on the contrary, an improvement in competition. It is also interesting to extend the analysis of banking competition to take into account the procyclical effects of monetary policy on market power. This would allow us to check how monetary policy influences lending and deposit rates, the location of banks and, therefore, competition in the banking sector. A third avenue for development would

be to further integrate the growing sophistication of risk management practices into the description of bank behavior so that a significant part of the financial dimension of banking activity is not avoided.

The measurement of cost efficiency was carried out in this thesis using the parametric approach of a cost frontier. Our results suggest that efficiency levels are high but they indicate the presence of a difference in productive efficiency between the banks included in our sample. It is likely that these efficiency scores depend on the estimation method used which largely conditions the correlation relationships obtained between stability and banking efficiency. Indeed, the use of the stochastic frontier used to measure cost efficiency has disadvantages which are not only linked to the choice of the functional form of the production technology or to the statistical distribution of the efficiency term. On a panel, it is often difficult to assume that banks are aware of their inefficiency without trying to correct it from one period to the next. Such a correction can affect the choice and quantities of input used throughout the production activity of banks.

These shortcomings deserve to be filled with a view to extending this research. The literature on efficiency frontiers also offers other parametric and non-parametric measurement instruments. We can, for example, evaluate banking efficiency using trigonometric parametric frontiers (profit, income or cost frontier) or non-parametric frontier (estimation of the efficiency frontier using the FDH method (sequential, contemporary or intertemporal), evaluation of productivity using the Holder index, etc.). Extensions of this study are being considered and could provide further clarification of the results obtained. Nevertheless, we believe we have partially compensated for these shortcomings by providing certain elements that we hope are essential for this work.

Firstly, in relation to the evaluation tool used, to evaluate the competition and efficiency of banks, by the associations of banks and the central bank of each country, which is an accounting approach based on the ratio method, we propose another method combining both cost functions and parametric production frontiers. It provides a fairly precise measure of costs and a possibility of determining individual relative efficiency.

Secondly, the functional forms used constitute, by their flexible nature, interesting tools particularly suited to the banking sector. In addition, the multi-product activity of banks is quite easily taken into account and the hypotheses stipulated by these less rigid forms remain very consistent with the economic reality of banking activity.

Thirdly, given the weakness of certain models in taking into account individual and temporal variability, econometric analysis of panel data certainly makes it possible to represent these two dimensions in a judicious manner. We used this technique because we judged that, given the heterogeneity of banks on the one hand, and the random and risky nature of banking activity, on the other hand, this approach would prove very useful. In addition, the presence of specific individual effects, random or certain, reflecting the behavior of the managers, their management capacity, their aversion to risk can be understood through an effective and convergent estimator proposed by the specified model.

Finally, the use of the generalized method of moments (GMM) in a system makes it possible to avoid, on the one hand, the problem of endogeneity between stability, efficiency and banking competition, and on the other, the problem of autocorrelation between error terms.

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