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Banking Stability and efficiency in the MENA region: Disentangling the impact of distress, competition and regulation

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Dedication

To my family Andreas, Margarita and Petros, my wife Stamatoula and our new-born star.

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Publications and Conferences

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Abstract

The core research subject of the thesis is banking stability. I explore banking stability and efficiency for the Middle East, North Africa (MENA) region and empirically disentangle the role of bank distress, competition and regulation using empirical research which is contained in three chapters (2,3 and 4). In Chapter 2, I firstly explore how bank distress (measured by two approaches) affects overall banking stability (using Z-score and non-performing loans) and additionally how these results are modified under different regulation and bank characteristics. Finally, the impact of the presence of Islamic banks is explored. To this end I employ a bank-level data set from 322 banks operating in 19 MENA countries covering the period 2004 – 2015. The results show an overall strong negative effect of distress on banking stability, while stringent capital regulation, less restrictions on activities of the financial sector and less supervisory power appears to benefit banking stability. The presence of Islamic banks enhances bank stability. The analysis provides guidance for policy makers on how to strengthen the stability of the MENA banking system. In chapter 3, my focal point is bank competition and its relationship with bank stability following a two-part analysis. In the first part, I conduct an in-depth review of 279 empirical studies concerning the academic debate over whether the bank competition or concentration or market power has a positive or negative effect upon the bank risk or bank stability. This review not only covers one of the longest time periods (1990-2022) for literature reviews in this area but also the categorization of studies found more interesting and innovative based on the country or the region being investigated. The second part estimates the effect of competition on banking stability employing the commonly accepted, as unveiled in the review in the first part, LERNER and Boone competition indices. We use the same data set as in chapter 2 and apart from competition we use bank-level and country characteristics as control variables. Results using the GMM approach provide support to the competition-stability view. In chapter 4, I use a novel econometric model in order to explore the interrelationships between efficiency, competition, and stability. The econometric model is a single stage approach which using the Boone indicator allows the interdependence of competition. stability and (in)efficiency. The key contribution is that cost efficiency and stability efficiency are estimated jointly within a unified model that allows the interpretation of their relationship upon a common base. The results support the competition-stability view and provide implications for the stability

and (in)efficiency of the MENA region, setting a novel way of estimation for studies on emerging markets for policy makers and researchers.

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Chapter 1 Introduction

The intermediation role of banks between depositors and borrowers, the allocation of national savings to investors and the provision of liquidity to consumers and business are essential functions that banks perform. Any interruption of saving and borrowing flows of funds from one or more banks failures/closures may trigger a contagion phenomenon and a systemic banking crisis. Such a situation certainly interrupts economic growth and adversely affects the real economy. Therefore, the stability of the banks individually and of the entire banking market is essential for the health of the economy. Studies (e.g., Reis et al. 2002; Dell'Ariccia et al. 2008) have identified the costs associated with banking instability on the developed and developing economy. The world economy has recently retrieved apart from the recent global financial crisis while as presented by Reinhart and Rogoff (2013) a considerable number of banks crises have been recorded in the past from 1890 to 2008.

Therefore, given the importance of a stable financial system, academic interest has focused on investigating both theoretically and empirically the issue of banking stability. A favourite subject of academicians is to explore and empirically quantify the factors that are associated with and impact upon bank (in)stability. Policy makers and bank supervision authorities are also much interested to know these factors and control them for safeguarding bank market solvency and stability.

So far, the rich empirical research has explored a variety of factors. However, among the explored factors that affect bank stability bank market structure, or bank market competition or bank market power stands out as the main determinant of bank stability or fragility. Despite the common consensus that bank competition impact on stability, there is no agreement on the direction of this impact. The empirical findings are in disharmony. There are many studies supporting the view of an existing trade-off between competition and stability (competition-fragility hypothesis) but also many studies that reinforce the view that competition is beneficial to stability (competition-stability hypothesis). These divergent views could be associated with a range of issues related to the measurement of competition and stability, to the statistical and econometric estimation methods used and to the inclusion or not of other factors that influence the strength and direction of the competition-stability relationship.

The key role banks play in financial crises and the determination of factors that impinge upon bank instability is the background of our research interest in this thesis. The broad aim of this thesis is to investigate the determinants of bank stability with special attention given to its relationship with bank competition. The present thesis is focused on the relationships between bank (in)stability, bank distress, bank competition, and bank efficiency with a special reference to the Middle East North Africa (MENA) countries. The choice of MENA region is based primarily on the fact that there is limited relevant research and further investigation employing all available competition and stability measures and new econometric techniques is very welcome. Secondly the MENA region includes Arab countries with major Islamic banks in coexistence with conventional ones and this allow comparing the competition-stability issue between them. Thirdly Islamic banking in the last two decades has shown a continuous upward trend with the value of Islamic banking assets worldwide reaching 1.99 trillion of US $ from 1.3 trillion US $ in 2012 with a big share of MENA region banks.

Overall, in the second, third and fourth empirical chapters of the thesis our questions and hypotheses under investigation are the following:

H1: Different levels of Bank Distress have a negative effect on banking stability, irrespective of the type of banks (conventional or Islamic) in the MENA region.

H2: As the level of bank distress increases for all types of banks in the MENA region, when combined with a constant regulatory environment, the overall effect on banking stability is negative.

H3: The regulatory environment in the MENA region affects the stability of banks and its effect becomes more intense when it interacts with bank distress levels.

H4: Conventional banks have a stronger negative effect on banking stability compared to Islamic banks in the MENA region.

H5: Distressed conventional banks interact more negatively with banking stability compared to distressed Islamic banks in the MENA region.

H6 (a): The Arab Spring has a negative effect on banking stability in all countries in the MENA region.

H6 (b): The Arab Spring combined with distressed banks has a negative effect on banking stability in all countries in the MENA region.

H7: Empirical studies investigating bank stability considers bank competition or concentration an important determinant.

H8: The empirical studies investigating the competition-stability nexus predominantly use the LERNER bank competition index whilst the Boone bank competition indicator is rarely used.

H9: The global banking crisis elevated academic research for the competition-stability issue.

H10: Studies exploring the competition-stability issue for MENA region are limited.

H11: For the MENA region bank competition enhances bank stability and there is no trade-off between competition and stability no matter which bank competition indicator is used.

H12: For the MENA region the competition-stability positive relationship is stronger for Islamic banks compared to conventional banks.

H13: Cost inefficiency and stability inefficiency are highly correlated in a positive relationship in the MENA region.

H14: MENA banks are operating under constant returns to scale.

Furthermore, we estimate and use the competition Boone indicator which is rarely included in MENA empirical studies and consider the variation in financial regulation country frameworks. Last but not least, we set up a single-step novel econometric model where multiple output Boone competition indicators, Z-score inefficiency stability and bank cost-inefficiency measures are interrelated and estimated supplying interesting results.

In Chapter 2, we use for the first time the “distress” concept and its relationship with bank stability. Within this context, hypotheses H1 to H6 are empirically tested. . I utilise a bank level dataset from 322 banks in 21 Middle East North Africa (MENA) countries for the period 2004 - 2015. I calculate at the bank level Z-score and non-performing loans ratio as stability indicators while separating the sample into Islamic and conventional banks and estimate the bank “distress” index across country banking systems. The level of “distress” is measured with CAMEL indices and with a dummy variable approach. I conduct three empirical tests. First, I investigate whether the “distress” position of each bank for each year affects overall banking stability. Second, I estimate the GMM model to assess “distress” impact on stability. I finally, examine the relationship between “distressed” banks and stability under different regulatory frameworks and bank system reforms of each country. To conduct that, I interact distress with other bank characteristics and the regulation framework of each country to show the efficiency (or inefficiency) of different regulatory environment and policies in place. The results show an overall strong negative effect of “distress” on banking stability, while stringent capital regulation, less restrictions on activities of the financial sector and less supervisory power seems to benefit the stability of the banking sector. My results supply new evidence for policy makers on approaches to strengthen the financial stability of the system.

In Chapter 3, I supply new evidence on the debate of competition-stability vs competition-fragility/ instability, following a two-part analysis. In the first part I perform an in-depth critical review of the existing empirical literature (279 studies) on the stability-competition debate across different country-regions and individual countries, focusing on both advanced and emerging economies, Islamic and conventional banks, covering the period from 1990 to 2021. This literature review among others finding, supports our research hypotheses H7 to H10. It also reveals i) the rising number of such studies in the last decade and especially studies for single countries ii) the usage in many emerging countries ofbank concentration measures as synonymous to competition although this trend is diminished in the last decade owing to data availability and iii) that the GLOBAL studies group (studies including a mix of banking systems from countries across continents) provide new avenues for research. The second part of the analysis estimates the impact of bank competition on banking stability and verifies the hypotheses H11 and H12. To this end and according to my literature review revealed characteristics, I use not only the LERNER but also the less used Boone competition indicator. My sample consists of three hundred banks operating in the MENA region and cover the period 2004-2015. I use both panel OLS fixed effects and Generalized Method of Moments (GMM) with a focus on individual bank characteristics. My results, independently of the competition measure employed, find no trade-off between bank competition and stability and support the stability-competition hypothesis. The inclusion of bank characteristics (such as bank size and liquidity) and regulation/institutional frameworks (capital requirements and banking activity restrictions), gives new insights for policy makers to promote financial stability across different market structure, regulatory and bank characteristics environments.

In Chapter 4, I focus on the interrelationship among bank competition, stability and efficiency in the MENA region. To this end I exploit the Boone competition indicator which, as revealed in the literature review in chapter three, is seldomly used in general and especially in emerging countries and more particularly in the MENA region. We set up a novel econometric model where the estimation technique used for the bank instability and cost inefficiency estimation, binds with the Boone competition indicator's output and cost components to finally estimate a single-step model and disentangle the bank competition, instability and inefficiency relationship. Our results are in line with our research hypotheses H13 and H14. I use the parametric SFA (Stochastic Frontier Analysis) analysis to estimate bank and cost inefficiency for the MENA region's bank market and use the Boone indicator equation within a novel internally consistent econometric model which allows the interdependence of cost and stability inefficiencies both decided by the same set of predetermined variables. The key contribution is that cost efficiency and stability efficiency are estimated jointly within a unified model that allows the interpretation of their relationship upon a common base. Our model avoids two-stage estimation problems since the latter "suffer from multiple econometric problems as well as lack internal consistency/validity" (Tsionas et al., (2018)). My findings provide new evidence for the role of bank (in)efficiency and its relationship with bank market structure and banking (in)stability. My findings testify once more to the positive impact of competition on stability. However, this result contrasts with previous findings for the MENA region and has some different policy implications. Furthermore, the findings suggest that cost inefficiency and stability inefficiency are highly correlated in a positive relationship in the MENA region. Finally, we testify that MENA banks are operating under constant returns to scale. All these findings have important policy implications. Regulatory authorities should promote competition through further relaxation of entry into the banking market. They should not only take actions to enhance competition among banks but also closely watch managers' decisions about investment mix choices which have an impact on the efficiency, profitability and stability development of the bank. Further reforms may be desired in order to obtain the optimal utilization of capacities as well as making the greatest use of resources. Overall, a different mix of policies should be adopted depending on the characteristics of the MENA banking systems. I consider that our one-step model is a novel way of estimation for studies on emerging bank markets for policy makers and researchers.

Chapter 2 Distressed Banks and Bank stability: Evidence from Emerging countries with Islamic and Conventional banks.

2.1 Introduction

The banking sector is generally considered to be the cornerstone of the financial system and plays a significant and crucial role by contributing towards a country's economic growth, development, and steadiness. Therefore, banking, and financial stability has always been of paramount importance. Banking stability is the goal and aspiration of supervisory authorities when designing regulations and implementing supervision practices in both developed and developing and emerging countries. It is possible though that such prudent and insightful regulatory policies do not always establish and retain banking and financial stability. The global financial crisis (GFC) of 2008-9 is a clear case where the bank regulatory and prudential policies in operation proved ineffective to avoid and work out financial crises and promote banking stability. This ineffectiveness of regulation and supervision also found in studies by Cihak et al 2013 and Kim et al 2013 a factor that led to GFC. This failure put international organisations on alert especially the Bank for International Settlements (BIS) and the Federal Reserve (FED) and a set of actions was taken to ameliorate and improve the existing regulation framework. These changes known as Basel III (BCBS, 2011, BCBS, 2013 and BCBS, 2014) form an internationally agreed set of measures developed by the Basel Committee on Banking Supervision. The measures aim to strengthen regulation and supervision and improve the risk-taking policy and loss absorption capability of banks and are minimum requirements for implementation and application by active banks within an agreed time frame.

As expected, in the shadow of the global banking and financial crisis and the spread all over the continent of distressed and problematic individual banks and governmental actions to avoid bank failure and closures there were a number of studies (see for example Wheelock and Wilson, 1995; 2000, De Young, 2003; Cole and Curry, 2011; and Abou-El-Sood, 2016;) which focused their research on identifying the factors that are likely to cause banks to run into financial problems or otherwise become problematic or distressed. If such factors can be identified and known early, then this can assist in early recognition of individual bank problems without the fear of domino effects in the entire banking industry and in the economy as a whole. It is of course widely accepted that banking and financial crises are extremely difficult to predict since the factors and channels behind it are many, complicated and interrelated. (Rose and Spiegel, 2011). However, the health of banks is always the focal point when a banking crisis is examined. Therefore, analysis of the process and factors that make a bank distressed can ensure that a proper set of measures could be taken to either avoid a bank failure or ensure that the burden of a potential bank rescue (including options such as bail in and bail out) is distributed equitably between the bank's shareholders and taxpayers.

A considerable number of important studies emerged after the world financial crisis of 2007/9 aimed to reveal factors predicting failure or distress at the bank level (Betz et al. 2014) or to utilize early-warning signals methods for policymakers (Demirgüç-Kunt and Detragiache, 2000; Alessi and Detken, 2011; and Sarlin, 2013). A common characteristic of these studies is that their centre of attention is solely US and European banks. Although this is justified by the fact that the global crisis of 2007/9 originated in the USA and expanded to Europe affecting operating banks in these continents, the neglect of other regions in exploring banking crisis effects is noticeable and obtrusive. Indeed, focusing research solely on these two most important financial and economic regions left the emerging and developing countries with an important research gap. Research about the causes and effects of the financial global crisis and generally studies on banking in/stability focusing on these regions and especially on the MENA one is indeed very limited. Bank distress framework for developing and emerging markets, is not an explored concept and hence its interrelations with financial stability or other banking related issues. In fact, only a few studies have focused their research attention on banking crises through discussion of distressed banks in developing and emerging markets (Sahut and Mili, 2011; Maghyereh and Awartani, 2014). The present paper focuses on banks operating in the MENA region and not only adds to the limited research for developing countries but also explores a full list of possible factors that interact with bank distress and either weaken or promote banking stability.

The choice of MENA region is validated when it is considered that, firstly, this region contains four of the most important international trade canals (Suez, Hormuz, Bab-El-Mandeb, and Gibraltar) and attracts investors and worldwide bankers (Bitar et al. 2016). Secondly, due to the region's substantial reserves of petroleum and natural gas the MENA region is an essential world trade channel and an important source of world stability. According to the latest available data from the IMF (2016), the MENA region has 60% of the world's oil reserves and 45% of the world's natural gas reserves and that makes economic and financial stability in this area a vital source of global economic stability. Since the beginning of the financial crisis of 2007/9 MENA countries have experienced volatile credit growth which has raised concerns over the stability of their financial system, as higher credit growth is usually followed by a financial crisis (Crowley, 2008). Thirdly, in most countries of the region there is a dual banking system where Islamic and conventional banks coexist, albeit, varying significantly in their operating business model. This heterogeneity is present in the MENA region with countries, most members of GCC, where the banking sector is well developed and efficient which is not the case for other countries where banking sector ownership is dominated by public sector and is highly concentrated. Islamic finance has grown from about US$150 billion of capital and investments in the mid-1990's to around US$ 500 billion in 2012 and is estimated to have over 2$ trillion of assets globally and is offered in over 60 countries according to the IMF (2016). The increasing importance over time of Islamic finance has been substantiated by IMF in an announcement that from 2019 Islamic finance will be incorporated into its market surveillance reports.

Lastly the MENA region even though it has a relatively small population of over 360 million people holds a considerable percentage of over 7% of world GDP as recorded for 2015 (IMF, 2016). The above-mentioned MENA region economic characteristics assure that the effect of a financial and banking crisis in this area could have a significant impact on the rest of the world. Therefore, our research interest in this area is well founded not only due to the limited research for this economic area but also due to its significant and growing banking role in the world economy.

Our research focus on a group of MENA countries and innovates by using bank level data to identify distressed banks for each country and for the MENA region. Additionally, we assess the effect of distressed banks on banking stability by using the GMM method (Arellano and Bond, 1991) that allows us to uncover and establish a direct link between the research material on distress and banking stability in emerging and developing markets. In other words, we expand the research on financial stability by investigating its relationship with the distress stage both before and after the crisis of 2008/9 for the MENA banking sector. We further deepen and augment the analysis with dynamic panel analysis as suggested by Arellano and Bover (1995) and Blundell and Bond (1998) as this method allows for control of potential endogeneity induced from the relationship of the measures of banking stability to specific bank characteristics and the regulatory framework. Finally, we contribute further to empirical literature to the extent that we test for MENA region the regulations effects upon bank stability along with the interaction of regulation and distressed bank degree.

Overall, this study is a first endeavour to synthesize and integrate banking stability, banks regulatory frameworks and distressed banks analysis whilst taking account of the macroeconomic environment. To do this we apply our methodology in 19 countries from the MENA and Asian regions covering the time period of 2004–2015. Our first step is to define bank distress, then construct a measure of distress and finally categorize MENA banks as distressed and non-distressed. In our model we employ two such measures which have previously been used to identify distressed banks. The first measure is draws heavily on the Uniform Financial Rating System, informally known as the CAMEL ratings system, introduced by the US regulators in 1979, where the acronym stands for **C**apital adequacy, **A**sset quality, **M**anagement quality, **E**arnings, **L**iquidity and **S**ensitivity to Market Risk. Since 1996, the rating system also includes Sensitivity to market risk (i.e., CAMELS). The CAMELS rating system is an internal supervisory tool for evaluating the soundness of financial institutions on a uniform basis and for identifying those institutions requiring special supervision.

Capital adequacy ultimately determines how well financial institutions can cope with shocks to their balance sheets. Capital adequacy ratios are a measure of the amount of a bank's core capital expressed as a percentage of its risk-weighted asset. It includes the Tier 1 capital to total assets, the Total capital ratio measured as a ratio of (Tier 1 + Tier 2) over total assets and the ratio between total equity and total assets of the bank.

The solvency of financial institutions typically is at risk when their assets become impaired, so it is important to monitor indicators of the quality of their assets in terms of overexposure to specific risks. Asset quality is represented by Ratio of loans to total assets ratio, the ratio of loans loss provisions to total loans and the ratio of bank net income to average value of assets.

Sound management is key to bank performance. To capture the possible dynamics of management quality affecting the financial performance of the banks the following variables are considered : The average of historical loan growth rate and the average of historical earning growth rate.

In the dimension of earning ability of the banks three ratios to measure financial performance are considered. The ratio of interest received minus interest paid to total earning assets, the ratio of net income to average capital equity and the ratio of net income to average assets.

To capture the impact of liquidity on the financial performance of the banks three ratios are considered. The ratio of liquid assets to short term borrowing. The ratio of total loans to total deposits and the ratio of liquid assets to total assets.

The CAMEL rating system is an internal supervision tool for evaluating the soundness of financial institutions on a uniform basis and for identifying those institutions requiring special supervisory attention using publicly available information on banks' balance sheets. This measure has the advantage that allows us to break down distress into low, medium and high levels. As in many cases the CAMELS indicator is used which includes Sensitivity and covers how particular risk exposures can affect institutions. Examiners assess an institution's sensitivity to market risk by monitoring the management of credit concentrations. In this way, examiners can see how lending to specific industries affects an institution. These loans include agricultural lending, medical lending, credit card lending, and energy sector lending. Exposure to foreign exchange, commodities, equities, and derivatives are also included in rating the sensitivity of a company to market risk, as both CAMEL and CAMELS are used interchangeably in the literature. I decide to focus on the CAMEL, since the related financial variables of the CAMELS acronym have been adopted in several studies as an appropriate standard for detecting financial distress.. The study by Poghosyan and Cihak (2009) analyses causes of banking distress in European Union and create a data base using CAMEL ,market prices of bank stocks and the economic environment. A study by Sahut and Mili (2011) to predict rather than measure the distress of banks in MENA countries. In addition, the CAMEL framework is employed by Roman and Sargu (2013) to analyse the financial soundness of commercial banks in Romania by highlighting their strength and vulnerabilities. Chiaramonte, et. al. (2015) compares the reliability of Z-score and the CAMEL approach when they investigate the soundness of a sample of cooperative, savings, and commercial banks from OECD countries.. Mishra et. al. (2012) and Mathiraj and Ramya (2014) studies use CAMEL ratios to be analysing the soundness of Indian banks. Mannasoo and Mayer (2009) considers the joint role of macro-economic, structural and bank specific factors in explaining the occurrence of banking problems in the nineteen Eastern European transition countries over the last decade and argue that the 'traditional 'CAMELS' factors have a significant ability to detect financial distress.Rahman and Masngut(2014) and Wanke et al. (2016) use the CAMEL framework to detect financial distress in the Malaysian banking system .Finally a study by Wulandari et. al. (2017) examines the impact of CAMEL and economic growth on predicting bank distress. .

The second measure of distress combines an approach that classifies banks as distressed if they have been through bankruptcy, dissolved merger or liquidation (Betz *et al.* 2014) with the approach that a bank is distressed if its loan loss provisions to total loans ratio falls into the highest quartile of the loan loss provision ratio distribution (Sahut and Mili, 2011). We further build upon the studies of Di Patti and Kashyap (2009) and Carapeto et al. (2010) using their criterion that banks that fall in the lowest and highest percentiles of the distributions of profitability and loan loss provisions can be considered as distressed. This criterion can capture the evolution of bank behaviour both over time and across banks. Our analysis further expands upon the usage of distress measure by controlling for the classification of banks into commercial and Islamic banks and by considering the regulatory environment.

Since our prime interest is to explore the direction and strength of bank distress effects on banking stability our next goal is to measure banking stability. The measures adopted, after a thorough analysis of existing ones, is the Z-score index as a measure of stability at the bank level and the credit risk taking of banks is captured by the Non-Performing Loans (NPLs) ratio following closely the latest developments in the research literature (Beck *et al*. 2013(b); Bourkhis *et al*. 2013 and Chen *et al*. 2017).

Another difficult goal is collecting the essential data for composing regulatory indices that will realistically represent all available information on existing supervision guidelines and policies for these countries (see section 2.4.1). Macroeconomic environment developments are easily captured by three widely used key indicators: the real GDP growth rate, the inflation rate and the unemployment rate. For the estimation of our theoretical models, we use panel data with the pooled OLS and fixed effects approach to estimate the effect of distressed banks on our measures of overall banking system stability, also controlling for levels of distress and their interaction with the regulation framework.

The empirical results using both the CAMEL approach (first distress indicator showing three levels of distress named distress 1) and the dummy approach (second distress indicator having a binary approach on distress status of each bank named distress 2) support the importance of identifying distressed banks and the levels of distress in our analysis of the MENA region. The results have important implications in the context of enhancing the stability of banks while providing evidence about how banks' risk taking policy changes in response to the implementation of different regulations and supervision policies both before and after the financial crisis of 2008/9. Finally, we provide policy recommendations for considering closely the distress level of banks and to build up a regulation environment after accounting for bank and country specific characteristics.

The rest of the paper is organized as follows: Section 2.2 reviews the relevant literature. Section 2.3 presents the main characteristics of Islamic finance system; section 2.4 describes the data and variables used Section 2.5 the theoretical models to be estimated and in section 2.6 we present and discuss the empirical estimates. The results are discussed in Section 2.7 and finally section 2.8 concludes and presents the policy implications.

2.2 Literature Review

2.2.1 Banking and Financial Stability

Although, it is prevalent that the terms of financial stability and banking stability are used alternatively, conceptually they are different. Financial stability presupposes a stable banking sector, and a banking crisis is always a precondition for the spark of a possible financial crisis. This distinction has been repeatedly expressed in the financial stability reports (FSRs) that most central banks publish each year (Gadanecz and Jayaram, 2009). Hence, financial stability is a more general term than banking stability and is concerned not only with the banking sector but additionally with non- financial institutions. That is, financial stability describes the interactions between all the different segments of an economy's monetary and non-monetary institutions, requiring a multidimensional approach for capturing its size and complexity (Jeannea, 2014). In addition, after the financial crisis of 2008 the FED, the ECB (ECB 2017) as well as organizations such as the IMF (IMF, 2018), BIS and World Bank have broadened the financial stability definition as "the prevention of the build-up of systemic risk". Banking stability tends to focus on the safety of financial institutions at the micro prudential level. This is especially important for understanding the different effects of a single versus multiple sources of risk simultaneously, which is often important for banks.

The complexity encountered when developing a unique financial stability definition and measure is highlighted by Cihak et al. (2012) where they analyse the content of 44 financial stability reports (FSRs) and conclude that there is a weak empirical link between published financial stability reports per se and financial stability as measured empirically. One would argue that Financial reports are using a variety of indicators not always directly relevant to banking stability and provide an overview of the country's financial conditions for the immediate future and real economy prospects. However, the empirical studies when exploring bank stability, use past years data not only for a single country but for a region or for a group of countries and their main aim is to econometrically reveal the main contributors to bank (in)stability and/or ex post explain the financial crisis causes . All these empirical measures are backward looking when examining crisis events and even up to date, financial stability measures face the same issue as the FSRs reports when not examining crises closely. As noted by Munoz *et al.* (2012) that "there is only a weak empirical link between financial stability report publication per se and financial stability. This suggests room for improvement in terms of the quality of financial stability reports." In more recent years and especially since the Covid pandemic, FSR reports such as the quarterly reports by the IMF (2021) tend to include future challenges and highlight policies that may mitigate systemic risks. Still financial stability indicators tend to vary from a methodological point of view. A study by Horvath and Vasko (2016) broadens the coverage of FSRs reports to 110 countries from the 44 of Cihak *et al.* (2012) and develops a financial stability transparency index based on these reports. The index includes several advanced and emerging countries with specifications that allow meaningful comparisons across countries. The study also finds significant variations across the definitions and estimation methods of financial stability. Their index also assesses the effect of financial stability transparency on financial stability. Doumpos et al. (2015) also construct a financial stability index from central banks' stability reports within their attempt to identify the relationship of central bank independence and regulatory structure with financial stability. The index consists of 11 components, each one taking values 0, 1/2 or 1 and covers 110 countries from 2000 to 2011. One of the more recent studies that show the variety of financial stability indices constructed, is by Lepers and Serrano (2019) who construct a vulnerability index of the financial system of emerging economies from 2005 – 2015 based on aggregating 32 indicators using Granger Causality analysis and various data illustration narratives. Their analysis points to a further need to expand the analysis on financial stability moving away from the credit to GDP gap and the early warning models stemming from crisis regression work. The credit-to-GDP gap ("credit gap") is defined as the difference between the credit-to-GDP ratio and its long-term trend. Borio and Lowe (2002, 2004) first documented its property as a very useful early warning indicator (EWI) for banking crises. Even though a variety of measures have been proposed to reflect and capture banking stability, the dominant measure used in the relevant research is the Z-score index which is constructed purely from accounting and balance sheet data (Beck et al. 2007; Boyd and Runkle, 1993; Čihák and Hesse 2010; and Laeven and Levine, 2009, Fu et al. 2014, Koehler 2015, Carretta et al. 2015 and Klomp and Haan, 2015). This index combines buffer elements (capitalization and returns) with risk elements (volatility of returns) to measure a bank's solvency risk; a higher Z-score implies a lower probability of insolvency. The Z-score measure has the advantage that it can be easier constructed for any type of financial institution, especially in the case where very detailed data (either accounting or market data) may not be available.

All the stability measures referred to so far have been used in academic research on how banking stability is related to regulation practices, monetary authority's independence, foreign capital presence in banks and bank business models. Two missing points are obvious from these studies. First none of them so far assesses the effect of distressed banks on either financial or banking stability and second their analysis has largely been conducted on developed countries and conventional banks. The first part is an important gap in this field of research especially relevant for addressing both financial and banking stability issues in different economies under examination. The reason is our approach allows us to categorize distress at different levels and treat it as a bank characteristic/variable whereas distinguishing it from the banking stability indicator to the extent possible given the use of bank balance sheets. However, a simple measurement and inclusion of distress is not enough to fully capture, decompose its impact and evaluate its effects on banking stability. We also need to assess it in terms of its relationship with the regulation environment, banks' characteristics and macroeconomic environment. Only then can optimal policies be developed, especially in the changing environment of regulation in developing and emerging markets. Furthermore, the research attention to developing economies and to regions where Islamic finance coexists with conventional banking is an interesting and promising area of research.

2.2.2 Regulation and supervision of banks

There is a range of proposed measures to quantify the regulation and supervision frameworks. In the present analysis, we make use of indices published by World Bank and developed by Barth et al. (2004, 2006, 2008, 2013) which present three aspects of banking regulation such as capital stringency requirements, supervisory power and banking activity restrictions.

Capital Regulatory Requirements (CAPR): Capital regulations determine the amount of capital that bank must keep apart to face various risks associated its activities. Regulators believe that there is a positive association between capital requirements and soundness/stability of the banking sector. Theoretically, Barth et al. (2006) argue that the capital adequacy requirements prompt firstly banks to be more stringent with lending criteria and hence keep non-performing loans at low levels and secondly that banks consider capital as a buffer against losses and both considerations protect banks form failure. In a later study by Barth et al. (2008) argued that despite the adoption by many countries the Basel capital requirements guidelines their banking system stability either was not affected or in some cases stability was weakened as a result of banks shifting toward risky behaviour to compensate for loss returns associated with capital requirements. However, Barth et al. (2013) found that the bank's efficiency was significantly and positively affected by higher capital requirements. However, the study by Pasiouras et. al. (2009) report mixed results with respect to efficiency. They found that Capital requirement affects positively and negatively the cost and profit efficiency, respectively. In Pasiouras et al. (2006) directly explore the relationship of capital requirements and bank stability and found a significant negative relationship between them. In contrast, some studies report either report no existence of capital requirement and bank performance relationship (Barth et al. 2004) or a non-significant relationship between capital requirements and risk-taking as measured with non-performing loans (Boudriga et al 2009).

Official Supervisory Power (SUPP): There are two opposing views how the powerful bank supervision impact upon bank stability. These views are linked to the opposing theoretical views of how the authorities exercise their regulatory power. Barth et al. (2004, 2013) propose on the one hand the "public interest view" where supervisory authorities set up and exercise an unbiased supervision framework that protect and benefit public interest and so secure bank stability. On the other hand, they propose the “private interest view” where when authorities set up the supervisory framework, rules and restrictions are directed in favour of certain interest groups such as government owned banks and other specific interest groups such as politically connected. This prejudiced supervision framework deteriorates bank performance and jeopardise banking market stability. Empirical studies support both views. Barth et al (2002) found that high supervision power increased non-performing loans and endangered bank stability (private interest view). Also, Pasiouras et al. (2009) found that when supervision power increases both cost and profit efficiency fall (private interest view). In contrast, Agoraki et. al. (2011) supports the public interest view since supervision power and bank insolvency are found to be negatively related.

Restrictions on banks activities(ACTRS): These are considered to have an impact on banks' soundness. Banks with the purpose of boosting the return on assets and maximize profits are on the one hand inclined to be engaged in financial products that bear high risk and on the other diverse their activities in a broad range of products (insurance and real estate) with possible conflict of interest to appear (Barth et al. 2006). The restrictions imposed by authorities on banks’ asset allocation has the intention to limit risk-taking and safeguard their stability. So, this line of thought argues for a positive relationship between restriction on bank activities and stability. However, the opposite view put forward the idea that high restrictions are an impediment for banks to diversify their resources, increase charter value and utilize economies of scale. All these will then adversely impact on bank stability (Barth et al. 2006). Empirical evidence provide support for both views. Barth et al. (2004) showed that when authorities restrict bank activities, banks’ stability weakens and this result is also supported from the findings by Kim et al. (2013) where bank activities are correlated with lower probability of banking crisis. However, Pasiouras et al. (2009) cited that bank soundness improves with the presence of bank activities restrictions.

We must however notice that the quantitative measurement of regulation and supervisory was a challenge. This is a growing field of research focused on constructing regulation indices pioneered by the work of Barth et al. (2002, 2004, 2008, 2013). In the same line of thought as Barth et al. studies, Horvath and Vasko (2016) constructed a comprehensive index of transparency of central banks for 110 countries from 2000 to 2011. Their study includes several advanced and emerging countries with specifications that allow meaningful comparisons across countries. Then they examine then the determinants and effects of this index. Such an index also provides a direct measurement of how transparently banks conduct their business while balancing the different objectives of different groups who have interest in the wellbeing of the bank from different perspectives, such as borrowers, lenders, shareholders and regulators (Government and Central Bank).

Even though a variety of measures have been proposed to reflect and capture banking stability, the dominant measure used in the relevant research is the Z-score index which is constructed purely from accounting and balance sheet data (Beck et al. 2007; Boyd and Runkle, 1993; Čihák and Hesse 2010; and Laeven and Levine, 2009, Fu et al. 2014, Koehler 2015, Carretta et al. 2015 and Klomp and Haan, 2015). This index combines buffer elements (capitalization and returns) with risk elements (volatility of returns) to measure a bank's solvency risk; a higher Z-score implies a lower probability of insolvency. The Z-score measure has the advantage that it can be easier constructed for any type of financial institution, especially in the case where very detailed data (either accounting or market data) may not be available.

All the stability measures referred to so far have been used in academic research on how banking stability is related to regulation practices, monetary authority's independence, foreign capital presence in banks and bank business models. Two missing points are obvious from these studies. First none of them so far assesses the effect of distressed banks on either financial or banking stability and second their analysis has largely been conducted on developed countries and conventional banks. The first part is an important gap in this field of research especially relevant for addressing both financial and banking stability issues in different economies under examination. The reason is our approach allows us to disseminate distress at different levels and treat it as a bank characteristic/variable whereas distinguishing it from the banking stability indicator to the extent possible given the use of bank balance sheets. However, a simple measurement and inclusion of distress is not enough to fully capture, decompose its impact and evaluate its effects on banking stability. We also need to assess it in terms of its relationship with the regulation environment, banks' characteristics and macroeconomic environment. Only then can optimal policies be developed, especially in the changing environment of regulation in developing and emerging markets. Furthermore, the research attention to developing economies and to regions where Islamic finance coexists with conventional banking is an interesting and promising area of research.

2.2.3 The distressed bank: concept and measurement

The "distressed bank" concept has received limited attention prior to the crisis of 2008 (King *et al.* 2006 and Koetter *et al.* 2007). The term "distressed bank" has become increasingly popular over the last years for decomposing the fundamental drivers of banks' risk and designing optimal resolution policies (Kick *et al.* 2010 and Betz *et al.* 2014).

The potential need for outside (government or central bank) intervention in the case of problem banks is used as the criterion for a bank to be defined as a distressed bank by Koetter *et al*. (2005) and Kick and Koetter (2007). More specifically, Koetter *et al.* (2005) define a distressed bank "as a bank which is in danger of ceasing to exist as a going concern without outside intervention" and the only criterion required in order to include a bank as distressed is whether the bank accepted any correction or intervention from regulatory and supervisory authorities.

Profitability is another criterion for defining bank distress. According to Di Patti and Kashyap (2017) a distress definition may be based on parameters of profitability for the four largest euro area countries, namely France, Germany, Italy Spain. Specifically, a bank is in distress at year *t* if two conditions hold: firstly, its Return on Assets (RoA) has dropped by at least half (50%) compared to year t-1 (as a result of a shock) and secondly, the RoA value is such that the bank moves below the 25^{th} percentile of the returns on assets distribution across the sample average. The authors use the distress definition to categorise banks as newly distressed based on the two conditions above and extract patterns such as the initial profit drop being an important factor for banks' recovery.

In studies that deal with US banks the expression ''*problem bank*' 'is preferred instead of distressed bank and the on-site rating system CAMEL, ranging from 1 to 5, is the yardstick for distinguishing between non-problematic and problematic banks. These definitions of problematic banks are incorporated in the studies of Oshinsky and Olin (2005), and Cole and Curry (2011). They differ only in that the first study takes a narrower definition of a problematic bank and excludes those with CAMEL rating 3 although both studies agree that CAMEL rating of 4 and 5 are problematic banks.

As Männasoo and Mayes (2009) have demonstrated, this leaves an important gap which is the use of CAMEL in having a significant ability to detect financial distress to a certain degree. This approach is used in many papers as a measure of banks performance soundness. Amon others, Koetter *et al*. (2007) compare the CAMEL profiles of merging and non-merging banks. Rodica-Oana (2014) examines the evolution of the Romanian banking using the CAMEL approach. Čihák and Schaeck (2010) deduce that some of the CAMEL indicators, as measure of banks' soundness, can help identify systemic banking problems. The CAMEL approach is used by Sahut and Mili (2011) in order to measure the distress of banks in MENA countries. The CAMEL framework is employed by Roman and Sargu (2013) to analyse the financial soundness of commercial banks in Romania by highlighting their strength and vulnerabilities. Chiaramonte, Poli, and Oriani (2015) compare the reliability of Z-score and the CAMEL approach when they investigate the soundness of a sample of European banks. Finally, Wanke, et al. (2016) use the CAMEL framework to assess the financial distress of the Malaysian banking system and found higher inefficiency levels in Islamic banks. It is important to note that across the literature discussion for CAMEL indicators, the proxies used tend to vary and this is attributed to two main reasons: data availability and cut off range to classify whether the different CAMEL indicators are in the range of 1 to 5 with 5 being the level closest to distress. The general consensus is that CAMEL indicators are elucidated as follows: "Capital adequacy" is the first CAMEL variable which is measured as the ratio of total equity to total assets (Chiaramonte *et al.*2015; Čihák and Schaeck, 2010; Rodica-Oana, 2014; Roman and Sargu, 2013). Higher equity boosts a bank's soundness. "Asset quality" is computed as the ratio of non-performing loans to gross loans (Čihák & Schaeck, 2010). Thus, "Asset quality" is inversely proportional to a bank's soundness. "Management quality" of the bank is approximated by the cost-to-income ratio (Wanke *et al.* 2016). Low values of the cost-to-income ratio indicates better managerial quality and so better bank soundness. "Earnings ability" is measured by the profitability measure ROE which is also an indicator of financial performance (Čihák &Schaeck, 2010; Roman & Sargu, 2013; Wanke *et al.* 2016). Since higher values of ROE are indicators of higher profitability there is proportional association between this measures and bank soundness. "Liquidity" is proxied by the ratio of liquid assets over total assets (Čihák & Schaeck, 2010; Roman & Sargu, 2013). It constitutes one of the vital elements that evaluate the operational performance of a bank because it indicates the capacity of a bank to pay its short-term debts and face unexpected withdrawals of depositors. The indicators that measure liquidity reflect the capacity of banks to withstand shocks to cashflows (IMF and World Bank, 2005, p. 26). Hence, "Liquidity" has a significant impact on its financial soundness. “Sensitivity to market risk” is defined by the ratio of non-interest income to net operating revenue (Chiaramonte *et al.* 2015). Due to data availability constraints, we use such a proxy because the magnitude of non-interest income greatly reflects bank participation in activities related to financial markets such as securities trading, asset management services, to name a few. For that reason, we suggest that “Sensitivity to market risk” is proportional to bank's soundness because diversification leads to risk reduction and therefore lower probability of insolvency risk and greater banking stability.

Another distress measure which is based on bank’s financial accounting data is the loan loss provision ratio which is used in a group of studies. Elsas (2004) uses an indicator for troubled banks where they first construct a loan loss provisions distribution from the full sample of banks and then determine where each bank’s loan loss provision level falls within the distribution deciles. This distribution determines whether a bank is categorised as a troubled (distressed) bank or not depending on whether its own loan loss provisions level is in the worst decile. The same approach is adopted by Sahut and Mili (2011) who investigate the determinants of distressed banks in MENA countries. An attempt to settle the issue of distressed bank definition is a comparative study by Carapeto *et al*. (2010) where the authors use bank accounting variables and construct ten candidate indices for distress which are then tested against realized distressed merger events. Their comparative results lead them to best define a bank as distressed “*if the ratio of its non-performing loans to total loans is in the two highest deciles of the industry using a three-year moving average*” Finally, the study by Altman *et al.* (2014) examines the importance of accounting standards as information for explaining bank distress variation among many countries. In their analysis, they define distress as “a condition in which a bank’s realized or expected income from existing assets deteriorates to the extent that it impairs the bank’s current or future ability to honour commitments to its creditors.” Since the definition is rather broad, it can be related both to the profitability measures explained above and to the original definition of distress under which distressed banks are the ones that cannot repay their liabilities.

Our approach makes use of the standard measures mentioned above but it differs in the modelling structure and updates the relevant research in many aspects .. A distinctive characteristic of our model structure is that for the first time it directly explores the role and estimates the effects of distress on banking stability applying not only common panel estimation methods but also the GMM technique. The period of investigation covers the period before and after the recent global financial crisis. Lastly as already mentioned in section 1 we focus our attention on the MENA region since it is an economic and financial area with a global financial influence (IMF, 2015 and Bitar et al. 2016), and provide us the opportunity to study the characteristic of the coexistence of Islamic and conventional banks in this region in terms of stability. The Islamic-Conventional mixture of banks is, an issue discussed by Ariss (2010), Beck et al. (2013) and Pappas et al. (2017). Finally, we investigate how variability in regulation and supervision design at the country level (Appendix 1 Table 1 and Table 2) affects banking stability.

Our first hypothesis to be tested is as follows:

H1: Different levels of Bank Distress have a negative effect on banking stability, irrespective of the type of banks (conventional or Islamic) in the MENA region.

Summarising the issues covered in the studies reviewed above we can point out two facts. First the distress concept and its implementation varies substantially depending on where it is implemented and, second the study by Sahut and Mili, (2011) is the only one that has utilised the distressed bank concept in the MENA region There remains an important research gap especially given the fact that banks in developing countries have continued expanding their global role since the crisis of 2008 and most developed countries have strong bonds with these countries either through foreign bank branches or through foreign direct investments . Therefore, being able to identify which banks should be correctly classified as distressed under different regulatory frameworks makes it easier to design a unified regulation framework which can protect the financial system from another crisis originating from an important but "neglected" financial centre of the world. Indeed, there are recent studies concerning how the regulation environment can play an important role in banking operations in different regions mainly based on the database built up by Barth *et al.* (2013b). Recent papers have focused on the importance of international banks utilising regulation as the control environment (Ayadi *et al.* 2016). However, only a handful of studies such as Doumpos *et al*. (2017) deal with the MENA regulatory environment. The advantage of using regulatory information is the ability to classify countries depending on how strict they are in terms of applying rules to the financial sector. We expect the differences on the level and strictness of regulation, specifically on capital stringency, activity restriction, supervisory power and the level of corruption to play an important role in banking stability. Therefore, the second hypothesis for testing is as following.

H2: As the level of distress increases for all types of banks in the MENA region, when combined with a constant regulatory environment, the overall effect on banking stability is negative.

2.3 The Islamic Finance system and bank characteristics

2.3.1 Islamic Finance

Sharia' law is a legislative framework that regulates all aspects of life both private and public. Accordingly, Islamic finance means that all financial transactions are based on Sharia´ principles and legal framework which forbid payment or receipt of Riba. Riba refers to an excess return of an amount based on money lending. The Islamic terminology for such a kind of lending is "Qard Al-Hasan." It is interesting to note that Sharia´ recognizes the time value of money, since according to Islamic rules the price of a good to be sold on a deferred-payment basis can be different from its current value. Interest reflects the time value of money and the interest rate is an exchange rate across time. While Sharia´ recognizes interest in business, it prohibits interest on lending (Obaidullah, 2005).

The Islamic finance evolved based on Islamic rules on transactions where the Fiqh Muamalat covers the rulings that define and govern the relationship between humans, i.e., their financial rights and obligations towards each other and can mainly be categorized as: i) Debt-based financing: the financier purchases or has the underlying assets constructed or purchased and then this is sold to the client. The sale would be on a deferred-payment basis with one or several instalments. ii) Lease-based financing: the financier purchases or has the underlying assets constructed or purchased and then rents it to the client. At the end of the rental period ownership would be transferred wholly or partially to the client. iii) Profit Loss Sharing financing: the financier is the partner of the client and the realized profit or loss would be shared according to pre-agreed proportions (Khan and Ahmed, 2001). The first two Islamic finance methods are collectively known as Non-Profit and Loss Sharing "Non-PLS." Besides restrictions on Riba, Sharia´ has various other prohibitions which should be considered. For instance, according to the Sharia´ all contracts should be free from excessive uncertainty "Gharar" (Obaidullah, 2005), Hence, Islamic financial institutions face some restrictions on the application of financial derivatives and other types of contracts (including various forms of insurance policies).

2.3.2 Islamic Banks

Islamic banks, in practice, deviate somewhat from the above-mentioned financing principles and can operate similarly to conventional banks (Abedifar *et al*. 2013). This means that withdrawal risks may persuade management to vary from Non-PLS principles by paying competitive market returns to investment account holders regardless of realized performance. Chong and Liu (2009) use Malaysian data to show that investment deposit rates of Islamic banks are close to those of their conventional counterparts. They argue that competitive pressure from conventional banks constrains the actual implementation of non-PLS arrangements. This strategy can also help management to mitigate the sensitivity of investment account holders to bank's performance and hence avoid greater discipline.

In other words, equity-holders of Islamic banks can be at risk from transferring a part of their profits to investment account holders to reduce withdrawal risk. Nevertheless, in the event of crisis, management is highly likely to share realized losses with investment account holders to avoid insolvency. This suggests that Islamic banks may have a greater capacity to bear losses compared to conventional banks. The magnitude of the extra capacity depends on the weight of investment deposits in total funding. When Islamic banks are performing well, they may adjust profit rates upward but at a slower rate than realized profitability to limit the level and volatility of deposit inflows. Implicitly, investment account holders own a bond, a long position on a call option and a short position on a put option. The strike price of the call, however, is determined arbitrarily by Islamic banks, in the absence of supportive regulations on the account holders' rights. The strike price of the put is determined based on the degree of market competitive pressures, level of incurred loss, and the capital ratio of the Islamic bank.

Assets

In the process of lending, Islamic banks tend to apply non-PLS principles due to the risks and complexities associated with the PLS method. For instance, under PLS financing, Islamic banks need to determine the profit or loss sharing ratio for each project, which can be complicated due to difficulties in quantifying the characteristics of clients and the proposed business opportunity. Revenue is not guaranteed and since they cannot collect collateral, they need to put more effort into selection and monitoring to ensure that borrowers do not extract informational rents. Hence, for short-term financing, it is not viable for Islamic banks to use the PLS method. Moreover, under the Mudarabah contract Islamic banks have limited means to control and intervene in the management of a project (Abedifar *et al*. 2013).

Islamic banking is characterized by various features that appear to reduce credit risk. Greater discipline associated with higher deposits fragility (exerted by depositors' risk aversion) and the religious beliefs of borrowers may induce loyalty and discourage default. On the other hand, Islamic banks may face greater credit risk due a variety of factors such as: the complexity of Islamic loan contracts, limited default penalties, and moral hazard incentives caused by PLS contracts. In terms of insolvency risk, the special relationship with depositors could provide Islamic banks with greater capacity to bear losses yet at the same time, operational limitations on investment and risk management activities could make them less stable than their conventional counterparts. In addition, while interest is forbidden in Islamic banking, those institutions that compete with conventional banks may be forced to mirror their pricing behaviour and as such may be sensitive to interest rate changes. Higher or lower sensitivity compared to conventional banks is an empirical question which Abedifar *et al*. (2013) examine and, they conclude that Islamic banks have lower credit risk than conventional banks. In terms of insolvency risk, small Islamic banks also appear to exhibit greater stability than conventional banks, as they have to have better capital bases.

Understanding the risk features of Islamic versus conventional banks banking stability will enable us to investigate whether Islamic banks should be treated differently. Different treatment could potentially include a different legislation framework for these two types of banks, different treatment by regulator and whether traditional risk management tools should be used to gauge and control these risks.

H3: Regulatory environment in the MENA region is affecting stability of banks and its effect becomes more intense when interacts with bank distress levels.

H4: Conventional banks have a stronger negative effect on banking stability compared to Islamic banks in the MENA region.

H5: Distressed conventional banks interact more negatively with banking stability compared to distressed Islamic banks for the MENA region.

2.3.3 Arab Spring

The Arab Spring represents a period where revolts against the current regimes took a significant toll on the economic activity of the MENA region and Ghosh (2016) shows that the recent political turmoil in the Middle East due to the “Arab spring” had a detrimental effect on bank stability. The effect of this period differs depending on the country as some countries experienced negative shocks (stock markets of Egypt, Tunisia, Morocco and Lebanon recorded losses in the range of 8–15% during the period) while others experienced positive shocks (UAE and Qatar for example, witnessed a decline in NPLs). The overall economic effects of the Arab Spring vary by country (range of countries and events provided at Table 2-1 below). Deposits grew at a compound rate of 9% during 2010–2012 in the MENA countries. On the other hand, the growth in private credit during the same period was roughly of the order of 4%. These numbers, however, hide the wide divergence across countries (Finger and Gressani, 2014). To illustrate, deposit growth in the affected countries during this period was less than 0.5% as compared to over 20% in the non-affected ones. As compared to this, the change in overall credit was even sharper, declining by nearly 4% in the less-impacted countries as compared to nearly 20% in the affected ones.

Table 2-1 Arab spring presence and effects on

Country	Years	Effect
Algeria		No Impact
Bahrain	2011-2012	Civil disorder and governmental changes
Egypt	2011-2012	Civil disorder and governmental changes
Jordan	2011	Major protests and governmental changes
Kuwait	2011-2012	Major protests and governmental changes
Lebanon	2011	Major protests and governmental changes
Morocco	2011	Major protests and governmental changes
Oman		Minor Protests
Qatar		No Impact
Saudi Arabia		Minor Protests
Tunisia	2011-2012	Government overthrown
United Arab Emirates		No impact

Source: World Bank, IMF, Countries Reports. Arab Spring was a revolutionary wave of both violent and non-violent demonstrations, protests, riots, coups, foreign interventions, and civil wars in North Africa and the Middle East that began on 18 December 2010 in Tunisia with the Tunisian Revolution.

Despite its effects on the real economy and the financial sector, research on the effect of the Arab Spring on banks remain rather limited. Early analysis from Khandelwal and Roitman (2013) as well as from Mahboub and Abdou (2012) confirm that political instability results in significant output losses and those economic conditions were an important factor driving the Arab Spring revolutions. Regarding the real sector, Campante and Chor (2012) document how poor labour market prospects promoted the Arab Spring in the Middle East, in countries where the absence of democratic mechanisms for regime change led to societal pressures piling up against the incumbent regime. One of the few studies that analyses the impact of the Arab Spring on bank returns and risk in the MENA countries is by Ghosh (2016) who uses information on 106 banks of MENA during 2000–2012 and investigates the impact of political transition on bank behaviour by employing a difference-in-differences methodology. The analysis indicates that the Arab Spring lowered profitability and raised bank risk, which gives further support to the arguments about the potential impact from adverse political environments to the financial sector. Combined with the situation of a private sector that does not exist in the Middle East without state support and disconnection from global markets (Malik and Awadallah, 2013), it is necessary to study the relation of the Arab Spring as an external factor to the financial sector and combine it with the concept of distressed banks. This linkage can provide insights on how the financial sector is affected by political instability. What also makes this case especially interesting, is the randomness of the shock imposed on both the macroeconomy (Faria and McAdam, 2015) and the political situation, coupled with the variability on the types of banks existing in all the countries where Arab Spring had direct or indirect effects.

H6 (a): The Arab Spring has a negative effect on banking stability in all countries of the MENA region.

H6 (b): The Arab Spring combined with distressed banks has a negative effect on banking stability in all countries of the MENA region.

2.4 Data and Descriptive Statistics

Bank-level data was collected from ORBIS Bankscope and the websites of individual banks. The Bankscope classification for Islamic banks is only partly correct therefore all banks have been crosschecked with their websites available data to ensure maximum accuracy. The initial sample covers observations for 390 banks, across 21 countries in the MENA region over the period 2004–2014. The selection criteria for the final sample of the number of banks, countries and the covering period are the following: First, we consider banks with at least three years of available data. Second, we consider only countries with available data regarding the macroeconomic environment and the regulation framework with at least four banks and third, we drop Syria due to the ongoing crisis in the country from 2009. The application of the above filter restrictions on our initial sample leaves us with a final sample that consists of 20 MENA countries with 100 Islamic banks and 222 conventional (commercial) banks summing up to 322 banks. For Iran, observations are only available for Islamic banks as its banking system is 100% Riba-free. In other countries, both Islamic and conventional banking are authorized operating and practiced. Approximately, 40% of the total observations are for Islamic banks. A complete overview of the banks and countries is given in Table 2-3.

In addition to the bank-specific variables macroeconomic factors are likely influence bank stability. Neoclassical growth theory outlines the three factors necessary for a growing economy. These are labour, capital, and technology where capital accumulation is considered the corner stone of economic growth. This growth theory posits that the accumulation of capital within an economy, and how people use that capital, is important for economic growth. Further, the relationship between the capital and labour of an economy determines its output. Finally, technology is thought to augment labour productivity and increase the output growth. Therefore, savings and investment activities are playing a key role to increase available capital and move the economy to higher steady-state position. There is a consensus that the process of capital accumulation and growth is enhanced by financial markets since a higher degree of financial deepening through higher rates of saving and investment enhances economic growth. The argument that capital accumulation and growth is strengthened by the financial system that channel the resources of savers to borrowers has been presented early by Schumpeter (1912) who considers financial development a necessary condition for economic growth and that improved financial sector increases growth in technological innovations through the redistribution resources to productive areas. Empirical support for Schumpeterian hypothesis is given by King and Levine (1993). Furthermore, according to Levine (2005) improved domestic financial development is projected to spur economic growth through risk diversification, efficient resource allocation, reduction in information asymmetry, implementation of sound corporate governance practices and facilitating the exchange of goods and services. Thus, a healthy level of countries' domestic FD promotes EG through its efficient mobilization of resources that support capital formation and ultimately growth (Ehigiamusoe and Lean, 2018). For a comprehensive introduction to the literature related to the financial deepening and economic growth theoretical links is provided by Bhattarai k. (2015) where he examines the efficient and optimal path of capital output ratios implied by a dynamic general equilibrium model accounting for savers, investors and government. He concludes that 'shocks in financial deepening ratio cause massive macroeconomic fluctuations.' (p. 22). Furthermore, other studies investigate the role and impact of financial inclusion on economic growth and bank stability. Empirical studies agree that financial inclusion not only promotes economic growth Sethi and Acharya(2018) but also enhances bank stability (Ahamed and Mallick (2019), Danisman and Tarazi (2020), Jungo et. al. (2022) mainly through the channel where more people gain access to the banking system and, ceteris paribus, the banking system enjoys greater liquidity and funding sources. In our study the variables used for measuring the macroeconomic environment, are those commonly used in the literature. First is the real GDP growth rate which is used to monitor the effect of fluctuations in the business cycle and the trend of economic growth in general and indirectly includes the financial inclusion impact on access to banking facilities and provision of credit for new business set up or expansion of old ones and economic growth. Although the usual argument is that economic growth promotes stability in this context a study by Matsuyama (2007) has found evidence that economic growth encourages banks to reduce financial restrictions intended to restrict lending, which in turn generates more risk. Second, we use the variable real GDP per capita as an indicator of the general level of economic development. According to Demirgüç-Kunt and Huizinga (2010), banks in developed countries get lower return on assets, and have less risk than those in developing countries.

Third, we control for inflation as suggested in the work of Demirgüç-Kunt and Huizinga (2010), where the authors conclude that a high inflation rate makes banks achieve a high rate of return on assets, but also carries a high level of risk.

Theoretically, inflation erodes the consumers' purchasing power, which affects their ability to repay their loans and hence negatively affects bank's stability. This negative relationship can be explained by the fact that higher inflation rate affects the real value of individuals' income, leading to an increase in the number of impaired loans and increased insolvency (Fofack, (2005), Rinaldi and Sanchis-Arellano, (2006). On the contrary, other studies such as Nkusu (2011) Donath et al. (2014) and Rajha (2016) demonstrate that the explanatory power of inflation is considerably high in reducing NPLs and increase bank stability. All these findings are in accordance with the role of inflation as a determinant of bank stability.

Table 2-2 give the details for variables names, definitions and data sources and table 2-3 provides information on numbers of Islamic and conventional banks per country.

Table 2-2 variables definition and sources

Dependent Variable: Banking Stability		
Z-score	Measure of the distance of a bank from insolvency. Computed as the sum of equity to asset ratio and the return on assets (RoA) divided by the standard deviation of the RoA	Bankscope, Authors calculation
Ln (Z-score)	Measure of the distance of a bank from insolvency. Computed the natural logarithm of Z-score.	Bankscope, Authors calculation
NPL	The ratio between Non-performing loans and the total gross loans of the bank	Bankscope
Independent Variables		
Bank Specific Variables		
CAMEL		
Capital		
TC1	Tier 1 capital to total assets	Bankscope
TCR	Total capital ratio measured as a ratio of (Tier 1 + Tier 2) over total assets	Bankscope
EQA	The ratio between total equity and total assets of the bank	Bankscope
Asset quality		
LAS	Ratio of net loans to total assets.	Bankscope
LLP	Ratio of loan loss provisions to total loans.	Bankscope
RoA	The ratio of bank net income to average value of assets	Bankscope
Management quality		
LGR	Average of historical loan growth rate	Bankscope, Authors calculation
EGR	Average of historical earning growth rate	Bankscope, Authors calculation
Earnings		

NIM	Net interest margin measured as a ratio of (interest received − interest paid) to total earning assets.	Bankscope, Authors calculation
ROAE	Return on average equity measured as a ratio of net income to average capital equity.	Bankscope, Authors calculation
ROAA	Return on average assets measured as a ratio of net income to average assets.	Bankscope, Authors calculation
Liquidity quality		
LATS	The ratio between liquid assets and short term borrowing of the bank	Bankscope, Authors calculations
LTD	The ratio of total loans to total deposits of the bank	Bankscope, Authors calculations
LAT	The ratio of liquid assets over the total assets of the bank	Bankscope, Authors calculations
Bank Distress		
Low Distress	Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 1-2.4	Bankscope, Authors calculation
Medium Distress	Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 2.5-3.4	Bankscope, Authors calculation
High Distress	Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 3.5-5	Bankscope, Authors calculation
Distress Dummy	The observed value of the binary is one under the state of distress, and zero otherwise.	Bankscope, Authors calculation
Bank Controls		
Size	Natural logarithm of assets (in millions of constant US dollars)	Bankscope, Authors calculation
IntRate	Rate of interest charged on short-term loans made between banks	Bankscope, Authors calculation
Islamic	A dummy equal to 1 if a bank is Islamic and 0 otherwise	Bankscope, Authors calculation
Macroeconomic Variables		
GDPG growth rate	The annual growth rate of each country's real GDP	World Bank, IMF
GDP per capita	Gross domestic product divided by midyear population in constant 2010 U.S. dollars.	World Bank, IMF
INF	The inflation rate based on the consumer price index	World Bank, IMF

UNEM	Percentage of unemployed to total labor force (%)	World Bank, IMF
Regulatory variables		
CAPR	Capital Requirements: An index that takes values between 0 and 10, with higher values indicating greater stringency.	World Bank, Barth *et al.* (2004,2008,2013)
SUPP	Supervisory Power: An index that takes values between 0 and 14 with higher values denoting greater supervisory power.	World Bank, Barth *et al.* (2004,2008,2013)
ACTRS	Activity Restrictions: An index that takes values between 0 and 16 with higher values indicating more restrictive environment enforced by government	World Bank, Barth *et al.* (2004,2008,2013)
REGQ	Annual index of the quality of regulatory quality in the country. The index ranges from −2.5 to 2.5 with higher values denoting better institutional development.	World Bank, WGI
Control Variables		
Crisis Dummy	A dummy equal to 1 for the global financial crisis of 2008-2009, 0 for other periods	World Bank, Authors calculation
Arab Spring	A dummy equal to 1 for the Arab spring of 2011-2012 for Algeria Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisisa, United Arab Emirates and 0 for other periods	IMF, Authors calculation

Source: Bankscope, IMF, World Bank, Central banks reports. Dependent and CAMEL related variables are constructed from bank balance sheet reports. Macroeconomic, Regulatory and Control variables are constructed from country level data.

Note on Variables:

Banking stability includes Z**-score** (Measure of the distance of a bank from insolvency. Computed as the sum of equity to asset ratio and the return on assets (RoA) divided by the standard deviation of the RoA), Ln (Z-score) (Measure of the distance of a bank from insolvency. Computed the natural logarithm of Z-score), NPL (The ratio between non-performing loans and the total gross loans of the bank).

NPL is the ratio of nonperforming loans to total loans.

Independent Variables include:

Bank Specific Variables and CAMEL related variables: Capital (TC1=Tier 1 capital to total assets, TCR=Total capital ratio measured as a ratio of (Tier 1 + Tier 2) over total assets, EQA=The ratio between total equity and total assets of the bank, Asset quality (LAS=Ratio of net loans to total assets, LLP=Ratio of loan loss provisions to total loans, RoA=The ratio of bank net income to average value of assets) Management quality (LGR=Average of historical loan growth rate, EGR=Average of historical earning growth rate) Earnings (NIM=Net interest margin measured as a ratio of (interest received − interest paid) to total earning assets, ROAE=Return on average equity measured as a ratio of net income to average capital equity, ROAA=Return on average assets measured as a ratio of net income to average assets) Liquidity quality (LATS=The ratio between liquid assets and short term borrowing of the bank, LTD=The ratio of total loans to total deposits of the bank, LAT =The ratio of liquid assets over the total assets of the bank)

Bank Distress includes: Low Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 1-2.4), Medium Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 2.5-3.4) High Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 3.5-5), Distress Dummy (Dummy if the observed value of the binary is one under the state of distress following requirements in section 2.2, and zero otherwise).

Bank Controls: Size (Natural logarithm of assets (in millions of constant US dollars), IntRate (Rate of interest charged on short-term loans made between banks), Islamic (dummy equal to 1 if a bank is Islamic and 0 otherwise).

Macroeconomic Variables include: GDPG growth rate (The annual growth rate of each country's real GDP), GDP per capita (Gross domestic product divided by midyear population in constant 2010 U.S. dollars), INF (The inflation rate based on the consumer price index) UNEM (Percentage of unemployed to total labour force (%))

Regulatory variables: CAPR (Capital Requirements: An index that takes values between 0 and 9, with higher values indicating greater stringency), SUPP (Supervisory Power: An index that takes values between 0 and 14 with higher values denoting greater supervisory power) ACTRS (Activity Restrictions: An index that takes values between 0 and 16 with higher values indicating more restrictive environment enforced by government) and REGQ (Annual index of the quality of regulatory quality in the country. The index ranges from −2.5 to 2.5 with higher values denoting better institutional development).

Control Variables include Crisis Dummy (dummy equal to 1 for the global financial crisis of 2008-2009, 0 for other periods), Arab Spring (dummy equal to 1 for the Arab spring of 2011-2012 for Algeria Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates and 0 for other periods) Estimation method is fixed effects method with statistics reported under robust standard errors clustered by bank in columns (1) – (4) and (4)–(8). *,** and *** denote significance at 10%,5% and 1% respectively.

Table 2-3 Number and observations of Islamic and conventional banks

	Islamic banks		**Conventional bank**		**Total**	
Country	Banks	Observations	Banks	Observations	Banks	Observations
Algeria	4	22	13	80	17	102
Bahrain	3	15	5	30	8	45
Djibouti	1	8	5	20	6	28
Egypt	5	31	28	158	33	189
Iran	15	110	1	7	16	117
Iraq	7	28	7	42	14	70
Israel	0	0	16	111	16	111
Jordan	3	17	14	102	17	119
Kuwait	11	88	6	47	17	135
Lebanon	3	21	52	332	55	353
Libya	1	10	11	120	12	130
Malta	0	0	8	123	8	123
Morocco	0	0	14	123	14	123
Oman	4	26	7	69	11	95
Palestine	3	21	3	28	6	49
Qatar	6	52	7	60	13	112
Saudi Arabia	5	38	9	88	14	126
Tunisia	2	19	16	132	18	151
UAE	11	134	16	168	27	302
Total	**84**	**640**	**238**	**1,840**	**322**	**2480**

In table 2-4 we present descriptive statistics of the main variables used in our study such as stability measures and components of the CAMEL system from which distress variable is produced. The descriptive statistics in Table 2-4 shows that a) large conventional banks establish Islamic windows[1] and b) Islamic banks are, on average, more capitalized and profitable than conventional banks. Findings a) is justified by the fact that Islamic banks lack short-term liquidity instruments and have weak interbank money market and liquidity management. They cannot sell debt or collaborate with conventional banks and cannot borrow from central banks as lenders of last resort. For these reasons, Islamic banks prefer to protect themselves against any liquidity shortages by holding higher liquidity buffers. Finding b) is due to the fact that the lower levels of debt (possibly as a response to higher withdrawal risk) and higher non-interest income of Islamic banks might partly explain their greater profitability. The net interest margin of Islamic banks does not appear to be significantly different from that of conventional banks, however, Islamic banks have lower implicit interest income and expense rates than conventional banks. Interestingly, the structure of the asset portfolios of Islamic banks are significantly different from those of conventional banks. Islamic banks have a higher ratio of net loans to total earning assets possibly because they face limitations regarding their investments in other earning assets (such as bonds) as discussed in Section 2. Gross loans and total assets grow at higher rates for Islamic than conventional banks.

In terms of insolvency risk, the mean test results show that the Z-score and its components for Islamic banks are not significantly different from those of conventional banks, suggesting that the higher returns and capital of Islamic banks are offset by their higher asset return volatility. We further perform a Wilcoxon-Mann-Whitney test (Wilc) and a univariate analysis of variance (ANOVA) test for testing the equality of means for each financial ratio. The results are presented in Table 2-4 and bank level variables are presented according to the significance level of F-statistics. Estimations from both tests suggest that almost all the variables' evolution can split the banks between Islamic and conventional, thus providing empirical evidence that bank level indicators have a discriminating ability on the business operations of banks. The

[1] Islamic windows refer to services that are based on Islamic principles that are provided by a conventional bank. Some commercial banks offer Islamic banking services through dedicated windows or sections.

correlation matrix is shown in appendix III. Although most of the variables are used as measures for representing similar aspects of bank business operations, their associations remain at relatively low levels and does not suggest any major collinearity problems.

Table 2-4 Descriptive statistics and tests for the variables of Conventional and Islamic banks, 2004 – 2015

	Islamic banks					Conventional banks					Test statistics		
Variables	Obs.	Min	Max	Mean	SD	Obs.	Min	Max	Mean	SD	T.	F	Sig.
Dependent													
Z-score	712	1.02	46.21	26.25	13.02	1435	-1.65	39.89	29.39	15.12	5.07***	91.21	0
Ln Z-score	712	0.97	11.23	3.26	1.07	1435	0.67	9.87	3.69	1.09	6.02**	87.54	0
NPL	598	3.22	37.47	6.26	7.21	1083	4.92	42.33	6.22	6.36	1.05	0.02	0.894
Independent													
CAMEL													
Capital													
TCR	669	2.33	38.37	21.34	21.66	1024	1.88	26.77	13.71	12.29	−11.03***	154.66	0
TC1	671	3.64	39.56	24.31	19.01	1639	2.01	27.88	16.81	8.81	−9.12***	111.26	0
EQA	642	2.99	30.11	17.65	18.23	1100	3.72	28.03	10.88	6.08	−6.37***	81.48	0
Asset Quality													
LLP	521	0.02	8.91	1.76	2.7	1107	0.23	5.9	1.27	1.6	−3.3***	31.69	0
RoA	651	1.01	29.03	18.54	18.43	1205	1.89	19.65	12.34	6.33	−4.48***	67.96	0
LAS	714	9.52	82.83	68.63	61.9	1316	10.01	88.52	58.68	31.88	−2.84***	32.07	0
Management quality													
LGR	629	2.98	24.42	12.36	27.4	920	3.76	21.33	25.06	25.09	−2.91***	12.76	0
EGR	555	1.83	7.42	7.44	9.25	896	1.23	8.34	8.75	9.57	4.17***	9.88	0
Earnings													
ROAE	598	-2.22	7.27	4.11	5.05	1330	-1.34	8.07	5.73	6.73	6.82***	78.62	0
NIM	636	-1.22	5.94	4.27	4.72	1251	-5.33	8.19	3.94	2.86	−0.85*	6.27	0.012
ROAA	578	-2.67	18.43	9.47	15.76	1241	-2.34	17.76	10.1	15.42	2.74***	1.8	0.18
Liquidity Quality													
LATS	452	-4.76	18.78	55.12	14.02	724	-3.98	13.7	44.91	9.72	−9.03***	154.66	0
LTD	631	-12.67	22.22	40	9.55	839	-2.76	13.74	55	10.98	−8.12***	111.26	0
LAT	433	-10.98	16.3	20.11	5.32	489	-8.84	15.62	17.63	6.78	−5.38***	67.96	0

Note: All variables in this table are collected from bank balance sheet reports in Bankscope and Orbis Bank Focus. The dependent variables represent two different measures of banking stability while the independent variables stand for the individual bank characteristics.

Banking stability includes Z-score (Measure of the distance of a bank from insolvency. Computed as the sum of equity to asset ratio and the return on assets (RoA) divided by the standard deviation of the RoA), Ln (Z-score) (Measure of the distance of a bank from insolvency. Computed the natural logarithm of Z-score), NPL (The ratio between non-performing loans and the total gross loans of the bank). Independent Variables include Bank Specific Variables and CAMEL related variables: Capital (TC1=Tier 1 capital to total assets, TCR=Total capital ratio measured as a ratio of (Tier 1 + Tier 2) over total assets, EQA=The ratio between total equity and total assets of the bank, Asset quality (LLP=Ratio of loan loss provisions to total loans, RoA=The ratio of bank net income to average value of assets), LAS=Ratio of net loans to total assets. Management quality (LGR=Average of historical loan growth rate, EGR=Average of historical earning growth rate) Earnings (ROAE=Return on average equity measured as a ratio of net income to average capital equity, NIM=Net interest margin measured as a ratio of (interest received − interest paid) to total earning assets, ROAA=Return on average assets measured as a ratio of net income to average assets) Liquidity quality (LATS=The ratio between liquid assets and short term borrowing of the bank, LTD=The ratio of total loans to total deposits of the bank, LAT =The ratio of liquid assets over the total assets of the bank)

In order to have a comprehensive view of our data set we proceeded in calculating for 6 major countries in our sample the distress index ,the NPL and TCR and presented in the following graphs g-1 g-2 g-3. The values are the average per country as result from the respective individual bank values weighted with their assets value.. From the graphs we can observe the small variation in all variables. Distress lies between the two extreme values of 4 (OMAN 2010) and 2(UAE 2010) but overall, the average value of all countries is close to 3 suggesting a long term path around medium distress level. NPLs on average take the value to 22% while a maximum value of 30% is recorded for OMAN in 2008 and 2014. Furthermore, we observe that in the period 2008-2010 there is an increase in ratio probably depicting the global financial crisis. Overall, the average NPL ratio is not too high and its trend, apart from some temporal peaks, can be considered normal The capital assets ratio(TCR) also called capital adequacy ratio and high capital adequacy ratios are positive to see. The TCR values range within the range of 15% to 25% with the six countries average of 20% which, ceteris paribus, is considered a healthy situation in terms of capital adequacy.

Figure 2-1 Average of Distress Indicator CAMEL for six MENA countries 2004-2015

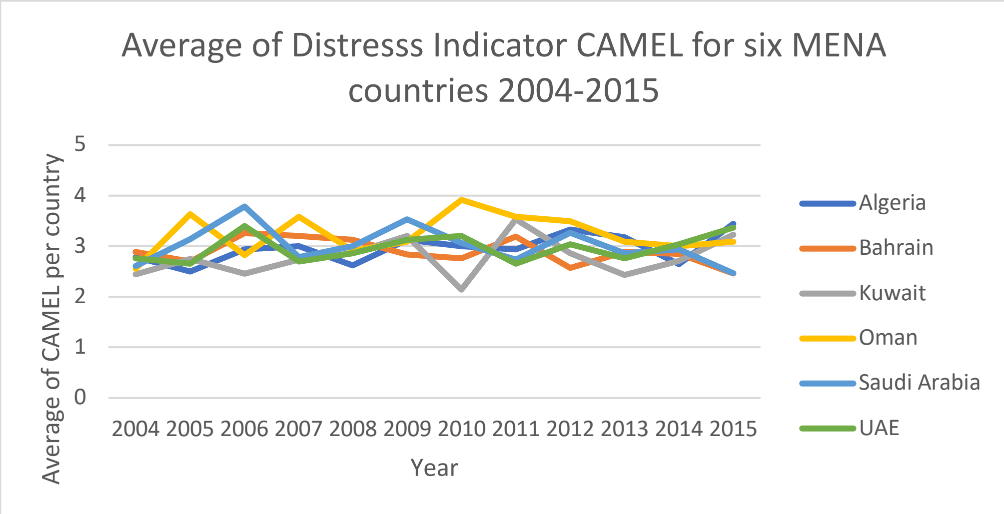


Figure 2-2 Average of TCR ratio for six MENA countries 2004-2015

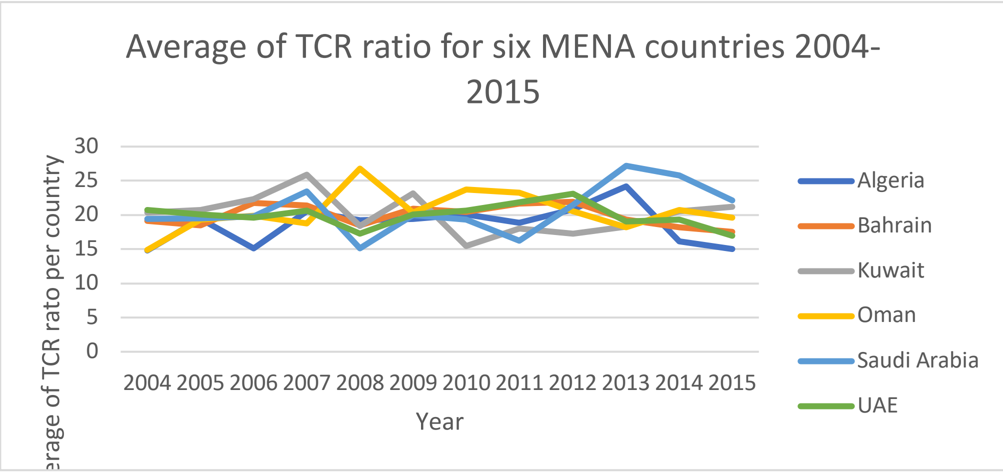
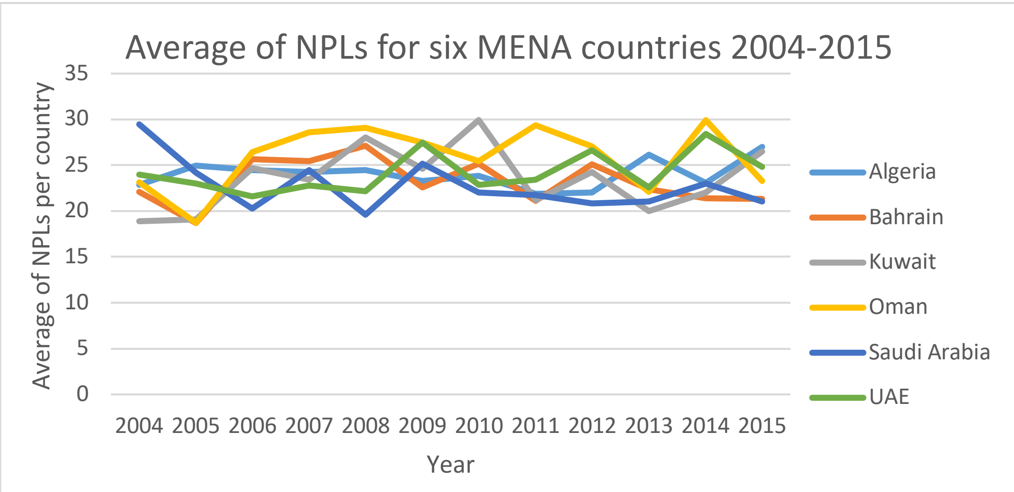


Figure 2-3 Average of NPLs for six MENA countries 2004-2015



2.4.1 Macroeconomic environment and Regulation framework

The macroeconomic environment, as mentioned above is summarized by real GDP growth rate, real GDP per capita and inflation rate as measured by the annual percentage change of consumer price index.

The regulatory environment is accounted for by using three indices that are available from the World Bank database: the capital requirement index (CAPR), the power of supervisory agencies index (SUPP) and the activity restrictions index (ACTRS).The World Bank database was developed by Barth *et al*. (2004, 2008, and 2013). Each index corresponds to one of the regulatory variables, and its value is obtained by adding the number of positive answers (or negative answers) of a pre-defined relevant qualitative question set. The question set describes the various dimensions of the related variable. For instance, the questions on capital requirement, relates to its consistency with Basel II, the deductions before computing regulatory capital and the sources of funds that may be used as capital. Similarly, for other variables there is another set of related questions. Additional information on the computation of these indices is available on the World Bank website.

An indicator used in controlling for bank failure studies is the REGQ index and is based on the institutional index that was developed by Kaufmann *et al*. (2011) and is part of the World Government Indicators (WGI) reports aggregate and individual governance indicators for over 200 countries and territories since 1996, for six dimensions of governance. The REGQ index controls for country level differences in institutional development and it measures six dimensions: voice accountability (VA) which It reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. The standardized value for VA lies between +2.5 and -2.5. The +2.5 indicates the situation where there is no obstacle to expressing voice and -2.5 is the situation where people have no way of expressing their voices. The value '0' is the average value of VA), political stability, government effectiveness, regulations quality, rule of law, and control of corruption. All the indices range from -2.5 (weak) to +2.5 strong, with an overall higher number implying a better institutional environment. We focus on the index of corruption as the main measure of relevance to bank business models and consider it as an exogenous explanatory variable of the overall conditions at the country level.

2.4.2 Banking stability

In our study we use two different proxies of risk-exposition as dependent variables: The Z-score stability indicator and the Non-Performing Loans (NPL) bank risk ratio. Since our previous review of relevant 270 studies confirmed that the commonly employed in the extent literature (see Laeven and Levine 2009; Houston *et al*. 2010), is the Z-score ratio and this is our primary measure of the individual banks' stability. Unlike liquidity risk, Z-score indicates the overall bank risk, also known as default risk. Papers that use the Z-score for the analysis of banking stability include Boyd and Runkle (1993); Beck, Demirgüç-Kunt and Levine (2007); Demirgüçetal., (2008); Laeven and Levine (2009); Čihák and Hesse (2010) Kasman and Kasman (2015), Kabir and Worthington, (2017). The popularity of the Z-score stems from the fact that it has a clear (negative) relationship to the probability of a financial institution's insolvency, that is, the probability that the value of its assets becomes lower than the value of its debt. An advantage of the Z-score is that it can be also used for institutions for which more sophisticated, market-based data are not available as is the case for some banks in our sample. Also, the Z-scores allow comparison of the risk of default in different groups of institutions, which may differ in their ownership, objectives or business models but still face the risk of insolvency.

This measure is formally expressed as $Z - score_{i,j,t} = \frac{RoA_{i,j,t}+EA_{i,j,t}}{\sigma(RoA)_{i,j,t}}$, where $RoA_{i,j,t}$ denotes the return on assets of bank i in country j for year t, EAi,j,t represents the ratio of equity over total assets, and $\sigma(RoA)_{i,j,t}$ is the standard deviation of return on assets. This ratio combines profitability(ROA), leverage(EA) and volatility in returns σ(ROA) and indicates the distance in terms of the number of standard deviations of return on assets a bank is far from solvency and likelihood of failure. A higher Z-scores suggest greater stability and lower probability of insolvency. We follow Beck *et al*. (2013) by using the full sample and a three-consecutive-year rolling window to calculate $\sigma(RoA)_{i,j,t}$ in order to ensure that results are unaffected by the variation of bank profitability and bank capital. In addition, the natural logarithm of the Z-score can replace the original Z-score values as they tend to be highly skewed, so we can avoid the truncation of the Z-score (Jeon et al. 2017). The details of the estimation of Zscore and data set are as following: We first estimate the 3 year moving average of both ROA and EA using the relevant excel command. The next step is the calculation of standard deviation of ROA with Excel command STDV and the final step is to divide the sum of average ROA with EA by STDV of ROA(see appendix 3)

The second proxy of banking stability we consider is the non-performing loans (NPLs) ratio that identifies problems with the quality of banks' assets. This measure is an accounting-based risk measure and it is calculated as a ratio where loans of which the debtor has not made their scheduled payments for at least 90 days (non-performing loans) is the numerator and the total loans (including NPLs) of the bank is the denominator. As the non-serviced loans that a bank hold increases and the NPL ratio moves higher it signals a deterioration of the bank's assets and possibly a move to a less stable or even insolvent situation. A larger NPL ratio signals a higher probability of a bank's bankruptcy(Fiordelisi and Mare(2014), Schaeck and Cihak(2014), Noman et. al. (2017), Kabir and Worthington (2017). Kasman and Kasman (2015) also argue that NPL is the main source of banking risk and the inability of banks to control credit-risk increase also increase the probability of insolvency. Furthermore , this indicator is also included in the "core" set of financial soundness indicators by the IMF (2006) analytical report on financial soundness indicators.

2.4.3 Bank distress

As already discussed in section 2.2 there are several different approaches to measure bank distress. In this paper I adopt two alternative measures, which we appropriately adjust to the developing and emerging markets under examination. The first measure (Low Distress to High Distress) reflects the composite index of the Capital adequacy, Asset quality, Management quality, earning ability, Liquidity (CAMEL). It is designed to take account of the most fundamental aspects of the bank's financial, operations and management factors and allows us to assess and classify distress in five categories numbered 1 to 5. The CAMEL Rating System was adopted by National Credit Union Administration (NCUA) in October 1987 and has been updated in 1994. For a detailed analysis of its components see link (CAMEL Rating System | NCUA). Unlike the recent approaches where CAMEL ratios have been used in early warning models (Maghyereh, and Awartani, (2014)) I construct a composite index reflecting CAMEL from 1 to 5 with rating1 showing strong position while rating 5 indicates a bank with the highest risk of failure. Although I rate each CAMEL components of every bank within the rating 1 to 5 according to Table 2-5, my approach is to confine the distress outcome within a range of three categories : low distress for the range of 1 to 2,4, medium distress for the range 2,5 to 3,4 and high distress for the range of 3,5 to 5,0. So each bank, after its all CAMEL components are rated 1 to 5, is assigned with a distress rating low-medium-high. This distress outcome is the average of each CAMEL rating 1 to 5.

Table 2-5 CAMEL Ratings per category based on analytical studies.

Components	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5
Capital Adequacy	>11%	8-11%	4-7.99%	1-3.99%	<.99%
Assets Quality	<1.5%	1.26-3.49%	3.5-6.99%	7-9.5%	>9.5
Management Quality	<25%	26-30%	31-38%	39-45%	>46%
Earning (ROA)	>1,5%	1.25-1.5%	1.01-1.24%	0.75-0.1%	<0.75%
(ROE)	>22%	21.99-17%	16.99-10%	9.99-7%	<6.99%
Liquidity ratio 1	<60%	60%-65%	65%-70%	69%-80%	>80%
Alternative Liquidity ratio	<60%	60%-65%	65%-70%	69%-80%	>80%

Source: adopted from (Masood et al., 2016 and Rozzani and Rahman, 2013)

This allows us to build a dynamic evolution of distress situations as banks can enter (exit) distress as financial conditions worsen (improve) as it is important to encapsulate in our estimation the interaction with changes in the macroeconomic and the regulation environment. As discussed in section 2.2 in many cases the CAMELS indicators are used which includes Sensitivity(S) component that measures sensitivity to market risk posed by the bank’s assets and liabilities and assess its potential impact on capital and earnings. Examiners assess an institution's Sensitivity to market risk by monitoring the management of credit concentrations. In this way, examiners are able to see how lending affects an institution in both positive and negative ways on their balance sheet. In our case, mainly due to data unavailability on an extensive sample for the specific set of countries and for not adding an unnecessary layer of complexity which in the end would reduce the sample size and its quality we have not included S component and kept the CAMEL components approach for optimally measuring distress in MENA region.

The second measure is a combination of the approaches followed by Betz et al. (2014) and Maghyereh and Awartani (2014). We define a dummy variable which measure bank distress called the Distress dummy. The dummy distress variable takes value 1 if the bank is in a state of distress, and zero otherwise. A state of distress is defined if any of the following conditions are met: (i) The bank's operation was suspended; (ii) The bank was recapitalized, or it received any liquidity support from the monetary authority; (iii) The bank eventually merged with another bank due to financial distress (i.e. distressed mergers); (iv) The bank was shut down by the government (v) The bank's ratio of non-performing loans to total loans during two subsequent years falls in the fourth quartile of the total sample distribution of this ratio for each country the bank under examination is situated in and (vi) if the loan loss provisions level of the bank falls into the fourth quartile of loan loss provision distribution as was constructed counting for all banks. The last condition was suggested and applied by Carapeto *et al*. (2010) since this category of banks are financially fragile.

A picture of how bank distress is observed according to our adopted measures for Islamic and conventional banks is presented in Table 2-5. The first characteristic of the data in Table 2-5 is that the number of distress events for both measures is greater than the number of distressed banks and this is an acceptable result because banks can have a rating for more than one period and a bank can face multiple distress events within the whole period under examination Looking at total (Islamic and conventional) distressed events as recorded by the two measures the numbers are 57 for the dummy approach and 86 for CAMEL. In addition, looking at the distress events, 71 distress events are recorded under distressed Dummy compared to 118 when the CAMEL distress concept is used. However, if we compare the "strict" Dummy cases of distress with more comparable distress events for CAMEL which include only medium and high distress, then the banks recorded in distress are very close (57 and 52 for dummy and CAMEL respectively). These, however, are absolute numbers without information on their relative importance. Turning to the percentages of distressed banks to total banks according to CAMEL (medium plus high distress) and distress DUMMY measures, we observe that 16.1% to 17.7% respectively of the total banks included in our sample, are facing a distress situation. However, when we break down the above percentages for Islamic and conventional banks the picture changes. In particular, for Islamic banks the percentage of banks in distress rises from 29.8% to 33.3% or in other words almost one out of three Islamic banks were recorded as distressed. In contrast for conventional banks the percentage is much smaller and only 10.1% to 13.4% are characterised as distressed. This result comes in contradiction to the general view that Islamic banks are less likely to get distressed or/and fail compared to conventional banks. This is an open issue which will be under further investigation in our empirical work.

In our analysis (Table 2-6) we include the final information as banks go in and out of distress, meaning our approach is flexible to distinguish in some cases the same banks coming in and out of distress. As such we can observe that the final number of distress events for both measures of CAMEL and the distress dummy are more than the number of banks in all cases under examination.

Table 2-6 Classification of distress based on CAMEL(low-medium-high) and distress dummy for 19 countries including MENA banking sector, 2004-2015

Distress Type	Islamic banks		Conventional banks		Total	
	Number of Banks	Number of events	Number of Banks	Number of events	Number of Banks	Number of events
Low Distress	19	27	15	25	34	52
Medium Distress	16	20	14	19	30	39
High Distress	12	12	10	15	22	27
Distress Dummy	25	33	32	38	57	71

Note: Low, Medium, and High distress represent the CAMEL rating approach for classifying banks in distress from a continuous measurement of 1 to 5 where 5 is the bank closest to failure. Distress dummy as a measure captures "realised distress" such as capital assistance, failure of liquidation as potential outcomes for each bank. All measures are constructed at the bank level with annual span for 19 countries.

2.5 Baseline Model

Our baseline model specification is based on the view that bank 'managers' choose their strategy in assets and liabilities allocation in order to succeed two parallel targets: to maximize earnings/profits and in parallel to minimize risks and remain stable. However, when a bank reaches a high distress situation its overall stability is in danger and the final outcome depends on certain internal bank factors, regulation framework and macroeconomic environment. A substantial body of literature has examined the variables that affect bank stability .However in our econometric model apart from inclusion of the mainstream variables affecting stability (Almarzoqi et. al. (2015), Albaity et. al. (2015), Zoghlami and Bouchemia(2020), I estimate, for the first time, the effect of bank distress on banking stability. So, the equation to be estimated has as dependent variable the bank stability measures and at the right hand side includes bank distress and other ,used frequently in other empirical studies, control variables.

$$Bank\ Stability_{i,j,t} = c + a * \overbrace{Distress_{i,j,t}} + \beta * Bank\ Char'_{i,j,t} + \delta * Crisis\ Dummy_{j,t} + \lambda * Regulation'_{j,t} + \zeta * Macroeconomy'_{j,t} + \varepsilon_{i,j,t}$$

Where *i* denotes the bank, *j* the country and *t* the year. The dependent variable is a measure of bank risk measured by Z-score or NPL ratio. We use two alternative measures of distress where the first one is based on banks' balance sheet level data (CAMEL) and the second is a dummy approach (as defined in section 2.4.3). From an empirical standpoint, the use of distress (especially in the case of the distress measure based on CAMEL indicators), their inclusion is supported a) the use of alternative indicators compared to the construction of the Z-score which we test and observe they have low correlation among them (for a detailed overview, see Appendix III) and b) from the point of considering distress as a bank characteristic similar to other bank characteristics such as ownership status. In other words, distress is simply another bank characteristic, only in our approach it is the joint outcome of already observable indicators. That is one of our main contributions of this analysis, that banks could potentially use their own financial position to alleviate distress by adapting their business model decisions (e.g., the amount of loans given). The same can be described for the distress dummy indicator only in this case the requirements for a bank to be in distress are based on observations that match the requirements detailed in section 2.4.3. The Crisis Dummy is a control dummy variable for the global financial crisis during 2008-9. We also include the following Bank characteristics variables derived from bank-level balance sheet data: size, liquidity and capital base. The macroeconomic environment is represented by GDP per capita level, real GDP growth rate and Inflation rate.

We also control for the regulatory strength (Regulation) using three aspects: a) the requirement for bank capital at the country level b) the restriction on banks' activity mix, and c) the extent to which banks are subject to market discipline. Using the survey data provided by Barth *et al*. (2004, 2008, 2013) and following the methodology suggested by Barth *et al*. (2004), we use country-level time-series indices for each of the above regulation aspects for each of the 19 economies in our sample following closely recent developments in the construction of the measures (Jeon *et al*. 2017). To ensure that our analysis is robust we also conduct estimations by completely excluding the distress indicators and using all the other information collected. The results (Appendix 1 Table 4) remain consistent in terms of expected sign and size of effect on banking stability for all the indicators involved, we observe the same signs and significance overall, with the variables representing bank capital (TCR) and Islamic dummy from the bank characteristics side, crisis dummy and GDP per capita from the macroeconomics side, the Capital requirements along with the rest of the variables related to regulation factors.

Finally, we use country-level time-series indices for Institutional Development based on the World Governance Indicators (WGI) database and the methodology of Kauffman (2011). Having set up the main terms of our model we specify below for each hypothesis discussed so far, the corresponding models:

2.6 Empirical results

2.6.1 Baseline Estimation

We further expand our previous model with an Arab spring dummy for testing our first hypothesis (H6a, H6b):

Model (1)

$$\begin{aligned} Bank\ Stability_{i,j,t} &\\ &= c - a * \overbrace{Distress_{i,j,t}} + \beta * Bank\ Char'_{i,t} - \delta * Crisis\ Dummy_{j,t} \\ &- \kappa * Arab\ Spring\ Dummy_{j,t} + \lambda * Regulation'_{j,t} + \zeta \\ &* Macroeconomy'_{j,t} + \varepsilon_{i,j,t} \end{aligned}$$

Our estimation approach covers three estimation techniques: a simple pooled-OLS panel model (Table 2-6), a fixed-effects panel model(Tables 2-7 and 2-8) and the two-step GMM model(table 2-9). This latter approach is dynamic which allows to address potential dynamic endogeneity, unobserved heterogeneity and the simultaneity between banking stability and distress variables and other bank characteristics to attain perfect estimators. This research employs the dynamic panel GMM approach proposed by Arellano and Bover (1995) and Blundell and Bond (1998). We report the result of the AR (2) second-order serial correlation tests, the Hansen J test of overidentifying restrictions and the difference in the Hansen J test of exogeneity. For all three tests, we find that the value is statistically insignificant and as such we cannot reject the null hypotheses that no second-order serial correlation; our instruments are valid and the instruments we use in the system GMM estimation is exogenous, respectively.

In Table 2-7, we present the results from the baseline estimation with the current levels of Z-score as the dependent variable representing banking stability as in Lepetit and Strobel (2013) while the distress variable is included and estimated with all different measures of distress which are used sequentially across the entire sample. The results from our model specification overall are in accordance with our theoretical discussion and H1 is not rejected. It is important to mention that in the baseline and subsequent estimations when we are looking at the Z-score of all the individual banks (subject to data availability) in all the countries we are essentially looking into the system of banks (and their stability). As such, our empirical observations are able to provide overall suggestions(conclusions) how banking stability can be enhanced at the system level, taking all the available factors into consideration. In this context, we observe that across all specifications of distress measures, the expected negative sign with stability (Z-score) is statistically significant indicating that as banks' distress is increasing, it hinders and put in danger the stability of the banking market and financial system. The low distress CAMEL positive sign can be justified on the basis that all banks included in this range of distress are strong enough financially not to jeopardise the soundness of the banking system. Another characteristic that should be pointed out is that the second measure of distress (Distress Dummy) not only is negative but also has the largest absolute value (effect) compared to the other indicators of distress. This is a plausible result since this variable includes the effect of bankruptcy, dissolved merger, and liquidation so it captures a broader set of events that can occur at the end of the lifecycle of the banks. On the contrary, the CAMEL distress measure relies on the fact that banks can recover once in distress.

Furthermore, our findings with regard to bank characteristics effect on stability agree with others research findings. We find that stronger bank capital base enhances stability of the banking sector reinforcing the perception that the adoption of Basel guidelines in combination with the ongoing changes in regulation regimes in the MENA and extended MENA region since the mid-1990s have had a positive effect on the banking and financial stability of the region. Also, our results of a positive and significant relationship of loan to deposits ratio with Z-score suggest that a strong liquid base of the banking sector in these countries protects financial stability. Indeed, based on our coefficient estimated an increase by a unit can increase Banking stability up to 9%. However, we must mention that Islamic banks included in our sample tend to be liquid by default due to the nature of the loan contracts they offer to customers. Even higher results are observed for macroeconomic characteristics and the regulation environment, where a unit increase in the GDP per capita can increase banking stability between 93 to 143%.

As regards the effect of regulatory framework on stability we notice that greater stringency on capital requirement (CAPR) and higher restricted banking environment enhance stability. However, according to our results greater supervisory power (SUPP), in this region as measured by the power of government to impose actions to correct problems within the financial sector, is not promoting the stability of the banking sector. This outcome can be closely related to the parallel operation of commercial and Islamic banks in many of the countries under investigation Finally the size of the bank in terms of total assets in all specifications of the base model always has a positive sign but not at a statistically significant level indicating no influence on the stability of the banks when distress is present. It is an interesting result which suggest that in the presence of distress, no matter its intensity, the structural differences between large and small banks do not seem to influence banking stability and the "too-big-to fail" argument is not supported for the MENA region and therefore this variable is excluded from further developments of our basic model. We must however mention a study by Cihak and Hesse (2010), where, covering the time period 1993 – 2004, they break down their sample of 77 Islamic and 397 conventional banks from 20 countries into large and small size banks and among others conclude that small Islamic banks are financially stronger than large ones.

Finally, when we include the Islamic dummy and thus implicitly breakdown our sample into Islamic and conventional banks, our findings indicate a significant positive effect on banking stability which comes in line with the persistence view that Islamic banks are less risky and more stable. This view is based on the facts that Islamic banks business model contains contracts with higher liquid nature due to the relevant Sharia laws regarding how loans are contracted and upheld in their nature and also due to assets and liabilities risk allocation restrictions within Sharia principles have high capital structure. This result is also in accordance with the findings of Cihak and Hesse (2010) All the above results should be evaluated under consideration on the type of estimation model used (Pooled OLS) which applies the OLS technique on the panel data directly. We know that *multicollinearity* might be a problem in such estimation models and that strong multicollinearity in general is unpleasant as it causes the variance of the OLS estimator to be large and makes it impossible to solve for the OLS estimator, i.e., the model cannot be estimated in the first place. I have checked for multicollinearity in the pooled OLS Table 2-7. There is no issue according to the results which have been added according to the Stata command "estat-vif" which calculates the variance inflation factors for the independent variables. The variance inflation factor is a useful way to look for multicollinearity amongst the independent variables. According to the values of the centred VIFs (1.02, 1.04,0.99, 1.00), no harmful collinearity is detected in the model.

Table 2-7 Pooled OLS results for banking stability, controlling for all countries, 2004-2015

Variables	Ln (Z-score)	Ln (Z-score)	Ln (Z-score)	Ln (Z-score)
	Bank Characteristics			
Low Distress	**0.339****			
	(3.86)			
Medium Distress		**-0.279*****		
		(-2.61)		
High Distress			**-0.287****	
			(-2.02)	
Distress Dummy				**-1.245****
				(-2.15)
TCR	0.22**	0.131**	0.231**	0.191**
	(2.17)	(2.41)	(2.31)	(2.34)
NIM	0.20**	0.221***	0.282***	0.182***
	(2.97)	(3.25)	(4.28)	(3.11)
LTD	0.028**	0.092**	0.089**	0.048**
	(2.51)	(2.46)	(2.56)	(2.51)
Size	-0.022	-0.022	-0.022	-0.021
	(-1.56)	(-1.37)	(-1.27)	(-1.56)
Inter rate	0.088**	0.0192**	0.0211**	0.0189**
	(2.31)	(2.36)	(2.26)	(2.51)
Islamic	0.018**	0.019**	0.021**	0.018**
	(2.31)	(2.46)	(2.36)	(2.16)
	Macroeconomic Variables			
GDP per capita	0.097***	0.127***	0.111**	0.093***
	(2.91)	(2.71)	(2.21)	(3.01)
GDP Growth rate	0.139**	0.143***	0.133***	0.093***
	(2.21)	(3.86)	(3.56)	(3.21)
Inflation	0.038***	0.023***	0.033***	0.048***
	(2.88)	(3.16)	(3.06)	(3.01)
Crisis Dummy	0.023	0.034	0.03	0.02
	(1.23)	(1.19)	(1.2)	(1.1)
	Regulation Measures			
CAPR	0.137**	0.142**	0.113**	0.111**
	(2.21)	(2.46)	(2.36)	(2.12)

Variables	Ln (Z-score)	Ln (Z-score)	Ln (Z-score)	Ln (Z-score)
SUPP	-0.079**	-0.099*	-0.089*	-0.019*
	(-2.27)	(-1.73)	(-1.93)	(-1.86)
ACTRS	0.087**	0.079**	0.049**	0.059**
	(2.34)	(2.53)	(2.36)	(2.16)
REGQ	0.374**	0.423**	0.211**	0.233**
	(2.11)	(2.36)	(2.46)	(2.23)
Arab Spring Dummy	0.087**	0.091**	0.099**	0.109**
	(2.37)	(2.43)	(2.14)	(2.33)
Constant	2.108***	3.224***	3.224***	3.224***
	(3.23)	(3.17)	(3.21)	(3.01)
Diagnostics				
N	2284	2284	2284	2284
Adjusted R^2	23%	22%	28%	24%
F test	231	223	222	218

Note: t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Unbalanced panel across 19 countries from 2004-2015. The dependent variable is the banking stability as measured by Z-score, which is an accounting-based bank-level indicator of financial soundness. Banking stability includes Z-score (Measure of the distance of a bank from insolvency. Computed as the sum of equity to asset ratio and the return on assets (RoA) divided by the standard deviation of the RoA), Ln (Z-score) (Measure of the distance of a bank from insolvency. Computed the natural logarithm of Z-score), NPL (The ratio between non-performing loans and the total gross loans of the bank).

Independent Variables include: Bank Specific Variables and CAMEL related variables: Capital (TC1=Tier 1 capital to total assets, TCR=Total capital ratio measured as a ratio of (Tier 1 + Tier 2) over total assets, EQA=The ratio between total equity and total assets of the bank, Asset quality (LAS=Ratio of net loans to total assets, LLP=Ratio of loan loss provisions to total loans, RoA=The ratio of bank net income to average value of assets) Management quality (LGR=Average of historical loan growth rate, EGR=Average of historical earning growth rate) Earnings (NIM=Net interest margin measured as a ratio of (interest received − interest paid) to total earning assets, ROAE=Return on average equity measured as a ratio of net income to average capital equity, ROAA=Return on average assets measured as a ratio of net income to average assets) Liquidity quality (LATS=The ratio between liquid assets and short term borrowing of the bank, LTD=The ratio of total loans to total deposits of the bank, LAT =The ratio of liquid assets over the total assets of the bank).

Bank Distress includes: Low Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 1-2.4), Medium Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 2.5-3.4) High Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 3.5-5), Distress Dummy (Dummy if the observed value of the binary is one under the state of distress following requirements in section 2.2, and zero otherwise).

Bank Controls: Size (Natural logarithm of assets (in millions of constant US dollars), IntRate (Rate of interest charged on short-term loans made between banks), Islamic (dummy equal to 1 if a bank is Islamic and 0 otherwise). Macroeconomic Variables include: GDPG growth rate (The annual growth rate of each country's real GDP), GDP per capita (Gross domestic product divided by midyear population in constant 2010 U.S. dollars), INF (The inflation rate based on the consumer price index) UNEM (Percentage of unemployed to total labour force (%)) Regulatory variables: CAPR (Capital Requirements: An index that takes values between 0 and 9, with higher values indicating greater stringency), SUPP (Supervisory Power: An index that takes values between 0 and 14 with higher values denoting greater supervisory power) ACTRS (Activity Restrictions: An index that takes values between 0 and 16 with higher values indicating more restrictive environment enforced by government) and REGQ (Annual index of the quality of regulatory quality in the country. The index ranges from −2.5 to 2.5 with higher values denoting better institutional development). Control Variables include Crisis Dummy (dummy equal to 1 for the global financial crisis of 2008-2009, 0 for other periods), Arab Spring (dummy equal to 1 for the Arab spring of 2011-2012 for Algeria Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates and 0 for other periods).

Another attempt to measure the effects of distress on stability in our unbalanced panel is to use the bank-specific fixed-effects estimator, which we prefer not only because it is commonly adopted in extant research (Desbordes et al. 2018 and Aysan et al. 2016) but also because of its advantages compared to previous estimation model used. First, using bank-level panel data, the fixed effects model allows for unobservable bank-level individual effects, which may be heterogeneous across banks and constant over time. Second, the fixed effects model allows the bank-level time-invariant effects to be correlated with explanatory variables, (supported by the result of the Hausman test). We use robust standard errors at the bank level. To check the robustness of our main results, we also employ and estimate the same set of variables with the NPL ratio (non-performing loans to total loans) as an alternative dependent variable for banks risk-taking and hence for bank stability.

A characteristic of our fixed effects panel results (see Table 2-8) is that although the overall pattern of the results compared to the pooled OLS results does not alter the estimated magnitude of all coefficients are much lower. Specifically, the coefficients for the three CAMEL distress variables (-0.022, -0.024, -0.022) are much lower (in absolute values) than the corresponding values in Table 6 (0.339, -0.279, -0.287). Furthermore, the coefficient of the dummy indicating distress is again negative and much higher (-0.014) than was in the case of our pooled OLS results (-1.245).

The results from Table 2-8 either with Z-score or with NPL as dependent variables do not give contradicting results with respect to the effects on stability. When all distress measures are regressed upon the Z-score and NPL are (columns1-4 and 5-8 in Table 2-7) measures of banking stability we notice that all measures of distress produce highly statistically significant coefficients and with the expected negative and positive signs, respectively. Findings that confirm once again that distressed banks are associated with instability in the financial system. Furthermore, the negative coefficient for the CAMEL low distress indicates that even banks that fall into the lowest category of the CAMEL index might have the potential to destabilizing the banking system. Negative effects remain strong even when considering cases of highly distressed banks close to failure (High Distress) considering that banks close to 5 in the CAMEL index are most often dissolved in one way or another. The Dummy measure of distress () demonstrates similar behaviour confirming our findings that distressed banks is a potential factor enhancing banking instability.

Continuing with the remaining set of variables, we notice that the results overall are in line with our pooled regression ones (Table 2-7). That is, we find positive effects on stability of capital ratio, liquidity and interest margin measures.

Moving to the Regulation environment again we notice the positive effect of Capital requirements index (CAPR), the negative effect of Supervisory power (SUPP) and the of Activity restrictions (ACTR) index while Regulation quality index (REGQ) remains insignificant across all specifications.

The positive effect of CAPR on stability can be justified on the ground that banks that have to adhere to stronger capital requirements from the regulators are more likely to enhance their capital base in response to these requirements. This theoretical view was expressed by Bath et. al. 2006 who argue that the strict capital requirements enhance stability and decrease default probability because banks become cautious when lending and consider capital as a buffer against losses.

Since that is the case for most banks, the increased capital base is more likely to promote a safer environment, especially in combination with the coexistence of commercial and Islamic banks where the latter have by default a stronger capital base of operations.

However, there are studies that either find no significant relationship such as a cross-country study by Barth et al. (2008) and by Boudriga et al (2011) for Europe or that bank soundness is harmed when capital restrictions stringency increase (Pasiouras et al (2006). The results of relevant studies for MENA region are rather inconclusive. Our result agrees with findings from a study by Al-Smadi (2015) using a sample of 177 banks from 10 MENA countries for a short period 2008-2011 finds a strong positive relationship between stringency of capital requirement and stability. A very recent study by Alber and Ramadan (2022) covering the period 2008-2018 for 19 MENA countries concludes that there is significant positive effect on stability. However, the study by Haque (2018) for 144 conventional banks from 12 MENA countries and time span of 2001-2012 concludes that capital requirement stringency shows positive association with risk-taking only when higher activity restrictions coexist. Overall argues that all regulatory reforms in the post global financial crisis were ineffective to reduce risk-taking in MENA region.

A recent study by Mateev et al. (2022) taking a sample of 225 banks operating in 18 MENA countries for the period 2005-2018 which finds no significant relation between capital requirement stringency and stability and only when interacted with ownership type find a negative and positive relationship with stability for government and foreign owned banks, respectively.

Another study by Ibrahim and Rizvi (2017) examines the role of the bank size on stability controlling for regulations. They use a sample of 45 banks from 13 Islamic countries (mainly from MENA region) covering the period 2000-2014. Their findings show that capital stringency strengthens the positive relationship between size and stability.

Another strand of papers for MENA region explores the effects of regulation on bank profitability and indirectly on soundness. Mateev and Bachvarov (2020) taking a sample of 308 banks for 19 MENA countries for the period 2005-2015 finds that higher restrictions on capital requirements decrease the level of profitability and ceteris paribus weakens banks soundness.

The Supervisory Power variable (SUPP) refers to the degree of power that supervision authorities (normally Central Bank) have to intervene promptly and effectively on management choices to avoid instability situations. The negative and statistically significant sign found between supervisory power and stability(Z-score) indicates that powerful supervisory authorities support stability since banks managers are prevented to engage in risky portfolio choices. Our results are in conformity with the "public interest view" suggested by Barth et al. (2013) which support the idea that strict supervision aims to protect public interest and regulating most activities of banks secure their efficiency and stability. However, the same authors propose a second view, that of "private interest view" where regulation is set up by government to benefit particular interest groups such as the banks themselves or the politically well connected, which may suggest government owned banks. Therefore these "directed" restrictions since are biased in favour of certain sectors deteriorates efficiency and do not enhance overall stability. The empirical literature is inconclusive. Finding from Pasiouras et al. (2009), Agoraki et al. (2011) and Bouheni et al. (2014) studies agree with "public interest view" while Barth et al. (2002) and Danisman and Demirel (2018) found a significant positive relationship between supervision power and nonperforming loans a result in agreement with "private interest view".

Focusing on studies for MENA region our results come in contrast with those derived from the study of Haque and Brown (2017). They use a sample of 132 commercial banks from 12 MENA countries over the period 2002-2012 and examine the impact of ownership and bank regulation individually and interactively influence on bank efficiency. Their findings support the "public interest view" of regulation where regulation enhance efficient allocation of resources and cost efficiency of bank and hence, I add, stability. A study by Haque (2018) that directly explores supervision and stability relationship finds that official supervisory power is positively related with bank risk-taking supporting the "private interest view". Also, a study by Ibrahim and Rizvi (2017) when examine, for 45 Islamic banks from 13 Islamic countries, the relationship between bank size with stability they also control for regulations and supervision. The GMM estimates show a positive effect of supervision power on Z-score(public interest view) although when interacts with size becomes negative and significant. . The most recent study by Mateev et al. (2022) they use a sample of 225 banks from 18 MENA countries covering the period 2005-2018 and find that the official supervisory power measure is positively associated with overall stability measured by Z-score which is in line with 'private interest view' of bank regulation. However, when banks are split to Islamic and conventional groups the "private interest view" is supported only for conventional and the "public interest view" for Islamic. The latter finding supports our results from the fact that over the recent years the MENA region has being more favourable towards Islamic banks given the increase in number of Islamic and the decrease of foreign conventional banks.

Finally, the study by Al-Smadi (2015) finds that the official supervising power is not significantly related to banking soundness, but the supervisory authority independence tends to enhance bank soundness.

Finally, we examine the results with respect to activity restrictions (ACTRS) variable. These restrictions refer to the regulations imposed by government on the banks' portfolio choices, new entrants' requirements, and foreign banking activities. These restrictions are considered to have an impact upon banks performance and stability. The empirical findings so far give mixed results with both positive and negative impacts. Our estimates come with a negative and a positive significant coefficients of Activity restrictions (ACTRS) with Z-score and NPL respectively which suggest that , independently of the degree of distress, the more restrictive is the environment imposed by the government the less stable and riskier becomes the banking market. In other words when banks are restricted and confined within a limited degree of income diversification efficiency, profitability and hence their stability are jeopardized. The same result is found in Kohler (2015) since activities restrictions could decrease bank stability by limiting diversification benefits. Furthermore, banks, within a high restricted activities environment, to boost returns on their assets is possible to invest in "covered" risky products and hence increase their instability. Our results reinforce the early findings of Barth et. al. (2004,2006) where from a cross-country study conclude that countries with less restrictions and private monitoring suffered fewer crisis and had lower non-performing loans. Also, findings of Barth et al. (2013a) and Chortareas et al. (2012) and is consistent with our results. However, results from Pasiouras et al., (2006) and Pasiouras et al., (2013) conclude that a stringent banking activity environment promotes banks' soundness and profit efficiency while Agoraki et al. (2011) finds that a higher degree of banking restrictions decreases the insolvency risk.

Focusing on MENA region empirical studies, our findings are in line with those from Haque (2014) and Haque and Brown (2017) where they verify that as activity restrictions becoming more stringent risk-taking is also increasing and stability weakens. Also, a recent study by Mateev and Bachvarov (2020) for19 MENA countries finds that activity restriction has a positive effect on profitability, and this is more evident in case of Conventional banks. An opposite to our empirical result is found in Al- Smadi (2015) where a strict activity environment along with high supervising power enhance bank stability. Finally, very recent study by Mateev et al (2022) find that activity restriction plays a significant role in risk-taking behavior of Islamic banks only. However, panel regression and GMM results for all banks give significant negative relationship between activity restriction index and Z-score a result that is in line with our findings. A final comment is on the variable REGQ that measures the quality of regulation and the institutional development. Although it positively, as expected, affects stability it is not statistically significant. 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. Looking analytically for MENA countries the variable's value and its development through the period under examination we observe that in the majority of the countries the REGQ index has a minus value that indicates a very low quality of institutional development and furthermore there is not any observable positive, in contrast in some countries REGQ becomes from low positive to negative, development in the time span we examine. This is probably the reason for its statistical insignificancy.

Among the macro environment variables positive and increasing GDP growth rate and diminishing inflation rates have the expected signs (positive and negative) and support the view that a well performing economy promotes a healthy banking system. The unemployment rate is not significant under all specifications and was dropped.

Our findings are then cross-checked by running the fixed effect panel model again but with nonperforming loans (NPL) as an alternative measure of financial stability. The results in rows 5-8 in Table 2-8 remain qualitatively and quantitatively similar to those in Table 6 with the expected change of sign in all our variables highlighting that our model specification is independent of the stability measure we apply and it captures all factors and especially the bank distress that contribute to stability of the banks. Last, we notice that the presence of Islamic banks in our model specification (Islamic Dummy) is always positive and significant, and we consider that this finding is worthwhile to be further examined when it interacts with the distress phenomenon and regulatory environment that affected the Islamic banks.

Table 2-8 Fixed effects panel results on banking stability controlling for bank distress, 2004-2015

Variables	Ln (Z-score)				Non-Performing Loans (NPL)			
	1	2	3	4	5	6	7	8
			Bank characteristics					
Low Distress	-0.022***				0.022**			
	(-3.206)				(2.296)			

Variables	Ln (Z-score)				Non-Performing Loans (NPL)			
	1	2	3	4	5	6	7	8
Medium Distress		-0.024***				0.015***		
		(-3.271)				(3.055)		
High Distress			-0.022***				0.033**	
			(-3.483)				(2.455)	
Distress dummy				-0.014***				0.033***
				(-3.271)				(2.741)
TCR (total capital ratio)	0.021**	0.034**	0.032**	0.015**	-0.056**	-0.079*	-0.056**	-0.049**
	(2.319)	(2.371)	(2.310)	(2.433)	(-2.227)	(-1.743)	(-2.368)	(2.169)
NIM (net interest margin)	0.016**	0.016**	0.010**	0.072**	-0.088**	-0.105**	-0.090**	-0.016**
	(2.171)	(2.126)	(2.118)	(2.342)	(-2.071)	(-2.115)	(-2.002)	(-2.126)
LTD (Loans to deposits)	0.041**	0.184**	0.027**	0.087	-0.090**	-0.016***	-0.010***	-0.184**
	(2.066)	(2.227)	(2.936)	(1.387)	(-2.902)	(-3.726)	(-2.618)	(-2.227)
Inter. Rate	-0.18**	-0.09**	-0.11**	-0.18**	-0.2	-0.25*	-0.19	-0.29
	(-2.411)	(-2.116)	(-2.231)	(-2.161)	(-1.311)	(-1.76)	(-0.99)	(-1.21)
Islamic	0.110**	0.146***	0.054**	0.012**	-0.030**	-0.045**	-0.484**	-0.385**
	(2.342)	(3.179)	(2.175)	(2.267)	(-2.306)	(-2.249)	(-2.432)	(-2.369)
				Macroeconomic Variables				
GDP growth rate	0.012**	0.012**	0.013**	0.022**	-0.017*	-0.011*	-0.030**	-0.028**
	(2.353)	(2.555)	(2.186)	(2.266)	(-1.729)	(-1.936)	(-2.049)	(-2.023)
GDP per capita	0.022**	0.012**	0.032**	0.013**	-0.012	-0.001	-0.021	0-.022
	(2.053)	(2.055)	(1.986)	(1.966)	(-1.529)	(-1.336)	(-1.049)	(-1.223)
Inflation41	-0.057*	-0.036*	-0.076	-0.023	0.045*	0.069**	0.037***	0.029**
	(-1.690)	(-1.723)	(-1.579)	(-1.328)	(1.750)	(2.193)	(2.072)	(2.184)
Crisis Dummy	-0.008	-0.006	-0.022	-0.072*	0.018**	0.015**	0.016**	0.026**
	(-0.414)	(-0.34)	(-1.293)	(-1.742)	(2.071)	(1.999)	(2.080)	(2.100)
				Regulation Measures				
CAPR	0.005**	0.008**	0.002**	0.007	-0.003**	-0.001**	-0.048**	-0.062**
	(2.320)	(2.361)	(2.522)	(2.073)	(-2.335)	(-2.173)	(-2.262)	(-2.148)
SUPP	-0.006**	-0.005***	-0.003**	-0.003***	0.027***	0.023***	0.030***	0.028***
	(-2.319)	(-2.865)	(-2.416)	(-2.799)	(3.163)	(3.057)	(3.049)	(3.019)
ACTRS	-0.005***	-0.002***	-0.004***	-0.007***	0.004*	0.006*	0.022**	0.012*
	(-3.128)	(-2.856)	(-3.054)	(-3.196)	(1.951)	(1.960)	(2.154)	(1.986)
REGQ	0.011	0.011	0.021	0.008	0.007	0.004	0.002	-0.004
	(0.275)	(0.322)	(0.017)	(1.445)	(1.222)	(0.762)	(0.115)	(0.265)
Arab Spring	-0.011	-0.021	-0.012	-0.014	0.024	0.012	0.012	0.021
	(-0.608)	(-0.159)	(-0.155)	(-1.508)	(1.322)	(0.191)	(0.592)	(0.527)
Constant	0.013***	0.022***	0.008***	0.017***	0.020***	0.010**	0.061***	0.120***
	(3.442)	(4.818)	(2.985)	(2.891)	(4.016)	(2.285)	(2.691)	(4.412)
				Diagnostics				
Num. of obs.	2369	2369	2369	2369	2111	2111	2111	2111
Bank and Year FE	Y	Y	Y	Y	Y	Y	Y	Y
R^2	18.12%	15.21%	16.12%	16.45%	15.01%	15.23%	16.46%	15.09%
F stat	156.9***	154.9***	157.3***	156.6***	146.9***	158.74***	158.68***	158.88***

Note: Unbalanced panel 2004-2015.The dependent variables of each regression are noted in the first line of the table. For variable definitions and sources, Banking stability includes Z-score (Measure of the distance of a bank from insolvency. Computed as the sum of equity to asset ratio and the return on assets (RoA) divided by the standard deviation of the RoA), Ln (Z-score) (Measure of the distance of a bank from insolvency. Computed the natural logarithm of Z-score), NPL (The ratio between non-performing loans and the total gross loans of the bank).

Independent Variables include: Bank Specific Variables and CAMEL related variables: Capital (TC1=Tier 1 capital to total assets, TCR=Total capital ratio measured as a ratio of (Tier 1 + Tier 2) over total assets, EQA=The ratio between total equity and total assets of the bank, Asset quality (LAS=Ratio of net loans to total assets, LLP=Ratio of loan loss provisions to total loans, RoA=The ratio of bank net income to average value of assets) Management quality (LGR=Average of historical loan growth rate, EGR=Average of historical earning growth rate) Earnings (NIM=Net interest margin measured as a ratio of (interest received − interest paid) to total earning assets, ROAE=Return on average equity measured as a ratio of net income to average capital equity, ROAA=Return on average assets measured as a ratio of net income to average assets) Liquidity quality (LATS=The ratio between liquid assets and short term borrowing of the bank, LTD=The ratio of total loans to total deposits of the bank, LAT =The ratio of liquid assets over the total assets of the bank)

Bank Distress includes: Low Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 1-2.4), Medium Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 2.5-3.4) High Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 3.5-5), Distress Dummy (Dummy if the observed value of the binary is one under the state of distress following requirements in section 2.2, and zero otherwise).

Bank Controls: Size (Natural logarithm of assets (in millions of constant US dollars), IntRate (Rate of interest charged on short-term loans made between banks), Islamic (dummy equal to 1 if a bank is Islamic and 0 otherwise). Macroeconomic Variables include: GDPG growth rate (The annual growth rate of each country's real GDP), GDP per capita (Gross domestic product divided by midyear population in constant 2010 U.S. dollars), INF (The inflation rate based on the consumer price index) UNEM (Percentage of unemployed to total labour force (%)) Regulatory variables: CAPR (Capital Requirements: An index that takes values between 0 and 9, with higher values indicating greater stringency), SUPP (Supervisory Power: An index that takes values between 0 and 14 with higher values denoting greater supervisory power) ACTRS (Activity Restrictions: An index that takes values between 0 and 16 with higher values indicating more restrictive environment enforced by government) and REGQ (Annual index of the quality of regulatory quality in the country. The index ranges from −2.5 to 2.5 with higher values denoting better institutional development). Control Variables include Crisis Dummy (dummy equal to 1 for the global financial crisis of 2008-2009, 0 for other periods), Arab Spring (dummy equal to 1 for the Arab spring of 2011-2012 for Algeria Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates and 0 for other periods). Country dummies are included in all regressions. Estimation method is fixed effects method with statistics reported under robust standard errors clustered by bank in columns (1) – (4) and (4)–(8).

*,** and *** denote significance at 10%,5% and 1% respectively

2.6.2 Distress, bank types and regulation measure

Having established from the results in Tables 2-7 and 2-8 strong evidence for the negative effect of distressed banks on banking stability we proceed to examine the interaction of distress with the variables that were found to be statistically significant when model (1) was estimated. Our approach is to consider the interactions between the bank distress variables and the presence of Islamic banks and each of the regulation variables found significant in our benchmark specification. So, our attempt is not only to estimate the effect on stability of the Islamic banks presence when interact with various degrees of distress but also to explore the impact of each regulation condition on stability when at the same time distress situation is taken into account . We therefore conclude with following two models (2) and (3) for the full sample, for checking out our second hypothesis:

Model (2) $Bank\ Stability_{i,j,t} = c - a * \widehat{Distress_{i,j,t}} + \beta * Bank\ Char'_{i,t} + \gamma * Islamic_{i,t} + \gamma_1 * (Islamic * Distress_{i,t}) + \delta * Crisis\ Dummy_{j,t} \mp \lambda * Regulation'_{j,t} + \zeta * Macroeconomy'_{j,t} + \varepsilon_{i,j,t}$

Model (3) $Bank\ Stability_{i,j,t} = c - a * \widehat{Distress_{i,j,t}} + \beta * Bank\ Char'_{i,t} + \gamma * Conven_{i,t} + \delta * Crisis\ Dummy_{j,t} + \lambda * Regulation'_{j,t} + \lambda_1 * (Regulation_{j,t} * Distress_{i,t}) + \zeta * Macroeconomy'_{j,t} + \varepsilon_{i,j,t}$

Banking stability is proxy with the Z-score index and NPL ratio; Distress uses the classification of CAMEL; Bank Char refers to a vector of bank characteristics; Conventional (non-Islamic) refers to the types of banks as a reference group; Crisis dummy is a dummy that takes the value of 1 for 2008-2009 when the global financial crisis occurred; Regulation refers to country level regulatory decisions and Macroeconomy is a vector of macroeconomic performance of countries included in our analysis.

For the estimation of the above models, we employ a fixed effects panel model where we include the interaction terms of each variable separately with each policy. The results are summarized in Table 2-9 where we have 3 groups of explanatory variables. First, individual distress measures and their interaction with the Islamic banks, second regulatory measures as well as their interaction with distress and third the usual macroeconomic variables. Overall, the results are in accordance with our theoretical model and the estimated parameters for individual distress and regulation variables are close to the fixed effects estimations in Table 2-8. The presence of the Islamic banks comes, as in our initial baseline model, with a positive sign which points out its positive effect on banking stability. However, when we disaggregate Islamic banks interactions with the distress level measures (low, medium, high) we observe that in the case of low distress, Islamic banks continue contributing to banking stability. However, when the distress situation becomes serious (CAMEL distressed banks measure increases above 3.4 points) the presence of Islamic banks, despite their stability promoting business model characteristics , have a negative effect on bank risk although of a small magnitude. In other words, Islamic banks that experience a distress level for the composite CAMEL index above 3, have a negative effect on overall banking stability. These results appear to contradict our initial observation derived from our total sample estimates where Islamic banks, due to their limited degrees of freedom in their assets and liabilities allocation policy, have a stronger capital base and Z-score than conventional banks. Our results indicate that this expected positive effect that Islamic banks have on bank market stability is not strong enough and hence is counteracted and thwarted by the strong negative distress effect on stability.

For the Distress Dummy, we notice a positive effect with the Islamic dummy showing evidence that the banks with a good average performance in terms of distress benefit banking stability.

Regarding the regulation measures, we notice the following: Capital requirements (CAPR) when they become more stringent give, as expected, a positive push to financial stability. However, when the interaction with the distress measures is considered, the results change. In the case of low distress, banks are well capitalised, and despite the additional capital requirements stringency the overall effect still produces a positive effect on banking stability. In contrast, when the distress is medium or high, that is above 3.4 in the CAMEL index, its negative effect on stability overcomes the positive effect of CAPR and their interaction weakens financial stability. These results once again show how important the bank's distress factor is to the financial stability. For the Distress dummy, since this measure captures events where the banks have ended their operations, the restrictions of capital requirements at the government level can impose a positive effect on banking stability as it allows the limitation of losses and the overall damage to the banking sector.

Moving to the interaction between distress and Supervisory Power (SUPP) (values between 0 and 14 with higher values denoting greater supervisory power) the results show a negative effect for all banks at higher levels of distress (High Distress and Medium Distress). This falls in line with the reasoning that banks in distress are likely to respond negatively to stringent regulation requirements and when they are already facing issues with some of their operations, the enhancement of restrictions are more likely to endanger their survivability and banking stability. As regarding banks at low levels of distress the interaction effect is positive which falls in line with the notion that banks, that are already at good capital levels, who have overcome periods of crisis with less losses, can take advantage of the change in supervisory power to enhance their business models and stability.

For the final set of interaction terms between distress and Activity Restrictions (ACTRS), the effect is negative at all levels of distress. This is an expected findings since distress negatively affects stability and the individual effects of activity restrictions show a negative response of banks operations at the bank level. This finding indicates that for all types of bank business models, increased restriction of activities results in a decrease of banking stability as banks are restricted in how they allocate and adjust their assets towards what they consider to be the most efficient structure in their case and this in turn increase inefficiency decrease profits and solvency . The effect remains statistically significant for all levels of distress indicating that once a bank has problems with its operation, increases in activity restriction at the country level can further deteriorate the overall banking sector stability in the MENA region. The evidence is suggestive that the observed overall increase of activity restriction across the MENA region has led distressed banks into a worse position where recovery becomes more difficult considering the increase of bank risk. This finding supports Naceur and Omran (2011), who argues in favour of fewer activity restrictions on banks in the MENA region to promote and encourage market competitiveness and increase banking system soundness. Once again the REGQ variable appears positive but insignificant both when alone and interacts with distress variable. As we have mentioned before, its low values and its values stability over the time span under examination, make the variable positive effect on stability non-significant.

Table 2-9 Fixed effects panel results on stability controlling for bank distress and its interaction with Regulation Measures for 2004-2015.

	Ln Z-score			
Variables	1	2	3	4
Low distress	**-0.011****			
	(-2.206)			
Medium Distress		**-0.012*****		
		(-3.071)		
High Distress			**-0.013*****	
			(-3.183)	
Distress Dummy				**-0.034*****
				(-3.171)
Islamic	**0.112****	**0.116*****	**0.094****	**0.087****
	(2.342)	**(2.679)**	**(1.975)**	**(2.267)**
Low Distress * Islamic	**0.098****			
	(2.03)			
Medium Distress * Islamic		**-0.063****		
		(-1.991)		
High Distress * Islamic			**-0.069***	
			(-1.94)	
Distress Dummy * Islamic				**-0.138*****
				(-2.951)
Inter Rate	-0.038	-0.065	-0.056	-0.078
	(-1.204)	(-1.041)	(-1.019)	(-0.904)
Macroeconomic Variables				
GDP growth rate	0.022**	0.049***	0.042**	0.040**
	(2.353)	(2.455)	(2.186)	(2.266)
GDP per capita	0.035**	0.028**	0.022*	0.021**
	(2.312)	(2.261)	(1.922)	(2.073)
Inflation	-0.037**	-0.026**	-0.036**	-0.023*
	(-1.990)	(-2.223)	(-2.079)	(-1.928)
Crisis Dummy	-0.008	-0.006*	-0.022*	-0.122*
	(-1.414)	(-1.842)	(-1.913)	(-1.942)
Regulation Measures				
CAPR	0.095***	0.098***	0.092*	0.091**
	(3.312)	(3.061)	(1.522)	(2.073)
Low Distress * CAPR	0.031**			
	(2.093)			
Medium Distress * CAPR		-0.048**		
		(-2.162)		
High * CAPR			-0.018**	
			(-2.212)	
Distress Dummy * CAPR				0.028**
				(2.162)
SUPP	-0.016***	-0.015***	-0.013***	-0.033**
	(-3.019)	(-3.065)	(-2.636)	(-2.229)
Low Distress * SUPP	0.020**			
	(2.096)			

	Ln Z-score			
Variables	1	2	3	4
Medium Distress * SUPP		-0.061***		
		(-2.619)		
High Distress * SUPP			-0.010**	
			(-2.285)	
Distress Dummy * SUPP				-0.120**
				(-2.212)
ACTRS	-0.015**	-0.022**	-0.016**	-0.017**
	(-2.028)	(-2.154)	(-2.068)	(-2.096)
Low Distress * ACTRS	-0.024*			
	(-1.851)			
Medium Distress * ACTRS		-0.026*		
		(-1.806)		
High Distress * ACTRS			-0.016*	
			(-1.868)	
Distress Dummy * ACTRS				-0.014*
				(-1.851)
REGQ	0.011	0.021	0.031	0.038
	(0.975)	(0.922)	(0.917)	(0.945)
REGQ* Low Distress	0.021			
	(1.011)			
REGQ* Medium Distress		-0.013		
		(-0.911)		
REGQ* High Distress			-0.021	
			(-0.921)	
REGQ*Distress Dummy				-0.021
				(-0.921)
Arab Spring	-0.091*	-0.089*	-0.071*	-0.064*
	(-1.808)	(-1.859)	(-1.815)	(-1.808)
Constant	4.013***	5.022***	5.008***	5.017***
	(3.422)	(3.818)	(3.685)	(3.791)
Diagnostics				
Number of obs.	2056	2056	2056	2056
R^2	15.12%	14.34%	15.12%	15.01%
Bank and Year FE	Y	Y	Y	Y
F stat	127.99***	121.95***	128.34***	124.68***

Note: Panel at the bank level with annual frequency 2004-2015.The dependent variables of each regression are noted in the first line of the table. For a complete overview variable definitions and sources, Banking stability includes Z-score (Measure of the distance of a bank from insolvency. Computed as the sum of equity to asset ratio and the return on assets (RoA) divided by the standard deviation of the RoA), Ln (Z-score) (Measure of the distance of a bank from insolvency. Computed the natural logarithm of Z-score), NPL (The ratio between non-performing loans and the total gross loans of the bank).

Independent Variables include: Bank Specific Variables and CAMEL related variables: Capital (TC1=Tier 1 capital to total assets, TCR=Total capital ratio measured as a ratio of (Tier 1 + Tier 2) over total assets, EQA=The ratio between total equity and total assets of the bank, Asset quality (LAS=Ratio of net loans to total assets, LLP=Ratio

of loan loss provisions to total loans, RoA=The ratio of bank net income to average value of assets) Management quality (LGR=Average of historical loan growth rate, EGR=Average of historical earning growth rate) Earnings (NIM=Net interest margin measured as a ratio of (interest received − interest paid) to total earning assets, ROAE=Return on average equity measured as a ratio of net income to average capital equity, ROAA=Return on average assets measured as a ratio of net income to average assets) Liquidity quality (LATS=The ratio between liquid assets and short term borrowing of the bank, LTD=The ratio of total loans to total deposits of the bank, LAT =The ratio of liquid assets over the total assets of the bank)
Bank Distress includes: Low Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 1-2.4), Medium Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 2.5-3.4) High Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 3.5-5), Distress Dummy (Dummy if the observed value of the binary is one under the state of distress following requirements in section 2.2, and zero otherwise).
Bank Controls: Size (Natural logarithm of assets (in millions of constant US dollars), IntRate (Rate of interest charged on short-term loans made between banks), Islamic (dummy equal to 1 if a bank is Islamic and 0 otherwise). Macroeconomic Variables include: GDPG growth rate (The annual growth rate of each country's real GDP), GDP per capita (Gross domestic product divided by midyear population in constant 2010 U.S. dollars), INF (The inflation rate based on the consumer price index) UNEM (Percentage of unemployed to total labour force (%)) Regulatory variables: CAPR (Capital Requirements: An index that takes values between 0 and 9, with higher values indicating greater stringency), SUPP (Supervisory Power: An index that takes values between 0 and 14 with higher values denoting greater supervisory power) ACTRS (Activity Restrictions: An index that takes values between 0 and 16 with higher values indicating more restrictive environment enforced by government) and REGQ (Annual index of the quality of regulatory quality in the country. The index ranges from −2.5 to 2.5 with higher values denoting better institutional development). Control Variables include Crisis Dummy (dummy equal to 1 for the global financial crisis of 2008-2009, 0 for other periods), Arab Spring (dummy equal to 1 for the Arab spring of 2011-2012 for Algeria Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates and 0 for other periods). Country dummies are included in all regressions. Estimation method is fixed effects method with t statistics robust standard errors clustered by bank in columns (1) – (4).
*,** and *** denote significance at 10%,5% and 1% respectively.

A comment related to low R2 is that such 'low' values of fit are not exceptional in our model since the R2 values in other relevant studies range from ,07 in Louati, et. al.(2016) to 0,27 in Mateev and Sahyoumi (2020).

The main results of distress being highly significant and negative is further supported by our robust test using the two-step system GMM results (Table 2-10). This GMM approach allows to address potential dynamic endogeneity, unobserved heterogeneity and the simultaneity between banking stability and competition variables and other bank characteristics to attain perfect estimators. This research employs the dynamic panel GMM approach proposed by Arellano and Bover (1995) and Blundell and Bond (1998). We report the result of the AR (2) second-order serial correlation tests, the Hansen J test of overidentifying restrictions and the difference in the Hansen J test of exogeneity. For all three tests, we find that the value is statistically insignificant and as such we cannot reject the null hypotheses that no second-order serial correlation; our instruments are valid and the instruments we use in the system GMM estimation is exogenous, respectively. The distress dummy as an alternative specification also displays highly negative values by decreasing stability. Since the distress of a bank is not instantaneous we find that the lagged one year Z-score significantly and negatively affects the level of stability of the banks in all countries next year. For macroeconomic and the regulation environment variables, there is no change of signs.

A final comment on our results from the different estimation methods is that the Crisis dummy for global financial crisis 2008-2010 and for the Arab spring crisis variables show a negative and positive effects but with no or low statistical significance. It is possible that the effect is not able to be captured by our model as even in the countries in which the Arab Spring originated there was only a strong short-term impact within the year it started. The negative shock measured in the literature was mainly to GDP growth. This means that both the positive and negative shocks the Arab Spring had in all the countries (note that almost half of them did not have any indirect or indirect effect from the Arab Spring), is cancelled out due to the larger size of countries included than the ones experiencing the shock.

In all models' estimation the GDP per capita comes with a positive sign and significant which indicates that economic development and income improvement especially in emerging countries that also improves financial inclusion also enhances bank stability Unexpectedly, in contrast with the findings in previous estimations' models, the GDP-growth variable appears with a negative significant sign indicating that as GDP increase stability decreases. Such findings however are not unique. In a study by Gonzalez et. al. (2017) estimating the impact of competition on bank stability for MENA region found that GDP growth has a negative effect on stability and attributes it to inconsistent macro policies by policy makers. A view also shared by Abraham Oni and Ozemhoka M (2014). Cubillas and Gonzalez (2014) and Dong et. al. (2014) found that banks, within higher GDP growth environment, faced hurdles in growing their capital i.e a negative relationship between capital ratio and GDP growth. Finally, a study investigating the determinants of bank stability in MENA countries by Majed Alharthi (2017) finds that the GDP growth significantly decreases the stability of conventional banks and is nonsignificant for Islamic banks.

Table 2-10 System GMM for the estimation of the effects of distress on banking stability for MENA region, 2004-2015

Variables	Ln Z-score	Ln Z-score	Ln Z-score	Ln Z-score
Low Distress	0.011**			
	(2.050)			
Medium Distress		-0.028**		
		(-2.215)		
High Distress			-0.071**	
			(-2.035)	
Distress Dummy				-0.024**
				(-2.171)
Ln Z-score (-1)	-0.261***	-0.263***	-0.262***	-0.264***
	(-10.201)	(-11.078)	(-11.605)	(-11.107)
TCR	0.085***	0.072***	0.072***	0.069***
	(4.450)	(3.126)	(3.138)	(3.069)
NIM	0.044***	0.043***	0.042***	0.121*
	(2.855)	(2.759)	(2.777)	(1.818)
Islamic	0.080**	0.076***	0.071**	0.042***
	(2.312)	(2.979)	(2.775)	(2.367)
LTD	0.039***	0.038***	0.031***	0.016
	(2.389)	(3.022)	(3.131)	(1.234)
GDP per capita	0.022***	0.030***	0.035***	0.030***
	(3.353)	(3.355)	(3.126)	(3.200)
INF	-0.047	-0.016	-0.016	-0.021
	(-1.190)	(-1.123)	(-1.179)	(-1.228)
GDP growth rate	-0.038**	-0.026**	-0.026***	-0.028***
	(-2.204)	(-2.241)	(-2.819)	(-2.904)
Crisis Dummy	0.023***	0.022***	0.018***	0.027***
	(3.232)	(3.818)	(2.685)	(3.109)
CAPR	0.026**	0.020**	0.0180**	0.028**
	(2.126)	(2.118)	(2.049)	(2.223)
SUPP	-0.015**	-0.013**	-0.020**	-0.018**
	(-2.002)	(-2.016)	(-2.009)	(-2.029)
ACTRS	0.023*	0.024**	0.026**	0.017**
	(1.923)	(2.115)	(2.128)	(2.126)
REGQ	-0.007	-0.004	-0.001	-0.001
	(-1.222)	(-0.762)	(-0.608)	(-0.159)
Arab Spring	-0.017*	-0.014*	-0.013*	-0.0018*
	(−1.704)	(-1.761)	(-1.735)	(-1.738)
Constant	3.33***	4.32***	3.28***	3.27***
	(3.142)	(3.318)	(2.601)	(3.531)
Wald Chi2	91.013	90.676	93.471	92.824
# of obs.	878	889	876	861
AR(1) p value	0.028	0.036	0.035	0.038
AR(2) p value	0.349	0.299	0.367	0.283
Hansen p-value	0.281	0.315	0.343	0.281
Number of instruments	111	108	114	112

Panel 2004-2015.The dependent variables of each regression are noted in the first line of the table. For variable definitions and sources, Banking stability includes Z-score (Measure of the distance of a bank from insolvency. Computed as the sum of equity to asset ratio and the return on assets (RoA) divided by the standard deviation of the RoA), Ln (Z-score) (Measure of the distance of a bank from insolvency.

Computed the natural logarithm of Z-score), NPL (The ratio between non-performing loans and the total gross loans of the bank).

Independent Variables include: Bank Specific Variables and CAMEL related variables: Capital (TC1=Tier 1 capital to total assets, TCR=Total capital ratio measured as a ratio of (Tier 1 + Tier 2) over total assets, EQA=The ratio between total equity and total assets of the bank, Asset quality (LAS=Ratio of net loans to total assets, LLP=Ratio of loan loss provisions to total loans, RoA=The ratio of bank net income to average value of assets) Management quality (LGR=Average of historical loan growth rate, EGR=Average of historical earning growth rate) Earnings (NIM=Net interest margin measured as a ratio of (interest received − interest paid) to total earning assets, ROAE=Return on average equity measured as a ratio of net income to average capital equity, ROAA=Return on average assets measured as a ratio of net income to average assets) Liquidity quality (LATS=The ratio between liquid assets and short term borrowing of the bank, LTD=The ratio of total loans to total deposits of the bank, LAT =The ratio of liquid assets over the total assets of the bank).

Bank Distress includes: Low Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 1-2.4), Medium Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 2.5-3.4) High Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 3.5-5), Distress Dummy (Dummy if the observed value of the binary is one under the state of distress following requirements in section 2.2, and zero otherwise).

Bank Controls: Size (Natural logarithm of assets (in millions of constant US dollars), IntRate (Rate of interest charged on short-term loans made between banks), Islamic (dummy equal to 1 if a bank is Islamic and 0 otherwise). Macroeconomic Variables include: GDPG growth rate (The annual growth rate of each country's real GDP), GDP per capita (Gross domestic product divided by midyear population in constant 2010 U.S. dollars), INF (The inflation rate based on the consumer price index) UNEM (Percentage of unemployed to total labour force (%)) Regulatory variables: CAPR (Capital Requirements: An index that takes values between 0 and 9, with higher values indicating greater stringency), SUPP (Supervisory Power: An index that takes values between 0 and 14 with higher values denoting greater supervisory power) ACTRS (Activity Restrictions: An index that takes values between 0 and 16 with higher values indicating more restrictive environment enforced by government) and REGQ (Annual index of the quality of regulatory quality in the country. The index ranges from −2.5 to 2.5 with higher values denoting better institutional development). Control Variables include Crisis Dummy (dummy equal to 1 for the global financial crisis of 2008-2009, 0 for other periods), Arab Spring (dummy equal to 1 for the Arab spring of 2011-2012 for Algeria Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates and 0 for other periods). Estimation method is two step Panel GMM model with t statistics reported under robust standard errors. We have treated lagged dependent variable as the endogenous variable in the GMM style instruments. For the case of transformed equation *, ** and *** denote significance at 10%,5% and 1% respectively.

2.7 Discussion and Policy implications

In this study the main objective is to examine if distressed banks and the regulatory environment influence the overall banking sector stability. Our modelling approach provides results that certify that distressed banks have an overall significant and negative effect on banking stability whilst regulation policies such as capital stringency, supervisory power and activity restrictions come out with mixed results. Specifically, supervisory power in all models comes out with a negative sign thus showing weakening stability while the results for capital stringency and institutional quality indicate a positive effect on banking stability but activity restrictions show mixed results.

Our modelling also explores whether the presence of Islamic banks and their interaction with all levels of bank distress affects financial stability. Our findings show that stability weakens. Therefore, the presence of conventional or Islamic banks does not differentiate the effect of bank distress on overall stability.

Finally, we model and estimate in a robust way the interactions of the regulation measures with each level of bank distress and the results show that the effect on stability varies with the level of bank distress. However, it is clear that when bank distress is severe (Medium to High Distress) the interaction effect is significantly negative for all regulatory measures. Although the results of separate regulatory measures provide mixed results for their effect on stability, we have a clear result that distress's negative effects on stability, especially when bank distress is medium or high, overrides the positive regulatory effects or enhance the negative regulatory effects on stability and overall weakens the stability of the banking system. This is a strong sign that stricter regulations and supervision imposed on banks that already face financial problems is going to increase their overall risk of their business operations and destabilise the whole system further. This is based on the notion is that banks already facing issues might go all out on their attempts to recover losses and in worst case scenario they will simply be absorbed by the government given the closer collaboration principles between Islamic banks and the government in the MENA region, especially for domestic banks. In the case of foreign banks, the parent banks are the ones deciding to help by relocating capital to their foreign subsidiaries or withdraw their presence based on their performance but also that of their foreign counterparties causing a domino effect, given that foreign presence is already limited in our sample.

A final mode of our basic estimation and other models explores the effect of the Arab spring on stability. The results from all models estimated are not surprising in that the

Arab spring has a significant negative effect on stability no matter how the latter is measured.

Our summarized findings above have at least four important policy implications. Primarily, the fact that we found a significant negative effect of distress on banking stability gives a warning to financial authorities that situations of medium or high distress not only can be identified in the banking sector but quickly should be resolved to avoid creating domino effects for the financial stability.

Second the presence in our sample of Islamic and conventional banks characterised by different bank business models has been explored in terms of stability effects and our results highlights how important is to provide regulations that can benefit all banks instead of indirectly placing the burden of operation on one type of banks.

Third the explicit modelling of the regulatory environment and the following econometric results reinforce the arguments favouring implementation of more stringent capital regulations, less restrictions on activities of the banking sector and less supervisory power for the enhancement of financial stability. In the MENA region, however, the trend across most of its countries was toward increased capital stringency (by adopting Basel's guidelines on capital requirements) before the burst of global financial crisis and combined with the special profile of Islamic banks had a positive effect on banking stability. However, the combination of more capital requirements in a stricter regulation environment leads to an ambiguous effect on banking stability, under the effect of distressed banks.

Our results once again warn the regulatory authorities that no matter how stringent capital requirements are, how powerful is the supervisory power, how strong are activity restrictions and how good is institutional quality the presence of the distress phenomenon dominates and regulatory authorities must, before implementing such measures, tackle issues of distress for avoiding financial instability.

Fourth, the overall results indicate that distressed banks hurt banking stability but also that a clear way of successfully dealing with crisis in the MENA region requires the decomposition of the regulation environment, as depicted with the four variables we use. Our results can be used as a first pass at decomposing how bank distress evolves over time in this regard. Bank distress will always exist due to banks risk involvement, but close monitoring should allow regulators to distinguish which cases require immediate treatment and which types of resolution are optimal. To this end, our approach can be used as an additional monitoring tool in creating safety nets for the financial sector.

2.8 Conclusions

Our approach contributes to the literature by using bank level data to identify the level of bank distress for a group of 21 MENA countries. In addition, by using the dynamic panel GMM, we assess the effect of distressed banks on stability and provide a direct link between research on distress and banking stability in emerging and developing markets which are in an important region of the world, but still not sufficiently explored. We augment the analysis by considering the macroeconomic and the regulatory environments as well as the global financial crisis and other structural events. This chapter sheds light on the relationship between distressed banks, the macroeconomic environment and regulatory framework in the MENA region. In particular, we investigate the effect of distress on banking stability by identifying the key macro-financial interlinkages developed in the MENA region when banks act under distress. We analyse, the key macroeconomic indicators' behaviour combined with the regulatory regime, when banks face different types of distress and other structural events such as the global financial crisis and the Arab Spring. In addition, this study answers questions on the different role of commercial and Islamic banks in the stability of the banking system, while the focus on the MENA region reveals the interaction among banks when acting in the distress period, the stability of banks as well as the macroeconomic environment as defined by the economic performance and indicators of the respective group of countries. By utilising and combining different datasets with balance sheet information for 320 banks from 21 countries, which cover the time period of 2004-2015, we study banks' behaviour and evolution, when distress arises in the system under examination. In this regard we depict the dynamic evolution of distress and its effect on banking stability under two alternative specifications, the CAMEL methodology and a dummy variable approach. This is achieved by interacting the levels of distress (and the dummy variable) with both macroeconomic and regulatory measures to provide empirical evidence on whether banks' reaction to distress events of varying magnitude, affect the stability of the MENA region banking system.

Our results show the role of distress as a significant driver of banking stability, with higher levels of distress exhibiting stronger negative effects, in line with expectations.

The macroeconomic and regulation environment results also remain consistent with previous findings in the literature on the different effects stricter regulation can have on banking stability while shedding new light under the added dimension of distress as a bank characteristic, with GDP per capita and Capital regulations at the national levels being the stronger performance indicators, respectively. Furthermore, among the interactions created as part of our analysis, the results show a distinct pattern of the investment restrictions on banks exhibiting a higher level of negative influence on banking stability. Also, the global financial crisis and the Arab springs have a moderate effect (at best) on our analysis.

All our econometric models are estimated using fixed effect panel, system GMM and 2SLS estimators checking for endogeneity which was rejected. The main overarching theme of our analysis is that the distress phenomenon is significant for financial stability and has a weaker effect the lower the level of distress (based on the CAMEL approach). The distinction between different levels of distress does not change the negative effect of all levels on financial stability. The regulatory environment, as represented by four variables, has a significant effect on banking stability but not all regulations have the same effect when increasing their role in the system. Such is the case of regulation quality vs Supervisory Power where for the latter more regulation actions (increase in the indices) seem to benefit banking stability as opposed to the effect of increased supervisory related actions (such as capital stringency). However, when the regulatory regime interacts with the distressed phenomenon the latter's negative effect prevails in the overall effect on financial stability.

It is clear from our results that the financial regulation apparatus in operation in the MENA countries must be reformed in a such way to promote bank performance and stability. The findings from the study would help regulators, supervisors, to reform outstanding capital regulations and supervising practices to enhance better functioning of the banking systems Firstly, since capital requirement regulation promotes bank stability there is a need for more MENA countries to adopt Basel III requirements. Second the negative effect of supervision power and activity restrictions on stability must be taken into consideration by regulators to ease such restrictions, relax governmental confinement of bank operations and allow a higher degree of competition. However, our findings from regulation and supervisory measures interaction with bank distress points out that no matter the positive effects of regulation and no matter of type of banks (Islamic or conventional) regulators must set up a system of disclosure that will allow them to foresee the degree of bank distress and take the necessary actions.

The macroeconomic environment, despite the variation in regulatory enforcement, is a significant driver of banking stability with a focus on the continuous growth of GDP per capita for both oil and non-oil producing countries. On the regulatory side and the macroprudential and micro prudential surveillance, the capital requirement index, the power of supervisory agencies index and the activity restrictions index contribute to banking stability in different ways. This behaviour is explained by the variation of the index presented for each country, as investment restrictions on banks' activities impose the largest penalty on banking stability.

The existence of Islamic banks, according to our results, enhances financial stability. Their limited risk taking combined with the tight regulatory capital regime, lead Islamic banks' activities to contribute to the stability of the financial system. However, when Islamic banks operate in a distress period, their impact on the financial stability is negative, which explains that these banks underperform and lead to financial system instability. These findings uncover the strong interlinkage between the macro and the financial side of the economy, as a booming economic system can promote financial stability.

This study is not without limitations, as is any empirical study in a new field. Firstly, the development of the CAMEL ratios can be sensitive to alternative specifications. Despite back testing with a broad range of tools and definitions, the possibility of variability cannot be eliminated. Secondly, data limitations in collecting detailed information, particularly on the regulatory environment are apparent. As such the use of indices and proxies had to be employed, so a potential loss of information exists. Finally, from an econometric and analytical standpoint, despite the use of multiple tests in every step of the process including the selection of the CAMEL measures for distress, the use of bank characteristics and the use of different econometric estimations, we have to note that the interpretation remains conditional on the context of the sample of the analysis, that is the MENA region and is rather difficult to interpret in a way that can be applied to every type of banking systems. Still our analysis indicates multiple ways to assess bank condition through distress and in parallel suggests policy implications in broadening a financial safety net which over the last years has become more essential than ever during crisis.

At the same time this research paves the road for further analysis of stability and the interaction with different levels of regulatory frameworks, in combination with up to date information on banks' balance sheets. Additionally, the inclusion of a broader range of countries which share the dual system of commercial and Islamic banks, could lead to an overarching investigation of distress in dual banking systems and their effect on banking stability. Finally, this study provides an empirical analysis examining distress under the dynamic evolution of environments and can be expanded in multiple directions to incorporate the latest on-going crisis.

Overall, this empirical chapter contributes to the current academic and policy related literature on banking stability and financial distress by providing significant policy implications in three distinct ways: Firstly, our study assesses different measures of distress and provides a toolkit for reviewing the dynamic evolutions of distress at panel level, between different types of banks and countries, simultaneously. Secondly, this empirical analysis addresses the complex interlinkages different banking systems face, as the macroeconomic performance and regulatory regime interact with a range of levels of distress. The MENA region economic and banking heterogeneity lacks a unified framework for assessing banking stability when banks operate under distress. Our approach overcomes this limitation, as it allows us to assess whether different regulatory policies and economic activities can affect banks' performance and stability when facing distress events. Finally, our empirical findings give a clear view of the characteristics of banks in dual banking systems. In particular, our analysis provides evidence to regulators and policy makers, to consider financial system heterogenous behaviour. Regulators and policy makers should develop a mix of policies which can enhance banking stability, instead of imposing a "one size fits all" approach.

Chapter 3 Competition and stability relationship under the prism of banks and concentration: a literature review of studies region and an empirical study for MENA region

3.1 (In)Stability and Competition: h/theory and practice overview

The allocation of national savings to investors, the provision of liquidity to consumers and business and the monitoring of well-functioning payment systems in the economy are essential functions that banks perform. Therefore, the financial system significance lies in the functions it performs for the real economy: intermediating between the personal sector of an economy (households and individuals) and the corporate sector (business firms). In the seminal paper by Fama (1980) he examined the role and function of banking within the theoretical framework of finance. He argues that banks are indeed financial intermediaries offering deposits accounts to individuals and with the deposits' proceeds are funding their portfolio investment in securities. He further argues that when banking is competitive, these portfolio allocation and securities management activities in principle fall under. the Modigliani-.Miller theorem which theorem simply states that in an efficient market a company's capital structure is not a factor in its value. In other words, Fama argues that banks are not special in any way and can be analysed using the same tools as other firms and there is no need to control the deposit and/or security activities of banks to obtain a stable general equilibrium with respect to prices and real activity. From another point of view however, banks provide services to both depositors, who tend to prefer liquid accounts in case they need easy access to funds, and loan-takers, including businesses and individuals making large purchases, who often look for long-maturity but low-liquidity loans for banks. This special feature of banking business is the backbone of the seminal work by Diamond and Dybvig (1983) (DD hereafter) who set up an arrangement model that contains two important characteristics that are typically identified with banks. First, it performs maturity transformation by offering short-dated (liquid) claims against long-dated(illiquid) assets and second it issues liabilities that are payable on demand. This model gives apart from the social optimum equilibrium a second equilibrium: bank run. Demand deposits work very well when investors forecast that banks will survive and there is normality in daily deposits and withdrawals but if depositors lose faith in banks then a massive at the same time deposits withdrawals makes bank to face a bank run and more likely bank failure. A simplified presentation of DD model is provided by Diamond (2007). Furthermore, the DD model forms the foundation of modern bank regulation by considering three policies (suspension of payments, government intervention and deposit insurance) that can prevent bank runs. In a later work Diamond and Dybvig (1986) they argue that deposit insurance is the only effective measure to prevent bank runs and keep banks creating liquidity. However, they make a notice that deposit insurance can create incentive to banks to take much risk in their assets allocation and bank regulation should contract this phenomenon. Since DD work a lot of work has gone into developing a better understanding of what is essential in terms of hypotheses to DD's fragility and what can be done to prevent it. The basic structure of the model has become a platform on which many other banking-related models have been built. The fact that Diamond and Dybvig's model appears to be simple, can be extended to deliver insights about much more complicated environments. DD model also improves our understanding of the recent global financial crisis. The literature following DD work has provided extensions of the model with alternative assumptions about agents and environment involved and is often very technical. However, the article by Ennis and Keister (2010) provides a non-technical overview of this literature. Perhaps the most important refinement to the model is the introduction of bank risk taking. Banks in the Diamond-Dybvig work invest in riskless assets. Hence risk-taking incentives do not enter the model. Introducing investments in risky assets and the impact of deposit guarantee on the risk-taking incentives of banks and their private monitors raises concerns of "moral hazard" which has been central in later theoretical extensions (Calomiris and Gordon, 1991; Cooper and Ross, 2002-. In other words, the fragility of banks in modern banking theory models are also the result of physical and informational frictions, but only specific combinations of these frictions lead to fragility. Research on bank fragility issues has proceeded with its attention to the assets side of the bank i.e., their credit provision. When banks provide liquidity for the finance of enterprises long-term projects they take a credit-risk of loans' repayments failure (non-performing loans). An increasing volume of unanticipated non-performing loans create banking instability and can show-up through insolvency. Over the past four decades, a number of researchers have widely documented that most credit market failures are attributed to information asymmetries between lenders and borrowers (Stiglitz & Weiss, (1981)-., Besanko & Thakor, (1987)-; Dell'Ariccia & Marquez, 2006- Therefore, banks in their process of lending funds have to confront the issue of information asymmetry. According to Stiglitz, J., &Weiss, A. (1981) when banks provide loans they are concerned with the interest rate and riskiness and since interest rate influence riskiness there is an equilibrium situation with credit rationing. This situation is the result of information asymmetry. Actually, there are two types of associated to credit rationing and credit risk : the adverse selection and the moral hazard. In both types the one of the contracting parties has informational advantage.

Overall although banks provide essential services for the real economy at the same time are subjected to fragility-instability cases which are detrimental for the economy . The stability of the banks individually and of the entire banking market is essential for the health of the economy. A non-stable situation in the banking market is mirrored by one or more banks failures/closures which may trigger a contagion phenomenon and a systemic banking crisis. Such a situation certainly interrupts economic growth and has severe adverse effects in the real economy. Although the bank run theoretical framework and the information asymmetry theory rather establish the case of bank default there is a plethora of empirical research about the factors that are associated with and which impact upon bank (in)stability Among the explored factors that affect bank stability is bank market structure or the competition in banking market of banks or bank market power. As in other industries, competition in the banking system is desirable for efficiency and maximization of social welfare. However, due to its roles and functions, there are some properties that distinguish it from other industries. It is important to not only make sure that banking sector is competitive and efficient, but also stable.Competition in banking sector affects bank's strategies on assets and liabilities pricing and allocation given the regulation and economic environment and may lead to bank distress situation that finally brings, in most cases, bank insolvency.

Competition-fragility and competition-stability are the two main streams of thought when answering the question: Is competition positively related to bank stability or to bank fragility? The competition-fragility view evokes that more competition is associated with more fragility or less bank stability whilst competition – stability supports the view that more competition makes the banking system more stable and sounder. Two seminal papers that the literature focuses upon for the academic debate on the competition-stability relationship are by Keely (1990) on the competition-fragility view arguing that bank competition is enhancing bank fragility (also called the charter value hypothesis) and by Boyd and De Nicolo (2005) who find mixed evidence in support of the competition - stability view depending on the model assumptions (existence of loan markets and/or inclusion of bankruptcy costs) and on the number of banks in any given banking system competing with one another.

In particular Keely (1990) analyzing the behavior of the US banking system (the 150 largest banks) in the pre and post deregulation periods of the 70's and 80's documents that the decline of charter value (the difference between the market value of a bank and its book value) of banks in the 70's was followed by banks failure in 80's. He then rationalized this phenomenon on the grounds that deregulation (relaxation of entry restrictions) opened up competition (measured by Tobin q index) which in turn pressurized profits, monopoly rents and reduced bank's charter value. The banks' reaction in order to reverse such a situation is to choose more risky portfolio strategies which finally make banks less sound and more fragile. This is the well known as charter value hypothesis. Two studies by Elijah and Staidenberg (1996) and Demsetz et al. (1996**)** following the rational in Keely's paper extend the empirical research to saving and loans institutions by using a variety of types of bank risk and argue strongly supporting the moral hazard hypothesis and that BHC (Bank Holding Companies) and S&L (Saving & Loans) banks with lower franchise value hold riskier assets. Following a theoretical approach Matutes and Vives (2000) introduce the role of social failure costs which banks pass on, where taking on more risk goes along with flat-premium deposit insurance and risk is minimized with risk-based insurance. In the case of increased competition the critical social failure cost above which rates are too high is lowered. The Allen and Gale (2001) analysis of competition in the deposit market supports the competition fragility hypothesis, later extended by Boyd and De Nicolo (2002) who include entrepreneurs obtaining loans from banks and investing. Interestingly, as competition between banks increases, the risks taken by borrowers is unambiguously reduced and financial stability is improved. This show one of many ways in which evidence is mixed. Further on this, Franklin, and Gale (2004) in their approach of examining competition and financial stability under the prisms of Agency Costs and contagion (among others) to find the right balance mix, find that sometimes competition decreases stability and sometimes perfect competition is compatible with the socially optimal level of stability. For example, even in cases of simple partial-equilibrium models, where it is possible to generate a negative trade-off between competition and financial stability, the underlying parts of the trade-off is more complicated. In other words, it is possible in some cases for a number of banks of large size in terms of assets to be able to pursue a stringent monitoring of borrowers leading to safer lending which enhance bank stability, a view supported by Petersen (1995) and Hauswald (2006). In an empirical cross section approach, Beck et al. (2006) examine the role of bank concentration and competition in banking crises and find evidence in support of crises being less likely in economies with more concentrated banking systems after controlling for a number of factors such as regulatory policies. Especially regimes where regulations restrict banks from engaging in non-loan making activities have a greater likelihood of experiencing a systemic crisis.

As mentioned above the prelude to the competition-stability view is a paper by Boyd and De Nicolo (2005) and Boyd et al., (2006) where they examine the asset side of the bank, the borrower. Their theoretical model allows for competition in both deposits and loans markets and considers the borrower's reactions to loan rates and other lending terms changes. Under competition conditions borrowers enjoy low loan rates and their investments' rate of success, ceteris paribus, increases in parallel with their profits. This, from the bank's point of view, makes the repayments of the loans safe and reduces the likelihood of default. The same rational is expressed in a study by Boyd et al., (2010) when investigating the crisis' determinant channels. Their results deny the trade-off between competition and stability and declare that that their "Results suggest that this (competition-fragility) finding is incorrect, and that the relationship is actually of opposite sign'' (p.30). Furthermore, they argue that when bank market power increases the result of higher interest loan induce borrowers to undertake risky projects and hence banks' portfolios become riskier and banks' stability is jeopardized.

Another argument with mixed empirical support of the competition-stability is the 'too-big-to-fail' concept which falls into the "concentration-fragility view" that larger banks are often more likely to receive public guarantees or subsidies, which is discussed as the "too big to fail- " TBTF in short- doctrine (Mishkin, 1999). This became well known in the aftermath of the recent financial crisis of 2008 where large banks created in a noncompetitive market became so crucial to the economy's stability and daily business that it became apparent that (almost ex-ante) in the case of failure the supervisory authorities and governments will not let them default in fear of collapsing the system as a whole. Knowing this in advance, bank managers are prone to pursue risky projects and as a result of the financial crisis in 2008-9, several empirical studies for both the US and Europe propose increased cross-country cooperation between regulators and supervisors while finding positive relationships between objectives of competition policy (market efficiency) and banking regulation (systemic stability) for Eastern, but not for Western European countries (Uhde and Heimeshoff (2009). However, Mishkin (2006) considers that the importance of the TBTF problem is overstated and it is not as serious as stated by Stern and Feldman (2004) who argue for appointing "conservative" bank regulators/supervisors and ones who have expertise in dealing with financial disruptions so that they can make an appropriate judgement as to whether there needs to be intervention to deal with financial instability. Furthermore, Barth et al. (2012) showed that the stricter capital and liquidity requirement as proposed in the Basel III standards and Dodd-Frank Act in US will have an uncertain effect on the TBTF banks.

Although, both of the opposing views above have theoretical and empirical support a reconciling view is documented in a paper by Martinez-Miera and Repullo (2010). It is argued that the different and opposing views so far are the result of assuming a linear relationship between competition and stability. Depending on the level (high or low) of competition the degree of stability can be increasing or decreasing. The U shape is the outcome of opposing effects that competition causes when it is increasing: the risk-shifting stability effect and the margin fragility effect. The lower loan rates as a result of competition either make borrowers investment projects profitable and easy to pay back and hence reduce credit-risk and increase stability of banks or makes banks' revenue (returns) fall and squeeze profits and buffers which in turn induces banks to invest in risky assets resulting in higher degrees of fragility. A number of empirical studies support the concavity of the relationship.

The theoretical opposing views have produced extensive empirical studies with results supporting each view. The variety of empirical studies which explore the stability and fragility relationship with competition cover many dimensions such as geographical (single country or cross-countries), time span and control variables (bank specific and country specific) in their sample data. Of course, there are various econometric techniques applied in their estimation although the panel GMM is mostly used due to the nature of their data.

A usual approach when reviewing the empirical research is to break down the studies into two categories reflecting the two views. We do not to follow this method, our review follows a more geographical focus. The reasoning behind this decision is to be able to examine in depth how different regions have experienced the competition-(in)stability relationship considering the variety of regulations, macroeconomic and other factors unique to each region across time. This is done in order to distinguish different methodology and modelling patterns which could shed light on the ongoing debate between competition-stability under a different prism compared to the debates for European and US banks which are the most common type of studies found in the literature. In addition, as many of the regions have a mix of developed and developing countries, the usual methods may need further insight in explaining the reasoning behind the studies' main results and suggest new alternatives in the examination of established academic debates in the literature. The Concentration and Competition relationship.

3.2 Competition index and measures in empirical literature: caveats to be aware of.

Before we embark on the review it is important to point out that there is an ambiguity over the correct measure to be used as a competition index. Both structural and non-structural measures to quantify competition and have been employed either separately or together. Concentration is traditionally the existence of a small number of firms which together have a big share of the market and hence exhibit non-competitive behavior. Some researchers use concentration in order to document which view is the correct one. However, concentration does not necessarily coincide conceptually and empirically, with competition. In other words, a concentrated market does not necessarily mean a noncompetitive bank market. Concentration is a 'structure' only measure and not a 'conduct' one and as Bikker and Spierdijk (2009). The latter study based on the Panzar-Rose approach for 101 countries shows that the ''structure itself does not impair competition. It is the conduct of financial institutions that determines competitive behavior. To assess the real situation on the financial markets in terms of competition, we need to measure the latter''. The main results are that monopolistic competition applies to most countries. We do not observe differences across continents. On average, the value of the measure of competition, is half-way between monopoly and perfect competition. This outcome indicates that, for most countries, the observed structural market failures did not keep financial institutions from behaving competitively. Of course (as the authors also mention), competition can still very strongly across submarkets. Schaeck et al., (2009) state that concentration and competition are two distinct elements and criticized the choice of concentration as a measure of competition. Beck et al., (2006) mention that concentration, which is often used as a competition proxy, cannot be considered satisfactory. This has started a separate stream of research that examines the relationship between concentration and competition i.e. do changes in concentration affect competition and, if so, in which direction? An answer to this question is given in a study by Bikker and Haaf (2002). They take a sample of 5444 banks in 23 developed countries (including US, UK and

Germany) to assess empirically the impact of market structure (bank concentration) on bank competition. They employ the Panzar and Rose approach for computing the PR-H statistic for bank competition as in Molyneux et al. (1994) while bank concentration is proxied with the Herfindahl-Hirschman Index (HHI) which is the sum of the squared market share of each bank in the system and with the Concentration Ratio which is the share of assets held by the k largest banks (typically three or five or ten) in a given economy (CR3,CR5,CR10). The regression results indicate that competition decreases as concentration increases. A different view is expressed by Claessens and Laeven (2004) who collect data for the banking sectors in 50 countries and use the Panzar and Rose method which is then examined using many bank structures and regulatory factors. Among other empirical results they find evidence that more banks lead to less competition while there is no evidence that banking concentration negatively relates to competitiveness. The same view is shared in a study by Casu and Girardone (2006) where, using bank-level data for the major EU banking markets for 1997 - 2003, the authors investigate the factors that influence the competitive conditions after controlling for efficiency, structural and institutional cross-country differences. The findings suggest that the level of concentration is not necessarily related to the level of competition. A more recent study by Jaab et al., (2017) where they collect and analyse data for US commercial banks in the period 1984 - 2013 using the HHI concentration and new critical mass measures further support that concentration measures are indeed unreliable competition metrics. Therefore, in results derived from empirical studies exploring the competition-stability issue it must be made clear whether stability or fragility is examined against bank concentration or competition since concentration and competition affinity is not yet decided. This means that if a negative relationship between concentration and stability is found in an empirical study this does not by default imply that one can accept the competition-fragility view.

3.3 Banking Stability across regions: Rationale and contribution(s)

The important contributions of the current in-depth literature review are firstly, that it reviews the empirical studies concerning the academic debate over whether the bank competition or concentration or market power has a positive or negative effect upon the bank risk or bank stability. We include papers that directly or indirectly present empirical estimates for such a relationship and assess their contributions accordingly. Secondly, we conducted a thorough research of all sources of academic articles and central banks/international organizations repositories to consider all aspects in our analysis. This was important for representing diverse finding and policy recommendations in an evolving and dynamic field of financial and banking stability where key challenges remain. Thirdly, our review covers one of the longest time periods presented in literature reviews in this area (to the best of our knowledge) starting from 1990 with the seminal paper of Keely (1990) and ending with papers published in 2021. Fourthly, the fact that the large number of articles collected covers is not, as usually, divided into and presented within the two competition-stability and competition-fragility rival views. We found the categorization more interesting and innovative to be based on the country or the region being investigated. Every geographical region covered has its own banking sector developments and characteristics and makes each one a unique case when the competition-stability issue is empirically investigated from both empirical and theoretical point of views.

The areas where the studies have been distributed are the continents Asia, Africa, Europe, and America with some countries of special interest such as the USA and China being reported separately. Also, studies exploring the competition-stability issue only for Islamic countries or comparing the competition-stability validity between Islamic and conventional banking systems (MENA, GCC) are also presented as separate groups. We also consider, as a separate group, studies concerning the Central Eastern Europe and Ex-soviet Countries (CEE), although these studies could be associated with the 'EUROPE' group. Finally, the Global studies group includes papers exploring the competition-stability issue using many countries from across the continents and the group Emerging includes relevant studies for a number of emerging/developing countries. Therefore the final grouping of the studies boils down to 15 groups which are: MENA(Middle East North Africa), GCC (Gulf Cooperation Council), ISL. vs. CONV, DEV/ED vs. DEV/ING, EMERGING, EUROPE, CEE(Central Eastern Europe), ASIA, CHINA, AFRICA, USA, LATIN AMERICA, GLOBAL, SINGLE COUNTRIES and BRICS(Brazil-Russia-India-China-South Africa).

With the review of the empirical studies I will examine the following hypotheses

H7: Empirical studies investigating bank stability determinants always include bank competition/concentration.

H8: The empirical studies investigating the competition-stability nexus are predominantly use the LERNER bank competition index and the Z-score stability indicator.

H9: Global banking crisis elevated academic research for the competition-stability issue.

H10: Studies exploring the competition-stability issue for MENA region are limited.

3.3.1 MENA Region

A very recent study by Zoghlami and Bouchemia (2020) using a sample of 197 commercial banks operating in 11 MENA countries over the 2011-2018 period estimate the impact of bank concentration and competition on both bank stability and profitability. Bank profitability is measured by ROA, ROE, and the ratio of net interest margin to total assets and the NPL ratio (Non-Performing Loans to total loans ratio) measures bank risk-taking. Competition is proxied with the HHI-assets concentration index and by the LERNER nonstructural competition measure. Control variables are the total assets, equity to total risk-weighted assets ratio, total loans to total assets ratio and GDP growth and inflation rate. They run a set of a panel fixed-effect OLS and dynamic panel difference GMM regressions with HHI-assets and LERNER explanatory variables alternatively. The results find a negative relationship between HHI-assets and LERNER indices with NPL ratio which suggest that higher concentration and lower competition reduces bank loan quality (increase of NPL). Overall results confirm that competition is associated with bank fragility.

Another recent study by Djebali et al., (2020) evaluate the positive or negative effect of credit and liquidity risks upon bank stability in the MENA banking system. To this end they collect data for the period 1999-2017 for 75 conventional banks from 11 MENA countries. The credit and liquidity risk are proxied by NPL ratio and liquid assets to total assets ratio respectively while the Z-score is the proxy used for bank stability. Control variables are the total assets, ROA, equity to assets ratio, political stability index and inflation. Furthermore, the LERNER index is the market power measure included in the explanatory variables set. They first check and confirm that there is a non-linear relationship using the econometric technique of panel smooth threshold regressions (PSTR). The results from the non-linear regression estimation find a threshold beyond of which credit and liquidity risks are seriously damaging stability.

Market power (LERNER index) in both regressions where credit and liquidity risk are the main explanatory variables comes with a positive and negative sign respectively but are non-significant. This suggests that in a non-linear framework and with the presence of credit and liquidity risk, competition may not be a relevant factor in the bank stability explanation.

Albaity et al., (2019) empirically test the competition-stability hypothesis collecting bank level data for 276 banks operating in 18 MENA countries for the period 2006-2015.The competition measures are the LERNER and BOONE indices while stability is proxied by the Z-score, NPL ratio, ROA and ROE. Control for financial inclusion and productivity is measured with the number of bank branches and ATMs per 100.000 adults and employment growth and labor productivity growth per person employed, respectively. Other control variables are the total assets, the net non-interest income to total income ratio, equity to assets ratio, and debt to GDP ratio. Findings from a two-step GMM estimator document a negative and positive effect of both LERNER and BOONE indicators upon Z-score and NPL respectively supporting the competition-fragility hypothesis. This competition-fragility effect is also found to be stronger for Islamic compared to conventional banks.

The role of ownership type and capital regulation regime in the MENA's banking sector stability is examined by Haque (2018). The data set covers the period of 2001-2012 for 144 commercial banks in 12 MENA countries. The dependent variable of bank stability is measured with the default risk Z-score index, the credit risk with NPL ratio and portfolio risk with the ratio of ROA (Return on Assets) to standard deviation of ROA. The percentage of shareholding by institutional investors, the proportion of equity held by the government by foreign investors and by the banks are the ownership variables used while the capital stringency, activity restrictions, supervisory power and market discipline, as defined in Agoraki et al. (2011), are the regulation variables. Among the bank-level control variables (total assets, the equity to assets, liquid assets to assets and loans to assets ratios and loan growth) the LERNER index is used for market power measurement. GMM estimations find that there is a trade-off between foreign ownership and bank risk-taking and that supervisory power has a positive effect upon the bank risk-taking activity, restrictions tend to have a weak negative relationship with bank risk-taking, and this relationship is stronger for banks that have higher concentration of ownership, and for countries that have stronger market discipline. On the contrary, capital stringency shows a positive association with bank risk-taking only in countries with higher activity restrictions. The market power as an explanatory variable for the full sample is only negative and significant when regressed against Z-score indicating that as competition decreases stability also decreases. However, when the sample is split into pre and post crisis periods the results for market power are mixed and as author argues are ‘’inconsistent results in most cases, indicating that competitive condition among banks cannot explain bank risk-taking in MENA countries’’ p 39.

Another study directly exploring the bank competition effects upon bank stability in the MENA countries is conducted by Almarzoqi et al., (2015). The sample period covered is 1999-2013 and includes 367 banks of which 258 are commercial, 8 real estate, 2 cooperative and 99 Islamic banks. The LERNER index at the bank and country level and the market share of each bank of assets of all banks in a country are the competition measures used. The ratio of liquid assets to short-term borrowing measures the Liquidity, the NPL ratio measure the credit risk and solvency risk is measured by the Z-score, the ratio of equity to assets and ratio of net income to average value of assets. Control variables are total assets and the ratios of non-interest income to total revenue, net income to average value of equity, bank holding of government bond to bank total assets, net loans to total loans and total deposits to total funding. GDP growth and inflation rate are the macroeconomic control variables. The activity restriction index, entry banking requirements, capital regulation, supervisory power, supervisor’s independence, government share of banking sector assets and deposit insurance scheme are the regulatory and institutional variables retrieved from the World Bank data base. Panel OLS regressions with bank fixed effect are estimated for the three dependent risk measures and the results show that competition affects differently the types of risks. Competition positively affects liquidity risk and has a negative impact on solvency risk meaning the competition stability view is supported. Also, the presence of Islamic banks does not make any difference to the bank solvency. However, competition has a positive effect on bank liquidity and negative impact on solvency.

Another study that focuses on the MENA region is Gonzalez, et al. (2017). They use a sample of 356 banks from 19 MENA countries covering the period from 2005 to 2012. The region is broken down to Gulf and Non-Gulf countries groups. They compute the PR-H competition index and the HHI concentration indicators which are then with a number of bank and country controls variables (equity to assets, net loans to total assets, loans growth rate, assets growth rate, Islamic bank dummy, GDP growth rate, inflation rate) regressed upon the total and credit risk measured by the Z-score and NPL ratio, respectively. Results from pooled OLS with a fixed and random effects estimation model find a nonlinear (U shaped) relationship between competition and risk–taking in MENA banks and this result can support both the competition-stability and competition-fragility hypotheses. The initial level of competition (high or low) determines competition's effect on fragility. Splitting banks into Gulf and non-Gulf countries findings show that for Gulf countries the linear relation between competition and stability is negative while for non-Gulf countries is positive. Also, the findings ''indicate that the concentration does not have to be associated with uncompetitive markets.'' (p. 600).

The impact of market power on stability in the MENA region is the research focus for a simple study by Labidi and Mensi (2015). Their sample includes 18 MENA countries and 157 commercial banks covering the period 2000-2008. To assess the default probability of banks they use the Z-score index with both ROA and ROE and competition is measured by the LERNER index. The estimation of these variables indicate that the MENA banking sector has a low degree of market power (low value of LERNER) and suffers from instability (low value of Z-score). The growth rate of loans, loan loss provisions to total loans, loans to deposits ratios and GDP growth rate and inflation rate are the control variables. OLS and fixed and random effect MCG estimations results testify that MENA banks operate in a competitive market and that competition does not lead to bank instability.

The market power in the MENA banking sector and its effect upon bank stability is examined in a paper by Louati and Boujelbene (2014). They collect bank level data for 62 conventional and 36 Islamic banks from 10 MENA countries over the period 2005-2012. The Z-score index and the LERNER index are the financial stability and the competition measures used, respectively. They control for bank size using total assets, for cost efficiency using the cost to income ratio, for the bank structure using the HHI-assets concentration index, for income diversity with the ratio of the difference of net interest income from other operating income to total operating income and for macroeconomic status using GDP growth. A dummy variable is used to indicate whether a bank is Islamic or not. After a descriptive comparative analysis for all countries covering efficiency, asset quality and profitability they run random effect panel regressions and find a positive and significant relationship between the LERNER and Z-score which is translated into support of the competition-fragility hypothesis. Furthermore, the HHI index shows positive but insignificant results that according to authors “confirms that the former (HHI) is an insufficient measure of competitiveness” p 242.

The impact of financial liberalization and banking competition on the banking stability is examined in another paper by Arafet (2013). Aggregate bank-level data is collected from 13 MENA countries over the period 1990-2009. Bank competition is measured by the PR-H statistic and the LERNER index and bank concentration by the CR3 and CR5 Indices. The dependent stability variable is the Z-score index. Measures of financial liberalization for capital, the author constructs capital account and domestic financial liberalization. Ratios of liquid reserves to bank assets, total credit to GDP, GDP growth rate, money supply to foreign reserves, inflation rate, real interest rate and net barter terms of trade are retrieved from the World Bank Indicators database. Fixed effect panel regressions results indicate that financial liberalization positively affects bank stability and concentration reduces bank soundness and competition enhances stability. The findings are consistent with the concentration-fragility hypothesis.

A comparative analysis of factors affecting the financial stability in MENA countries and Southeast Asian countries is investigated in a paper by Rajhi and Hassairi (2013). Annual data for 467 conventional banks and 90 Islamic banks from 10 MENA and 6 south Asian countries comprise the data set covering the period 2000-2008. The banks sample is split into four subsamples based on large -small banks and Islamic-conventional banks criteria. The banking stability measure used is the Z-score at bank level. The control variables include both bank and country specific variables. The former group includes total assets, equity capital to assets, loans to assets, loan loss provisions to net interest income, cost to income, noninterest income to total income ratios and 6-month labor rate. The latter group include the GDP growth rate, inflation rate and a governance indicator as estimated by Kaufmann Daniel, et al. (2010) as the explanatory variables. Control variables together with the HHI bank-concentration index estimated at country level are regressed upon the Z-score stability index. Their findings document that credit risk and income diversity are the common cause of insolvency in Islamic banks. Also, the stability index (Z-score) indicates higher stability of Islamic banks than conventional ones. Despite the split of banks into Islamic and non-Islamic such results are not reported but only the results concerning the two regions of MENA and South Asia and large and small banks in each region. There are no comments on how the HHI affects stability but from the various results presented we observe a significant negative relationship between HHI and Z-score for the full sample of banks and for the small Southeast Asian banks samples. The relationship becomes insignificant for the sample of MENA, small or large, banks. Therefore we can argue that higher concentration reduces insolvency risk for the banks in the countries in the full sample and this effect stems from the Southeast Asian banks included in the sample.

The comparison of bank capital effect on bank credit risk between Islamic and conventional banks is explored in a study by Ferhi (2017) where the data set consists of bank-level data for 89 conventional and 58 Islamic banks from 14 MENA countries over the period 2005-2015. The credit risk is proxied by two variables the loan loss reserves to gross loans ratio and the ratio of loan loss provisions to average gross loans. The main explanatory capitalisation variable is the standard equity to assets ratio and together with variables of total assets, ROA, cost inefficiency, GDP growth and the HHI-assets concentration index is regressed upon the credit risk variable. Findings from a two-step GMM model document a negative and a positive significant effect respectively of capitalization and bank size on credit risk for both Islamic and conventional banks. Concentration is positively related to credit risk for both Islamic and conventional banks and the effect is much higher for the latter. This result supports the concentration-fragility views.

A study by Srairi (2013) examines if the banks' risk-taking behaviour is influenced by the ownership structure in the MENA countries region. They take a sample of 131 banks (93 conventional and 40 Islamic banks) covering the time period 2005-2009. They estimate two PP-OLS for both conventional and Islamic banks with Z and NPL being the dependent variables while the independent set of variables include the ownership structure measured by the proportion of equity held by state, by individuals and by financial and non-financial company, bank specific variables such as equity to assets ratio, ROA, cost to income ratio, fixed assets to total assets and asset and loan growth. Also includes the bank concentration CR3 index. Overall results indicate that family-owned banks assume lower risks while state-owned banks take more risk. The concentration index is found to positively relate only to Z-score which implies that as concentration increases and market power also increases bank stability improves i.e., competition-fragility view is supported.

3.3.1.1 MENA summary

Overall, from the review of the 12 studies for the MENA region, it is clear that the competition-stability issue has been given limited attention. There are few papers that directly tackle the competition stability/fragility issue, and these were published in the last decade. The competition measures used are the LERNER and HHI indices and no study has used the BOONE competition indicator. The stability measures used are the score index and the NPL ratio. The findings support both the competition-stability and competition-fragility views and one study finds a significant nonlinear U-shape relationship. Furthermore, the sample period, the number of MENA countries covered and number of banks included varies and this has to be considered when comparing overall results. We consider that the competition-stability issue as regards the MENAS region needs further exploration in the following ways:

- The use of alternative measures of competition such as the BOONE indicator which have not been used extensively so far due to data issues.
- The use of the 'distress bank' concept and the investigation of its role in the competition-stability relationship.
- The Islamic-Conventional banks distinction and its role in the competition-stability relationship since in many recent studies concerning MENA region use data only for conventional banks.
- The pre and post financial crisis period analysis with a coverage period of 2004-2015.

3.3.2 Gulf Cooperation Council (GCC)

Six countries participate in the Gulf Cooperation Council (GCC) and these are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the UAE. The financial sector in these countries is dominated by Islamic banks and there are a limited number of non-bank institutions like insurance (Takaful) and investment banks (Sukuk). The banking sector is concentrated and the 3 largest banks count for more than half of total bank sector assets. The presence of entry barriers and strict license provisions to foreign banks lead to a banking system mostly owned by public or semi-public entities. Bahrain and Oman are the exception where foreign banks' branches control a significant share of total banks' assets. The banking sector was highly regulated until late 90's but after this there was a gradual relaxation of restrictions, increased transparency and close supervision of bank's risk-taking policy according to Basel II and III recommendations.

The effects of bank competition and concentration upon the bank stability for the GCC region are examined by Albaity et al., (2020). To this end they collect bank-level and country-level data for 50 conventional and 25 Islamic banks for 6 GCC countries covering the period 2006 to 2016. The bank stability measures are the Z-score index and the NPL ratio while competition is proxied by the LERNER and BOONE indicators. Also, the CR5 index is used for a bank concentration proxy. Both competition and concentration measures are regressed upon the stability measures. The control variables are bank specific such as capital to risk weighted assets, total assets, and ROA. Debt to GDP ratio, annual stock market return, world oil price annual change and two dummy variables one for crisis non-crisis years and the other for Islamic non-Islamic bank complete the set of explanatory variables. Separate regressions are run for the Z-score and NPL by applying the 2-step GGM estimator. Findings when LERNER is used in the linear form support the competition-fragility view while when BOONE is used both the competition-fragility and competition-stability are supported by the Z-score and NPL, respectively. However, when the LERNER and BOONE variables are squared the results significantly support the U-shaped relationship.

In a dynamic hazard model of early warning of bank distress applied by Maghyereh and Awartani (2014), competition along with CAMEL and non-CAMEL bank-specific variables, foreign or government owned banks index, regulatory index and country macro variables are employed as the leading indicators. The sample contains all 6 GCC countries and a set of 70 banks with 78 distress episodes recorded covering the period 2000-2009. Among other results they find that market power, measured by the LERNER index, has a negative effect on the distress variable which supports the competition –fragility hypothesis.

The influence of competition on the stability of the banking system in the GCC countries is explored by Maghyereh and Awartani (2016). All six countries which are members of GCC are included and their sample data set, after considering the data availability, contains 70 banks out of a total of 111 and covers the period 2001-2011. Bank stability is measured by the Z-score and NPL ratios and market power by the conventional LERNER index. The control variables are bank-level ratios cost to income, non-interest income to total income, equity to total assets and total assets. Also, regulation and supervisory indices are included taken from World Bank database and a fraction of bank assets foreign owned. The two-step GMM estimation method was employed and the results strongly support the view that competition makes banks take more risks and enhance their fragility and that regulated capital, supervisory power, private monitoring and bank restrictions contribute to bank stability and hence mitigate the adverse effect of competition on bank stability.

Financial stability and its determinants in both Islamic and conventional banks in the Gulf countries is the research topic in a study by Chakroun and Gallali (2015). Empirical results are based upon bank-level data for 136 banks of which 86 are conventional, covering the period from 2003 to 2012. The bank stability is proxied by the Z-score index and among the many bank-specific and country-level explanatory variables they use a market concentration index which is the HHI but based on credit supply. Their findings argue that bank size for both Islamic and conventional banks is a significant factor that erodes bank stability and as far as market share is concerned the results show a negative effect on stability for Islamic banks which turns positive for conventional banks.

Applying discrete-time models Alandejani et al. (2017) investigate which are the bank-level and macro-level factors behind bank failures. To this end they collect data for 57 banks from five GCC countries where the banks are split into Islamic (18) and conventional (39). The period covered is from 1995 to 2011. Bank level factors are the net interest revenue growth rate, other earning assets, ROA, the net interest margin, net loans to total assets ratio, the loan loss reserves to total loans and a binary variable indicating an Islamic (value 1) or a conventional (value 0) bank. Macro level variables are the bank concentration indicator proxied by the total assets of the three largest banks to total banking sector assets, real GDP growth rate, inflation rate, a bank ownership (government involvement or not) binary variable and an investment regulatory quality regime index. They apply parametric continuous-time, discrete-time models for all banks and separately for Islamic and conventional bank groups. The results show that Islamic banks have a double failure risk compared to conventional and bank level variables of ROA and net interest margin influence negatively and positively respectively only Islamic banks. The hazard risk for conventional banks increases when loan loss reserves to loans and loan to assets ratios are increasing. In terms of bank concentration findings suggest that a more concentrated banking market is associated with an increased hazard rate and this does not differ between bank groups.

In an attempt to explore how credit growth, bank profitability and stability are interrelated and affect each other Al-Khouri and Arouri (2016) apply a simultaneous equation model for 59 banks operating in GCC countries over the 2004-2012 period. The dependent variables used are the Z-score for bank stability, the ROA, ROE and market value to book value of capital for profitability and the annual percentage credit growth. The control variables are the size of executive board, NPL, total assets, loans to deposits ratio, total debt to total assets share of government ownership and disclosure and regulation indices. They also include the deposits based CR3 concentration index. They apply a 2-step GGM estimator and the results suggest that profitable banks are more stable, credit growth, up to a certain level, does not influence bank stability and government ownership affects bank stability. Regarding the concentration index relationship with stability and profitability the results indicate that bank concentration is positively associated with profitability, but stability is lower when concentration increases supporting the concentration-fragility view. The relation between concentration and credit growth although positive is non-significant. The effect of bank ownership structure and income diversification on financial stability is investigated for the GCC region by Ashraf D. et al. (2016). Their sample includes 125 banks from six GCC countries for the period 2000-2011. Financial stability is measured with Z-score and ownership concentration is measured by the proportion of shares by holder type. Among the standard bank control explanatory variables, bank concentration HHI-assets is also considered. The results from the generalized least square panel regressions, show a significant and positive effect of shareholder concentration on banks' insolvency while income diversity has a positive impact on stability. In all estimations bank concentration is significant and negative which translates to higher concentration enhance insolvency risk that is the concentration-fragility hypothesis is supported.

A very recent paper by Saif-Alyousfi et al., (2020) is a multidimensional study which explores both how the concentration and competition affects the banks' risk-taking behavior and banks' stability/fragility. Using the CR5 and HHI proxies for concentration and the LERNER and Boone indices for competition they estimate their effects upon, on the one hand, the risk-taking measured by NPL ratio, Loan Loss Provisions ratio to total loans (LLP) and the standard deviation of ROA and ROE and on the other hand on the stability indices of the Z-score, with ROA and ROE variations. Their sample contains 70 banks from 6 GCC countries and covers the 1998–2016 time span which is split into before the financial crisis (1998-2006), during the crisis period (2007-2009) and after the crisis period (2010-2016). Using the 2-step system GMM approach they run regressions with all risk-taking and stability measures being the dependent variables while competition and concentration measures along with bank specific, institutional and regulation measures are the explanatory variables. Their empirical results find that both measures of competition, LERNER and Boone, have a positive and negative effect upon risk-taking and stability respectively and this result supports the competition-fragility view. However, when concentration measures (CR5, HHI) are used empirical results document that although increase in bank concentration increase risk-taking and hence fragility, the overall stability (Z) is improving.

3.3.2.1 Summary

- The preferred stability measures are the Z-score index and the NPL ratio the former used in five studies and the latter in three studies. Two studies use distresses and bank failure events.
- The LERNER index is used in six out of eight surveyed studies (63%) while Boone measure is utilized in two papers along with the LERNER index. PR-H is not used at all. HHI and CR concentration indices are used standalone in two studies but also appear together with the competition indices of LERNER and Boone.
- The estimation methods used are mainly the GMM model which is employed in all studies except the two relating to failure and distressed banks which use hazard and logit estimation techniques.
- The findings support the competition-fragility view in five papers independently of whether LERNER or Boone is used and the concentration-fragility view is evidenced in papers when CR was employed. The results regarding to the competition-stability issue are clearer compared to MENA region The fact that the MENA region includes 6 GCC countries highly dependent on oil exports and present a mixed of high and low concentration and competition banking sector makes it necessary when the MENA region is examined to have a separate test for the GCC region. Such a split is conducted in Gonzalez et al., (2017) who find that for the GCC countries, competition enhances fragility whilst for non-GCC it promotes stability. Finally, the use of the Boone indicator only in Albaity et al. (2019) is associated with the competition-fragility view.
- Overall, the competition-stability issue in the GCC region needs further updated empirical evidence with further use of competition and concentration measures and PR-H statistic competition indicator. Attention also must be given to other banking and country factors and the usage, so far never explored, of the effect of “bank distress” situations on credit risk and overall bank stability.

3.3.3 ISLAMIC and(vs) CONVENTIONAL BANKS

In general, the distinct characteristic of Islamic banks is the non–interest or free-interest provision of their financial services. In the last decade, the high growth of Islamic banks in terms of geographical coverage and size of their assets has turned academics' attention to analyzing Islamic banks activities and the role they play in global stability and performance. The coexistence of conventional and Islamic banks in many Islamic countries further attracts research interest to compare their performance and their interaction. Our interest remains on such studies that analyze competition-stability within a dual banking system. Few papers directly examine the question of competition-stability or competition-fragility for a dual banking system.

A paper by Cihak and Hesse (2008) investigates empirically the relative soundness of Islamic banks compared to conventional ones. Their sample contains 77 Islamic and 397 commercial banks operating in 18 Islamic countries. Stability is measured with the Z-score and they run OLS regression with dummies for Islamic and commercial banks. Bank specific control variables of loans to assets ratio, cost to income ratio, income diversity, total assets are used as well as a governance index and bank HHI - a concentration index. The sample is separated into small and large banks. OLS estimates find that small Islamic banks are sounder than small commercial and large Islamic banks and those large commercial banks are safer than large Islamic banks. The result also show that for all banks and for large banks, as concentration is increasing stability is decreasing supporting the concentration-fragility view.

Farook et al. (2011) look into the factors responsible for any difference in bank stability between Islamic and conventional banks. Their sample includes 15 Islamic countries with 50 Islamic and 150 conventional banks covering the short period of six years 2001-2005.They run regressions with the dependent variable being the Z-score to proxy for financial stability while the main independent variables attempt to capture the differences in asset spread- Spread between ROA (excluding depositors returns) and average depositors profit distribution, liability (deposit spread- Inverse of the spread between national average deposit rates and average depositors profit distribution), income structure (income diversity ratio- net interest income – other operating income)/total operating income) and management restrictions of Islamic and conventional banking endogeneity as profit and reserves management.. Concentration is added as an additional explanatory variable proxied by the HHI for deposits index. Results from OLS regressions overall do not support any difference in stability between

Islamic and conventional banks but when they split the sample into small and large banks they find that large Islamic banks' stability is weaker relative to large conventional but when comparing small banks Islamic banks are more stable than small conventional banks. With regard to the concentration effect on bank stability, results in all basic model modifications for the whole sample give support to concentration-fragility view while when the sample is split into small-large banks, small banks stability improves when concentration decreases supporting the concentration-stability view.

The analysis of factors that have an impact upon the financial strength-stability of Islamic banks and its comparison with conventional banks is investigated by Okumus and Artar (2012). Their sample consists of 54 conventional banks and 16 Islamic banks belonging to 7 Islamic countries (5 GCC and Turkey and Jordan) for the period 2001-2010. The bank stability is measured by the Z-score and its explanatory variables are the HHI-assets concentration index variable , loans to assets and cost to income ratios, an income diversity index, GDP growth, inflation, exchange rate change, market share of Islamic bank assets in a country's total bank assets, a dummy to indicate Islamic – conventional bank and a dummy to indicate large-small bank. A set of Panel pooled regressions are run for all banks and separately for small and large Islamic and conventional banks. Results for all banks show that the loans to total assets ratio, income diversity and bank concentration are positively related to stability. The effects of other variables vary across banking samples. Regarding the HHI index for small banks either Islamic or conventional concentration enhances stability while for large banks concentration increase is associated with lower stability.

The investigation of the interconnectedness of bank risk, bank efficiency and bank capital for Islamic and conventional banks is the theme of a paper by Louati et al., (2016). Their sample consists of bank data for 89 conventional and 34 Islamic banks from 10 Islamic countries (OIC) over the period 2005-2014. To estimate interconnection, they use a system of three equations with dependent variables of risk (NPL, Z-score), of efficiency (cost and technical) and of capital (Equity to assets) measures. Cost efficiency is estimated using Stochastic Frontier Analysis and technical efficiency using the quadratic directional distance function. Explanatory variables for all regressions are bank size proxied by total assets, competition proxied by the LERNER index, liquidity proxied by loans to assets, diversification proxied by the noninterest income to total income ratio, GDP growth, inflation rate, financial freedom index, corruption index and a governance indicator. Capital, risk and efficiency variables are explanatory variables when are not dependent. They use a SUR (Seemingly Unrelated Regressions) estimation model and they run separate regressions for Islamic and conventional banks using as explanatory variables cost and technical efficiency alternately. The results document different interrelationships for Islamic and conventional banks. Capital and risk are positively related, but this is valid only for conventional banks. Also, stability is promoting technical efficiency in conventional banks. When focusing on the competition-stability relationship the results support the view that lower competition (higher LERNER) is related with higher bank stability (higher Z-score) and that is valid for both Islamic and conventional banks and independent of the efficiency index used. The relationship of competition with credit risk (NPL ratio) is insignificant in all the regressions run.

Similarly, to the previous study Saeed et al., (2020) in a system of three equations apply Seemingly Unrelated Regressions (SUR) in order to explore and compare for Islamic and conventional banks the interrelationship among bank stability, efficiency and capital. They collect bank-level data from 14 countries for 245 banks split into 180 conventional and 65 Islamic over the period 2000-2012. Stability is measured by the Z-score index, cost efficiency is estimated applying stochastic frontier analysis and capitalization is proxied by the equity to assets ratio. Explanatory variables are total assets, loans to total assets, tax to pre-tax profits, ROA, off-balance sheet activity to total assets, GDP growth rate and inflation. The CR3 concentration index is also included. The findings suggest that bank size (total assets) is positively associated with stability and capitalization for both Islamic and conventional banks. Cost efficiency has opposite effects since an increase in cost efficiency reduces bank risk for conventional banks but increases it for Islamic banks. The results regarding concentration measures, which are not commented upon, are interesting. In all forms of regressions, concentration is strongly significant and positively related to Z-score which suggest support of concentration-stability view. When the concentration index interacts with the Islamic variable the sign becomes negative which suggests that the presence of Islamic banks turns the concentration as a destabilizing factor for banks.

Another attempt to examine the competition stability issue in the context of Islamic and non-Islamic banks is taken by Kabir and Worthington (2017). They consider a sample of 16 developing countries over the period 2000-2012. After controlling for banks-specific variables (total assets, loans to deposits, total loans growth and net-interest income to total operating income) and country-specific variables (inflation, Governance index and financial and economic freedom indices) they run PVAR(Panel Variable Autoregressive Model) regression and 2-stage quantiles regressions with the LERNER index as the independent variable and the dependent variable the stability measured by the Z-score and NPL ratio. Their findings support the competition–fragility hypothesis for both Islamic and conventional banks irrespectively of the stability measurement used. Furthermore, this effect is stronger in conventional banks.

Louhichi et al., (2019) compare bank competition and bank risk/stability between Islamic and conventional banks and also assess the competition-stability trade-off for these two bank types. The sample set consists of 89 conventional and 34 Islamic banks operating in 10 Islamic countries over the period 2005-2014. The dependent variables are credit risk NPL ratio and stability Z-score index. Competition is measured with the LERNER and HHI indices and total assets, equity to assets ratio, loans growth rate, ROE, GDP growth rate, inflation rate and an overall freedom index are the explanatory variables. GMM panel data regressions and panel vector autoregressive model are the two estimation methods used. Results from the whole sample give evidence that market power and stability are positively related and hence support the competition-fragility view which also holds for both types of banks. However, results regarding bank risk and concentration show that higher concentration in conventional banks reduces bank risk but in contrast increases bank risk for Islamic banks.

A recent paper by Alam et al., (2019) investigates the competition and risk-taking taking in 10 advanced Islamic countries using a sample of 59 Islamic and 149 conventional banks for the period of 2006-2016. The competition is measured by the LERNER index while the stability is proxied by the Loan Loss Reserves. Control bank-specific variables are total assets, equity to total assets, average ROA, net loans to total assets and cost to income ratio. Country control variables include GDP per capita, growth rate and inflation. The institutional environment is proxied by the supervisory power, capital requirement, private monitoring and bank activities restriction indices. All these indices have been retrieved from the World Bank database. Although the results show a positive relation between competition (LERNER) and risk-taking for all banks in the sample when they run separate econometric test for Islamic and Conventional banks their main finding is that for Islamic banks the competition risk-taking relationship is negative i.e. indirectly supports the competition–stability view. In contrast, for conventional banks the relationship is positive (competition –fragility).

They also confirm that the market power of Islamic banks is low compared to conventional banks.

The role of income diversification in the competition-stability relationship is examined within a dual banking context by Azmi et al. (2019). To this end they collect for 14 countries data from 354 banks of which 268 are conventional and the remaining 86 are Islamic. The time period covers 12 years from 2005 to 2016. The competition is measured by the BOONE index and for robustness purposes LERNER and HHI are also used. Bank stability is measured by the Z-score index. The income diversification index equals 1 minus the ratio of net interest income subtracting other operating income over total operating income. Other control variables are the cost to income ratio, liquid assets to total assets ratio, ROA, gross loans to total assets, total assets, and GDP growth and inflation rate. They run GMM regressions for the whole sample, for Islamic and conventional and for large and small Islamic and conventional bank groups. The findings do not support either the competition-stability or competition-fragility hypothesis since competition is insignificant in all sample sets, and only concentration is found to enhance banking stability for both Islamic and conventional types of banks. Competition and income diversification do not influence differently the Islamic and conventional banks.

A sample of banks from 18 countries (11 emerging and 7 developing) with both Islamic and conventional banks is selected in a study by Fazelina and Mansor (2020) to estimate the interrelationships among bank competition, revenue and assets diversification and performance. The sample period is 2000-2016. The competition measure is the LERNER index. Revenue diversification is estimated as 1 minus the sum of the squared shares of net interest income and non-interest income to total operating income. The asset diversification index is estimated as 1 minus the sum of squared shares of net loans and operating earning assets to total earning assets. Performance is measured with the Z-score stability index and risk adjusted ROA. Cross country variations are controlled with GDP growth rate and bank size proxied by total assets. The dynamic relationship of all the above variables is estimated with the use of the panel vector autoregressive model (PVAR), impulse response function and decomposition of variance methods. The results confirm that market power increases bank revenue diversification, profitability and stability and these effects are stronger for emerging countries.

A very recent paper by Khattak, et al. (2021) explores the competition-stability issue within the context of conventional and Islamic banks. They collect for the period 2006-2017 bank-level data for 228 banks of which 173 are conventional banks from 11 countries. They employ both the conventional and efficiency adjusted LERNER index to measure competition which together with control bank-specific variables (total assets,equity to assets, net loans to total assets, non-interest income to total income) country-specific (GDP growth, inflation) variables and two dummies for Islamic/non-Islamic banks and years of global financial crisis are regressed upon the ROA based Z-score stability index. Their results from GMM model estimation on the one hand support, the view that conventional banks are more stable as compared to Islamic banks and on the other hand regardless of the estimation technique and which LERNER index is used, the competition-fragility hypothesis is supported for both Islamic and conventional banks group.

A recent set of papers by Risfandy Tastaftiyan (2018), Risfandy Tastaftiyan., et al. (2018) and Risfandy Tastaftiyan et al.(2020) explore the competition-stability issue within the context of Islamic and conventional banks. They argue that although overall results give support to competition-fragility view, when focused on Islamic banks such a view does not hold since they find no significant effect (positive or negative) of competition on stability. The first two studies make use of a sample of 18 developing countries and the United Kingdom, 100 Islamic banks and 390 conventional banks (of which 25% are from UK) is the bank data collected for the 2000-2014 period. The third study extends the coverage of countries to 29 mostly developing countries and the bank sample to 770 covering the after-crisis period of 2010 – 2018. All the studies use the LERNER index and HHI as competition proxies and the Z-score index for stability measurement. The 2SLS estimation method is applied and the results suggest that competition erodes the stability of conventional banks while Islamic banks stability is not affected.

Overall, studies examining the competition- stability are very scarce. The results are conflicting and further research is indeed welcomed in the form of additional measures for the competition side but also on the role of regulation and governments across multiple time periods.

3.3.3.1 Summary

The growing importance of Islamic banking worldwide, the progressive presence of foreign non-Islamic banks in Islamic countries and the Islamic windows opened in conventional banks either operating or not in Islamic countries have naturally increased the competition within and between Islamic and conventional banks.

- We have reviewed 14 studies. The first study appears in 2008 and the majority are published within the period 2017-2021. The time period covered in their data sample starts for all, except for one, studies from 2000 and afterwards. The shortest sampling period covers 6 years and the longest covered 19 years.
- The Z-score stability index is used in 13 studies either alone(10 times) or along with NPL (3 times) . In one study the loan loss reserves credit risk proxy is used. Distance to Default (DD) measure is used in one study.
- Competition is mainly measured with LERNER index in 10 studies and only in one study BOONE indicator is used along with LERNER. Bank concentration index HHI is applied in five studies together with LERNER index and three times standalone. CR3 is also used once.
- There is a variety of estimation methods used. OLS four times, GMM twice, 2SLS three times, PVAR twice, SURE twice and Quantile once.
- Overall results are in line with competition-fragility or concentration -stability hypotheses and these findings don't differ between Islamic and conventional banks. However, there are studies that support the concentration-stability and concentration-fragility views for conventional and Islamic banks respectively. When the sample used is split into large and small banks for the latter group concentration is positively related to stability.

3.3.4 DEVELOPED and/or DEVELOPING COUNTRIES

Another strand of literature exploring the competition-stability issue is taking a sample of banks from both developed and developing countries. Developed countries usually includes the U.K ,USA, Canada and western EU countries while developing group includes mostly Asian, Latin American and African countries.

An early study exploring the impact of market power on bank efficiency where the latter is considered the conduit to bank soundness is taken by Schaeck and Čihák (2008). They built up two sample sets, one including bank level data for 3,665 banks from 11 European countries and the second sample set consists of 8,900 banks operating in the USA. Both sample sets cover the same time period of 1995-2005. Competition is measured by the traditional LERNER index and BOONE indicator and profit efficiency is estimated by the stochastic frontier method. Bank financial soundness is measured with the Z-score index. Control variables are total assets, fixed assets to total assets, equity to total assets, total assets growth, loan loss provisions to total assets, income diversification index, financial freedom index, GDP growth and real interest rate. The empirical test is conducted in two stages. Firstly, they check for the competition-efficiency hypothesis taking a granger causality test between competition (LERNER index) and profit efficiency and results indicate, both for European and USA banks, that competition enhances profit efficiency. The second empirical test is to examine the validity of the competition-stability hypothesis considering the efficiency stability channel. They run regressions with the Z-score being the dependent variable and explanatory variables being the competition BOONE index and bank specific control variables while in other regression type, they add the HHI concentration index and the country specific control variables. The results as far as European banks are concerned show that competition through the efficiency channel make banks sounder and the competition-stability hypothesis is accepted. However, the findings regarding the USA do not give a clear verdict in favor of competition-soundness view. The results when HHI concentration index is included among explanatory variables give opposing results for European and USA banks with the former banks being less fragile when concentration is higher while the opposite is documented for the USA banks.

An in-depth approach to research the developed and developing countries by Beck et al., (2013) collects bank data from 27 developed (US, UK, Canada, Japan and European) and 52 developing countries for the period of 1994-2009. Their aim is to estimate the relationship between competition (proxied by the LERNER index) and stability (proxied by the Z-score index). Assuming a homogeneous relationship between the two variables across the countries and over time the regressions results confirm that more competition contributes to less stability. That is they support the competition-fragility hypothesis. Then they examine if banking and country characteristics play a role in variations of strength in competition- stability relationship. However, they do not split their sample into developed and developing to find any heterogeneity factors responsible for competition-stability strength differences. Instead they compute relative correlations among institutional, financial, regulation and supervision heterogeneity determinants and they run regressions with Z-score as the dependent variable and as explanatory variables the interaction of each heterogeneity determinant with the competition LERNER index. The results again, on average, support the positive relationship between competition and fragility but such a relationship is stronger in countries with stricter activity restrictions, better developed stock exchanges, more generous deposit insurance nd higher activity restrictions. In other words, they argue that market, regulatory and institutional factors in each country's framework influences how competition affects stability.

A similar mixture of developed (31) and developing (52) countries is the sample set of a paper by Cubillas and Gonzalez (2014). They collect bank-level data from a maximum of 4,333 banks from 83 countries over the 17 years period 1991-2007. The main goal of the paper is to explore if and how financial liberalization, measured by the Financial Reform Index, Financial Freedom Index and KAOPEN indices, affects banks' risk-taking the latter proxied by the Z-score stability index. Competition is considered a channel through which liberalization affects risk taking (stability). To this end they estimate through the 2SLS and GMM methods two basic equations where competition (LERNER index) and risk-taking (Z-score index) are alternatively dependent and independent variables along with liberalization and other usual control variables. Their all countries sample results show that an increase in competition due to financial liberalization reduces bank stability and thus supports the competition – fragility hypothesis. However, when the sample is split into developed and developing countries, financial liberalization deteriorates bank stability through an increase in competition only for developed countries. In developing countries liberalization and completion are not significantly related but still bank risk-taking (stability) deteriorates. We must point out however that the developed countries data in terms of number of banks (56% of total) and number of observations (66%) dominate the data set.

The banking competition and financial fragility relationship is again explored in a study by Ruis-Pora (2014) gathering data from 13 developed and 34 developing countries covering the eight years period of 1990 - 1997. They calculate a lengthy list of indicators related to banking competition, banking fragility, banking market structure, financial market structure, and financial development. Banking competition is measured with the CR3 banking concentration index, the share of public banks and the relative size of banks to that of bank-like institutions. Banking fragility is a binary variable that characterize banks in episodes of crisis (1) or in no episodes of crisis (0).

Banking structure, financial structure and development measures are related to the overhead cost to assets ratio, private credit to GDP ratio and stock market capitalization to GDP ratio, among others. It is worth mentioning that their data is extracted from the two databases of Beck et al. (2000) and Caprio and Klingebiel (2002). The regressions and a fixed-effects logit model for panel data are applied to a set of equations relating to competition-financial development, competition-financial structure, banking - financial indicators and competition – fragility. Their results come with a surprise, which contradicts 'even our own intuition' (p. 80), where competition as measured with concentration is not significantly related to fragility. Determinants of fragility are the property regime and if the financial system is bank-based the likelihood of crises increase. Overall, they claim that bank fragility is a complex phenomenon and the specific features of the banking and financial sectors play a role and policy making strategies should be 'tailored-made.'

A large sample of 26 developed (U.S excluded) and 94 developing countries covering the long period of two decades 1989 – 2008 is the database for a study by Fernadez et al., (2016) where their main target is to assess the importance of banking stability to the fluctuations of output growth. Competition interferes as the country characteristic which enhances or not this relationship. Output is broken down to industry ISC classification level and its volatility is measured as the relative standard deviation of real value added of each industry. Stability is measured with the Z-score index and NPL ratio where competition is proxied by the LERNER and Boone indicators. When the regressions are run, they find that less competition or higher market power makes banking stability further reduce economic volatility. This can be indirectly taken as supporting the competition – fragility view. We point out that country-level data on baking stability, banking development, bank competition/concentration, regulatory variables and institutional quality indices come from World Bank databases.

Another attempt to explore the relationship between competition and stability within a context of 25 developed and 56 developing countries for the period of 2000 - 2013 is taken by Laowattanabhongse and Sukcharoensin (2017b). The countries sample is not as usual divided into developed and developing groups but instead, in order to reflect different market characteristics, is segmented into four groups. The split criteria are firstly the percentage of firms using banks to finance their working capital (High or Low) and secondly the ratio of private credit to GDP (Big or Small) and both measures are taken from GFDD World bank database. This split has the result of formulating four segments which are almost equal in number of countries but with very unequal shares of developed and developing countries in each one. A distinct characteristic is that the majority of developed countries (14 out of 25) including the USA are in the low and large group. The basic dependent variable of stability (Z-score) and independent variable of competition (LERNER index) as well as that of NPL and total cost to total income ratio are taken ready to use from the GFDD database of the World Bank. Control variables are total assets, loan to assets and an HHI revenue diversification index. They run pooled panel regressions for the all-countries sample and the results support both the concentration-stability and competition-fragility hypothesis. However, the regressions results from the four countries groups provide mixed results. For the High-Big group, results support the competition-stability and concentration- stability hypotheses while for the Low-Big group (with the majority of developed countries in it) there is no meaningful relationship between competition or concentration and stability. For the other two groups of High-Small and High-Low results still support the competition-fragility view. Finally in all regressions, NPL as an explanatory variable is significantly negative with Z-score indicating that as credit-risk increases bank stability deteriorates.

Another attempt to add further empirical evidence in favor of either the competition-stability or competition-fragility nexus is the study by Calice and Leone (2018). To this end they collect data from 23 developed and 45 developing countries covering the period 1997 - 2015. The World Development Indicators (WDI) and Global financial Development (GFDD) databases of the World Bank provide the necessary data. The competition index used is a concentration index measuring the share of banks' assets held by the three largest banks, but the authors acknowledge that "concentration and competition are two different concepts that are not always related"(p. 6). Financial stability is a binary variable that with 1 indicates a systemic and non-systemic crisis event while 0 is a non-crisis event. This stability variable is extracted from the Reinhart, Rogoff (2009) dataset where crisis events are classified as systemic (bank runs-serious) and non-systemic (government assistance -mild). They consider four channels through which concentration impacts upon stability and crisis happenings. These are profitability, cost of credit, diversification and ease of monitoring proxied by ROA, real lending rate, foreign assets and liabilities to total assets ratio and number of banks, respectively. They estimate a binary logit probability model with the dependent being the binary crisis dummy and the concentration index along with mediators being the explanatory variables. The results indicate that the effect of concentration on the likelihood of crisis (financial stability) depends on the initial level of concentration ratio. At a concentration ratio of about 47%, increasing concentration increases stability but at a concentration ratio around 73% increasing concentration increases the likelihood of crisis or increases fragility. In the range of 55% to 66% concentration does not affect financial stability.

To investigate if and how the financial regulation and supervision regimes impinge upon financial stability in developed and emerging countries Shaddady and Moore (2018) collect data from 1154 banks in 20 developed and from 1056 banks in 27 emerging countries for 17 years 2000-2016. Their stability measure used is not the traditional Z-score and NPL ratio but instead they use CAMELS indicators which are bank specific indicators combined to assess the distress of banks. Then they apply DEA to CAMELS indicators and finally estimate a quantile model with five quantile results to distinguish banks into high, medium and low distress/stability, respectively. The CAMEL based stability index is the dependent variable while capital regulation index, activity restriction index, deposit insurance, private monitoring index, supervisory power, government-owned banks business freedom index are the explanatory variables. A concentration index of HHI for deposits market is also added as an explanatory variable. Results for the whole sample shows that when stability is at low or medium level (Q10 to Q75) then concentration has a positive impact on stability supporting the concentration-stability hypothesis especially for commercial banks. The results indicate that concentration does not play a role in banks stability for robust/stable banks (Q90).

The effect of bank concentration on financial stability is explored by Ben Ali et al., (2015) for 54 developed and 119 developing and by Ben Ali et al., (2018) for 82 developed and 74 developing countries for the long-time span of 1980-2011. We must point out however that the developed developing countries grouping in their list is not in accordance with United Nations classification. In both papers variables and estimation methods are identical. Financial stability is a binary systemic bank crisis variable taken from the Laeven and Valencia (2012) database. They consider two channels through which concentration affects bank crisis. A stabilizing one through the Returns on Assets (ROA) and a destabilizing through the Net Interest Margin (NIM) and these variables together with the concentration index (share of the assets of the three largest banks in each country) are the main explanatory variables of systemic crisis (bank stability) when they run the basic logit and probit models. The results show that concentration negatively but not significantly affects bank stability. However, the other two explanatory variables ROA and NIM are statistically significant with a negative and positive influence on instability (bank crisis) correspondingly. We think that these two opposing effects on instability cancel each other out and hence concentration appears ineffective. Furthermore, when they add a dummy deposit insurance variable the results do not change while its positive sign indicates that higher deposit insurance lead to instability. Finally, when they split the sample into developed and developing countries and estimate the basic model, they found that there is no evidence of a direct effect of concentration on banking crisis (instability) for either group of countries but ROA and NIM continue to have a negative and positive sign for both groups of countries. Overall, they find no relationship between concentration and stability for the whole sample or for the developed and developing groups. However, they argue that concentration through the ROA and NIM has positive and negative effects on stability.

The effect of market power and institutional-regulation factors upon bank risk is explored by Danisman and Demirel (2019) using a large sample of 6936 banks from 27 developed countries (of which 17 are European) over the period 2007-2015. The sample however is biased to the USA banking market with the presence of 6090 banks. They consider a range of eight risk variables: the Z-score (default risk), equity to total assets (Leverage risk), ROA to standard deviation of ROA (portfolio risk), NPL (credit risk), standard deviation of non-interest income growth (non-interest income risk), standard deviation of interest income growth(interest income risk), liquid assets to total assets(liquidity risk) and standard deviation of net interest margin(operational risk). Market power is measured with the LERNER index and institutional-regulations variables are the indices of capital stringency, activity restrictions and supervisory power. Other explanatory variables are loan to assets, non-interest income to total income, wholesale funding to total funding, growth of total operating income and three dummy variables for public banks, bank holding companies and crisis period of 2007-2009. Real GPD growth and inflation are also included. They run three regression using 2SLS and IV methods with dependent variable all the risk variables and the LERNER index as the only explanatory variable. They then run a nonlinear form with squared LERNER and lastly, they include both LERNER and institutional-regulation explanatory variables. The findings show that market power is negatively related to various risks and the competition-fragility hypothesis is verified. The non-linearity relation is not found significant, and stringency of capital is suppressing various bank risk while the supervisory power leads to higher bank risk.

Ji et al.(2019) adopts a semi parametric model who apply Bayesian inference to the estimation of the relationship between market power and bank risk taking. Their sample covers more than 1.000 banks from 35 emerging countries (10 Latin America, 15 Central Eastern European and 10 Asian) for the 2000-2014 time periods. Market power is proxy by the adjusted LERNER index while the Z-score, normalized between 0 and 1 at the country level, is the risk-taking measure. Control variables include bank-specific variables such as total assets, liquid assets to total assets, bank efficiency index, non-interest income to net operating income, non-deposit short-term funding to total short-term funding, binary for foreign and domestic banks and binary for state and private banks, macroeconomic variables include GDP growth and inflation while institutional variables include regulatory activity and capital stringency indices, supervisory power index, market discipline index, deposit insurance strength and rule of law index. Results reveal a nonlinear relationship where at low level of market power any increase enhances bank stability but as market power is growing and passes over a threshold value stability is deteriorating. Breaking the Z-score into its three components (ROA, Equity to assets and standard deviation of ROA) and running three regressions they come to the result that the standard deviation of ROA is the factor that is affected by market power increase and contributes to lower stability.

Bank data from 18 emerging countries (9 Asian, 6 Latin American, 2 European and South Africa) for the period 2003 to 2010 is the data set used in a study by Shiow-Ying and Yu (2013) in order to explore the relationship between market structure and stability taken into consideration the financial deepening and bank income structure changes in these countries. Concentration is measured with the HHI index for assets, deposits, and loans while Z-score measures bank stability. Financial deepening is proxied by five ratios computed as the value of listed shares, total shares traded in stock market, outstanding domestic debt securities issued by private and public firms, public domestic debt securities issued by government and international debt issues all expressed as share of GDP. Additionally non-interest income to gross revenue and NPL ratio are the two bank specific control variables used. OLS regression estimates show that the HHI concentration index comes with a significantly negative sign supporting that increasing bank concentration either in loan, deposits or assets market make banks riskier and stability decrease. Financial deepening variables come with a negative sign, however insignificant, indicating a positive effect on stability.

3.3.4.1 Summary

- There are 13 studies covering the developed-developing comparison, with eight of them published in the period 2015-2019 and the rest within the period 2008-2014.
- Stability measures used are the Z-score in 8 studies while 4 studies use a binary crisis variable and one the CAMEL distress score.
- Competition measurement is overwhelmed by the LERNER index (7 studies). BOONE indicator is used together with LERNER only twice. Six studies use only concentration indices either HHI or CR5.
- Estimation methods vary with GMM used once and panel pooled OLS in five studies. When binary crisis variable is used the probit or logit estimation model is employed.
- Results once more do not agree with one view. However, if one should summarize findings, could argue that for developing/emerging countries characterized with high concentrated banking system and relatively more restrictions competition is associated with less stability while the concentration is found a non-significant factor. In developed countries competition is found associated with more and less stability. Finally, there are findings that argue for a nonlinear relationship with competition effect upon stability depending on the initial level of market power/concentration.

3.3.5 European banks and competition

The European banking system has attracted numerous studies examining the competition - stability nexus due to the high quality of banks and available datasets but also because of its diversity when it comes to the European Union and the Euro. This creates regional differences which are also due to macroeconomic factors such as their fiscal status of countries indirectly affecting their banking systems.

An early empirical study examining the effect of regional conditions of bank competition on bank stability is taken by Liu et al., (2010). They collect accounting data for 2,397 banks allocated in 47 regions (regions defined in the Eurostat data base NUTS at level 1) of 11 European countries with all, except Norway, being EU members. The period coverage is from 2000 to 2008. Stability is measured at bank level using the Z-score index, ROA and standard deviation of ROA. Competition is measured by the LERNER index computed at regional level. This is done by weighting individual bank LERNER indices by the share of bank deposits over total deposits at the regional level. The bank and country control variables are total assets and the ratios of net interest income to total operating income, loans to assets, operating expenses to operating income, equity to assets, net income after tax to total assets. Two dummy variables are used for savings and cooperative banks. The estimation model employed is the first difference GMM estimator. The estimation findings argue in favour for a nonlinear relationship between regional bank competition and stability. This means that increasing competition is enhancing stability or fragility when the initial level of competition is low or high, respectively.

In a study by Mansilla-Fernadez (2020) the U-shaped relationship between bank competition and bank stability is considered the reason to explore the opposite transmission mechanism through which the bank stability and credit risk affects competition between banks in the lending market. A dynamic approach is employed to test whether increases in the NPL ratio is the linking mechanism that influences competition in the Euro-area banking markets. To this end the paper examines quarterly bank-level data for 388 banks separated into listed (86) and non-listed (302) banks operating in the euro zone countries. The examination period of 2002-Q1 to 2016-Q4 is broken down into pre-debt crisis 2002-Q1 to 2007-Q2 and the sovereign debt crisis from 2007-Q3 to 2016-Q4. LERNER and BOONE are the measures of bank competition used while the Z-score and the change in NPL ratio are the financial stability indicators employed. Control variables are total assets, non interest earnings to total earnings ratio, operating cost to operating income ratio and total assets to total equity ratio. Regressions run with dependent variable the LERNER, BOONE, marginal cost, loan price and market share and results show that financial instability (Z-score decrease) and higher risk-taking (NPL increase) increase competition in lending markets and marginal cost. Parametric means tests for listed and non-listed banks show that changes in financial instability and NPL cause a greater increase in marginal cost in non-listed banks.

The determinants of bank risk-taking are the subject of a paper by Wiem et al., (2017) focusing on the European banking market around the financial crisis. They collect bank level data from 280 banks operating in 26 European Union countries over the period 2005 to 2015. Risk-taking proxies are the NPL ratio and the Z-score index. The explanatory variables include bank specific variables such as the Tier 1 ratio, total assets, insurance coverage ratio, loan loss provisions to total loans and equity to assets ratio, institutional indicators of political stability and quality of banking regulation and macroeconomic variables of GDP growth and inflation rate. Also the HHI-deposits index is included as a competition proxy. They adopt the two step GMM method and findings from the regressions suggest that bank size (total assets) and bank capitalization reduces risk taking. The authors also argue that competition, as measured by HHI-deposits index, is reducing both credit and insolvency risks. However, we notice that the estimated coefficients of the HHI-d index are not significant either for the full sample or for the sub-samples of East and West European countries.

The interaction among bank competition, bank stability and economic growth within the context of 32 European countries is explored in a study by Jayakumar et al. (2018). The sample consist of annual data for the period from 1996 to 2014 for 32 European countries the majority being members of EU. The paper uses six bank-specific indices for stability measurement: equity to capital ratio, NPL ratio, loan loss provisions to total loans, and private credit to GDP and a composite index of stability. The banking competition set of indicators include bank market indices such as the LERNER, BOOTH and H-statistic, concentration index CR with three and five banks and foreign held bank assets to total bank assets. Growth of per capita GDP is the economic growth indicator. To test for short-run and long-run unidirectional or bidirectional causality between competition, stability and economic growth the paper deploys a vector error correction model (VECM). Two results are worth mentioning. First banking competition and stability are correlated with economic growth and there is a long-run equilibrium between them. Second overall banking competition and stability are the main drivers of economic growth in European countries.

The impact of bank competition and stability on economic growth is the research area of a paper by Ijaz et al., (2020a). They collect country data for 38 European countries from the Global Financial Development Database for the period 2001-2017. The study uses the Z-score and NPL as stability measures and BOONE as the measure for bank competition. Annual GDP and GDP per capita growth are the proxies for economic growth. Four control variables to capture the countries macroeconomic profile are trade openness, fixed capital formation, government expenditure and sum of external assets and liabilities. Although the main interest of the study is to investigate how competition and bank stability affect the economic growth, they also estimate with the 2-step GMM estimator the relationship between stability and competition. The results support the competition-fragility view. With regard to economic growth they find that bank stability is crucial to economic growth whilst market power also contributes to economic growth.

The determinants of bank equity risk is examined in a study by Haq and Heaney (2012) where they collect annual data from 117 financial institutions (91 commercial banks, 13 savings banks, 12 holding companies and 1 cooperative) across 15 Western European countries (11 are members of the EU) covering the period from 1996 to 2010. The sample is split into pre-euro, post-euro, pre-crisis and post-crisis periods. The bank equity risk is comprised of five risks measures: total risk which is the bank equity return standard deviation, credit risk which is the loans loss provisions to total assets ratio, systematic risk and interest rate risk which are coefficients from regressions run where the dependent variable is the weekly stock return of a bank and explanatory variables are the weekly return on the MSCI market index of the country and weekly change in the long-term interest rate of each country. The explanatory variables are total assets, bank capital to risk adjusted assets ratio, charter value computed by the ratio of market value of equity plus the book value of liabilities to book value of total assets, total value of off-balance sheet activities over total liabilities, fixed assets to total assets ratio and cash dividends paid to total earnings. The economic freedom index, a concentration index CR3 and GDP growth is also included. In a dynamic panel data two-step GMM estimation model all the above explanatory variables are regressed upon all type of risks. The findings indicate that bank capital and charter value are negatively related to credit risk and this suggests a disciplinary effect of capital and charter value on risk taking by banks. They also found that bank capital has a positive effect upon total risk becoming stronger in the post-crisis period with bank capital failing to reduce bank risk. A finding however that is not mentioned in their results is that the concentration index comes with a significant negative coefficient with credit risk, total risk and systemic risk. This result indicates that higher concentration in banking market is associated with less bank risk and implicitly higher bank stability.

The impact of bank market power upon the loan risk-taking as measured by non-performing loans is examined in a recent study by Karadima and Louri (2020). Their data set includes two samples of banks observations covering the 2005-2017 period. The first set includes 1442 banks from all Euro area members' countries in order to calculate the LERNER index and the second sample that consists of 646 banks from

19-euro area countries is used for all the econometrics estimations. The first difference of NPL ratio is the dependent variable while the independent competition variable is proxied by three types of LERNER index following the stochastic revenue-to-cost frontier methodology, the efficient-adjusted and the fixed-effect within-group estimator. Control variables include the bank size, net loans to total assets ratio, growth rate of gross loans, net loans to total deposits ratio, ROA, a crisis dummy and foreign ownership. Lastly the HHI index and the concentration ratio of five banks assets are used as concentration measures. They utilize quantile regression method and more specifically they are using a penalized quantile regression with fixed effect estimator. Results when the three variants of the LERNER index are used show a positive relation with ΔNPL but only significant within the range .50 to .90 quantile. The authors translate these results as supporting the competition-stability view. When HHI or CR5 concentration indices are used, the results reveal a significant negative relationship within the quantile range .10 to .30 and a significant positive one within the range .70 to .90 with no significant relationship in the quantile range of .40 to .50. The authors argue that these conflicting results of the impact of competition and concentration on ΔNPL suggest "that more concentration does not always imply less competition"p.17 and "that competition seems to support stability when it comes to increase in NPLs, but that concentration enhances the faster reduction of NPLs" p.17 and that their study can be classified as finding a non-linear relationship between competition and stability within the context of different quantiles of stability.

The study by Kocisova (2020) examining the competition effect upon bank stability takes a sample of 32 European Global systematically Important Banks (G-SIB) as they are defined by the European Banking Authority (EBA) over the period 2008-2017. NPL and Z-score measure bank credit risk and stability while the competition assessment is LERNER and the bank's market share in assets. Total assets, loans to total assets ratio, fixed assets to total assets, non-interest income to total income ratio and GDP growth and inflation rate are the control variables. The results from a fixed effect GMM estimator support a linear relationship and show that although higher market power is associated with higher bank credit risk the overall bank stability is improved. The non-linear model also provides the same results.

Faia et al., (2019) examine a sample of 15 banks located in 8 European countries and classified as G-SIBs and records their foreign branches in 38 destination countries. The period covered is 2005 to 2015. The main aim of the study is to examine if and how the bank foreign expansion affects individual and systemic bank risk. They estimate five individual bank risks: Z-score, Loan loss provisions to total loans, leverage ratio, CDS price and standard deviations of ROA. Systemic risk is measured by the capital shortfall of a bank conditional on a severe market decline, the propensity to be undercapitalized when the system as a whole is undercapitalized and ΔCoVar using equity or CDs price. New branch openings for each bank in other countries are the foreign expansion measure. Competition is measured by the HHI assets based concentration index. Initially OLS estimation is considered but due to endogeneity problems they end up estimating gravity regressions. The results establish a negative impact of foreign expansion on bank risk and that foreign expansion effect upon risk is higher in host countries with low HHI.

The competition-stability relationship is examined for the first time within the context of European cooperative banks in a paper by Clark et al. (2018). The sample consists of 1193 cooperative listed banks operating in the European countries of Austria, Germany, Italy and Spain over the period 2006 to 2014. The risk measures are the Z-score, loan loss provisions to total gross loans, loan loss reserves to total gross loans and risk-adjusted ROA and ROE. The competition measure are the LERNER index, the three diversification indices computed by decomposing assets, deposits and loans and total assets, total liabilities to total equity and unemployment rate and inflation are the explanatory variable set. Results from Panel fixed effects regressions estimation indicate a positive relationship between market power and stability although an inverse U shaped nonlinear relationship is significant. Furthermore, the interactions terms of competition (LERNER) in deposit and loan markets come with a sign that shows a positive relationship between market power in the loan market and bank stability but with no significant relationship between market power in the deposits market and bank risk.

A sample of 88 commercial and cooperative banks from five EU member countries covering the period from 2002 to 2015 is employed in a study by Bahri and Hamza (2019) to examine the effect of competition on bank risk-taking behavior. The Z-score along with the standard deviation of ROA and NPL are the dependent bank risk variables. The LERNER index, CR3-loans, CR3-deposits and HHI-loans, HHI-deposits are the competition and concentration explanatory main variables measures. The control variables are total assets, liquid assets total assets ratio, total revenue to total expenses ratio, loans to assets ratio, loan loss reserves to gross loans ratio and GDP growth rate. The findings from two-stage regressions estimates give support to the competition-fragility view since higher market power (LERNER increase) is associated with higher bank risk (Z-score increase). The findings, when concentration measures are used indicate that an increase in bank concentration in loan markets increases both credit-risk and the overall bank stability. However, the opposite results are found for the concentration in deposits markets effect on credit and overall risk. Finally, they report that after the implementation of Basel III accord, competition has positive effects on risk-taking compared to period before Basel III.

The factors that influence bank stability and their relative strength in EU countries and countries associated with EU is examined by Sysoyeva (2020). The sample includes all 28 EU member countries and three associated countries Ukraine, Moldova and Georgia and the period covered is from 2004 to 2014. The Z-score is the stability measure and apart from the concentration index the other drivers of stability included are ROA, ROE, regulatory capital to risk-weighted assets ratio, cost to income ratio, net interest margin, deposits to GDP ratio, NPL ratio and credit to deposits ratio and branches per 100.000 adults. The sample is grouped into 15 old EU 15 member countries, 13 new EU countries and 3 countries associated with the EU. The results from a system GMM estimator regression of the baseline model with all countries show a negative relationship between concentration and the Z-score implying that stability worsens when concentration increases. To capture the heterogeneity of the effects among country groups the baseline model is estimated adding up the interaction terms of branch and concentration variables with EU13 and EU3. The results indicate that concentration is still detrimental to stability and is stronger in the case of EU-13 and EU-3.

A paper by Samantas (2013) uses for the first time the Extreme Bound Analysis (EBA) method to examine the impact of bank concentration and competition on bank stability. The basic idea of EBA is to define a set of standard explanatory variables (competition and concentration) that relate to the dependent variable (bank stability) and then run many regressions. Each regression includes the standard explanatory variables and a different subset of candidate explanatory variables. Those variables with significant coefficients within an upper-lower bound are considered robust. The dataset includes financial data from 2450 banks operating in the 27 European Union countries and covers the 2003-2010 period. The LERNER index and the HHI-a index are the standard explanatory variables for competition and concentration, respectively. The bank stability dependent variable is the Z-score. Three set of explanatory variables are defined. A bank-specific set, an institutional set and a country-specific set. The bank-specific set includes five variables: bank assets, equity to total assets ratio, cost to income ratio, liquid assets to deposits and short funding and non-interest income to total income ratio. The institutional set includes five indices-variables: capital regulation, supervisory power, private monitoring, activity restriction and foreign ownership. GDP growth, inflation and stock market turnover comprise the country-specific variables set. After running a large regression with all possible combinations of variables from the bank, country and institutional set variables the results show, firstly, that across of all model specifications there is a negative relationship between concentration and Z-score supporting the concentration-fragility view. Secondly the LERNER and Z-score relationship is not clear depending on the different-sized information sets. From institutional factors more capital regulation and foreign ownership give more stability but more supervision power and more restrictions on activities give more fragility.

The 2,529 cooperative banks operating in the five largest cooperative banking sectors in five Europe European Union countries (Austria, France, Germany, Italy, and Spain) over the 1998-2009 period is the data sample selected by Fiordelisi and Mare (2014) in order to investigate how competition in these special credit institutions affects their stability. Competition is measured by the conventional and fund-adjusted LERNER index while concentration is also measured by HHI for loans and deposits. Bank stability is proxied by the Z-score and two credit risk ratios: as the loan loss provisions to total loans and loan loss provisions to net interest margin. The authors calculate a herding measure as the ratio of the standard deviation of non-interest income to total assets in order to capture the possible effect of higher competition on the banks' choice to expand their activities in other non-loan activities. They first run a granger causality test with the two variables of competition and stability and with other variables to consider other factors affecting causality. The results indicate a strong and significant positive relationship between market power and stability. The same result is supported with panel polled fixed effect OLS regressions with Z-score and credit risk ratio as dependent variables.

The bank competition-stability relationship and the role of bank efficiency is examined in a paper by Schaeck and Cihak (2014). The role of efficiency is founded on Industrial Organization theory where more efficient banks survive in a competitive environment and are more profitable. Efficiency and profitability make them robust and more stable.

Therefore, efficiency is the connecting link for the competition and stability relationship. Their sample set consists of 17,965 annual bank-level observations from 3,325 banks operating in 10 European developed countries (9 EU members and Switzerland) covering the period 1995-2005. They use the BOONE indicator to measure competition and argue that the BOONE indicator has the advantage of measuring cost efficiency among banks in an increasing competitive environment. Therefore, they apply a 2-step GMM estimation model where the bank stability dependent variable is measured by the Z-score and its individual components and the NPL ratio in robustness tests. Explanatory variables apart from the BOONE indicator are bank-specific and include total assets, total assets growth, loan loss provisions to total assets and an income diversification index and country specific variables including GDP growth and unemployment. Finally, the HHI concentration index is included to control for the effect of market structure although the authors repeatedly warn that concentration is not a good proxy for competition. The results affirm that competition enhances stability, and that efficiency is the mediator through which competition promotes stability.

The European Union is the geographical dimension covered in a study by Ahi and Laidroo (2019) where they pose the question of whether bank market competition enhances bank stability. To this end they collect bank level data from 1088 to 1111 banks from 27 European Union member countries from the period 2004-2013. Competition is proxied by the BOONE and LERNER index although the HHI - a concentration index is also used. The Bank stability control variables are bank-specific and include total assets, cost to income and income diversification index. GDP growth and two dummies for foreign owned and government owned banks are the country-specific variables. The system GMM results in the linear regression form support the competition-stability view but when a non-linear approach is used for estimating the relationship, they found indications of a U shape association for the Boone index and even weaker signs of an inverse U shape when the LERNER index is used.

The competition-fragility view is claimed to be supported by the results of a study by Leroy and Lucotte (2017). They collect data for 97 listed banks from 13 European countries. LERNER is the competition index used while stability is based on individual bank risk with the Z-score and Distance to Default obtained from the “credit research initiative” database of the National University of Singapore. Systemic risk is based on market data and ‘corresponds to the expected capital shortfall of a given financial institution conditional on a crisis affecting the whole financial system'' p203. Panel pooled Regressions with fixed and random effects are run and the results, when the Z-score is used, support the competition- fragility view while the opposite result is validated with respect to systemic risk.

The EU-25 is the geographic dimension for a study by Ijtsma et al. (2017) that explores the concentration-stability issue covering the period 1998-2014 for 923 commercial banks. The concentration measures are the CR5 and HHI-a indices while a country-level aggregate Z-score stands for stability. The bank control variables are total assets, net interest margin, LLP, overhead cost to total revenue, loans to total assets. The country control variables are GDP growth, GDP per capita, inflation and real interest rate. Their fixed and random effects panel OLS model is used for estimation of bank-level and country-level regressions. Both empirical analyses find no significant effect of concentration on stability. Concentration hardly affects stability at the bank and country level. I would argue, however, that since results are limited to concentration the inclusion of competition in their analysis might have influence on their results.

The EU area once again is the geographic dimension chosen for exploring the competition stability nexus by Capraru and Andries (2015). They collect data from 27 European Union countries for 923 commercial banks for the period 2001-2009. The sample is split into euro-area countries, non-euro area countries, old EU members and new EU members. There are only concentration proxies used such as HHI and CR5 and the Z-score index is the proxy for bank stability. The control variables are the total assets, equity to total assets, overhead costs to total assets, net interest margin, banking activity restriction index, market share of foreign banks in total assets. The results from the GMM dynamic model support both the concentration-stability and the concentration-fragility views depending on the choice of concentration index (CR5 or HHI) and the sub-sample used. For the full sample, the competition-stability view is supported when CR5 is used but there is no significant relationship when HHI-a is employed. For the euro-area concentration measured by CR5 and HHI-a is not significantly related to stability. For the non-euro area the concentration –fragility view is supported for both CR5 and HHI. For new member countries concentration-fragility is supported for both CR5 and HHI-a. For old members competition stability is valid only when CR5 is used.

The effect of the bank size and the market structure on bank stability is examined for the European Union banking market in a paper by Pawlowska (2016). Their empirical results are based on a panel data for the 27 E.U countries covering the period of 2004-2012. The competition measure of LERNER and the concentration indices of CR5 and HHI-a are retrieved from World Bank statistics database. The NPL bank risk-taking measure is retrieved from IMF soundness indicators. The bank size is measured with total assets and control variables are ROA and ROE. In order to account for the moral hazard effect and for too-big-to-fail effects the Tier1 index and the ratio of ROE to ROA are used as independent variables. The system GMM estimation method is used and in all regressions forms there are three sets of panel data including the EU-12 (small banking sectors), EU-15 (large banking sectors) and EU-27 countries. Results from the basic model show that for EU-15, as competition increase, risk-taking also increases (competition-fragility view) while the opposite (competition-stability view) is found for EU-12. For the whole sample of EU-27 a positive but non-significant relationship is found. Bank size has a strong positive effect on risk-taking.

In a paper by Lopez-Penabad et al. (2021) they utilize a data sample of 117 listed banks located in 16 European western countries for the period 2011-2018 to explore the relationship between competition and bank stability. LERNER index measures competition and Distance to Default together with Z-score are the stability proxies. The total sample of banks is split into two subsamples. The split criterion is the average value of Z-score as derived from World Bank's Global Finance Database calculated for each country. Banks that are located in countries with Z-score below or above the average Z-score comprise less stable and more stable banking subsamples. Conventional banking control variables are used such as total assets, equity to assets ratio, noninterest income share, liquid to total assets ratio, loans to assets and cost to income ratio. GDP growth and inflation are the macro control variables included. The results from estimated two-step GMM systems indicate that for total sample higher market competition increase banking risk that is the competition-fragility view persists. However, the results from subsamples suggest that this competition-fragility relationship is much more evident in the sample with less stable banking system.

3.3.5.1 Summary

- Again, most studies (18 out of 21) are recorded within the period 2014-2020 whereas half of them are published in the period 2018-2020. The sample period coverage ranges from 8 years (2003-2010) to 19 years (1996-2014) and 15 studies use a period starting from early 2000.

- The Z-score is mainly used (17 times) to represent bank stability and is accompanied in nine studies with NPL or LLP. The Distance to Default measure is used once.
- LERNER is again the favourite competition index and is used in 13 studies while Boone is used 2 times together with LERNER and 3 times is the only competition index. The concentration indices of CR3, CR5 and HHI are present in five studies as the only market power indices.
- The estimation techniques employed are mainly system GMM and Pooled Panel-OLS. The Gravity OLS, Quantile and Granger causality analysis are also applied.
- The countries sample used in most studies are European Union members with mostly harmonized banking systems and hence give a rather homogeneous sample. So, one should not expect much variation in their results. However, there are no unanimous findings. However, a detailed comparison of the characteristics of studies shows those focusing on European Union region are in majority agreement that competition and concentration are positively associated with stability and fragility, respectively. Another characteristic of the results is that when the sample is limited to a small number of developed western European Union members' countries the completion –fragility hypothesis is mostly validated. This result is in line with findings in the developed –developing region analysis. The euro area studies support the competition-stability hypothesis. Finally, two studies that separate the sample into eu-15 and eu-12 find for the latter group both concentration-fragility and competition-stability but for the former group competition-fragility and concentration-fragility are both found to be valid.

3.3.6 Central Eastern Europe (CEE)

Applying a discrete time survival model Mannassoo and Mayes (2009) investigates the bank, macro and structural specific factors that can explain the failure hazard of banks. They collect bank level data for 600 banks from 19 CEE countries (10 of them being new EU members for the 1995 to 2004 period and cover 118 bank distress episodes. A bank is classified as a distress case when it is in bankruptcy, dissolved or in the liquidation process. Variables including the ratios of loan to assets, loan loss provisions to total loans, equity to assets, cost to income, interest and fee income to total assets, interest expenses to liabilities, bank deposits to customer deposits are the bank–specific explanatory variables. Macro variables are real GDP growth rate, inflation rate, 3-month Euribor, change of exchange rate, share of foreign-owned and state-owned banks and stock market indices. Market structure is represented by the HHI concentration indicator. They estimate the cloglog hazard model. Results indicate that bank earnings, efficiency and size are not significant early warning factors of bank distress. However, CAMEL factors play an important role in bank distress and providing early warning of it. Among other results it is found that the bank failure probability increases along with an increase in banking market concentration supporting the concentration fragility view.

A paper by Cifter (2015) explores the impact of concentration upon non-performing loans taking a sample from ten CEE countries for the period 2000 to 2009. The CR3 concentration measure together with credit to deposit ratio, exchange rate change, gross fixed capital formation, exports of goods and services, unemployment rate and share of foreign banks are regressed upon the NPL ratio. Estimates from the GMM-system and 2SLS regressions show that bank concentration has no significant effect upon NPL. However, conducting cointegration analysis using Fully Modified OLS (FMOLS), the estimated cointegration coefficients indicate that concentration coefficient for the whole panel data set remains insignificant for stability (NPL) in the short and long run. However, results from FMOLS model indicate that concentration for individual CEE countries varies. For Estonia, Latvia and Slovakia bank concentration is negatively related to NPL but for Bulgaria, Croatia, Lithuania, Poland and Slovenia is positively related to NPL.

Another paper by Hujak (2015) takes a sample of 415 banks from 15 CEE countries from 1997 to 2012 and explores the market power effect upon banking stability. Bank level observations are used to compute the Z-score, NPL and leverage stability measures while competition is computed at bank level as a competition efficiency frontier using the stochastic frontier method where a revenue equation is estimated with two inputs of working and physical capital. The basic model estimated has as a dependent variable the franchise value (computed as the ratio of bank market value to book value the former proxied by the present value of operating revenue) and explanatory variables are cost efficiency, market share, equity to assets ratio, regulation power index. The results show a strong positive effect of market power on franchise value. The second step is regressing market power (competition efficiency index), cost efficiency, credit growth, loans to deposits ratio, bank market share and GDP growth upon the Z-score, NPL (portfolio stability) and leverage stability index. The results show no effect of market power on Z-score and on leverage stability but record a significant (at 1%) positive effect upon portfolio stability (NPL ratio). Finally, the paper argues that the overall results indicate support to the competition-fragility view.

Seventeen countries from central and Eastern Europe is the geographical context within which the concentration-stability issue is investigated in a study by Capraru et al. (2016). The sample set contains bank-level data from 134 commercial banks for the 2007-2012 period. The dependent variable is the ROA based Z-score index computed with the three-year rolling window method. As explanatory variables apart from the concentration ratio (CR) based on three and five largest banks there are bank-specific variables (total assets, net interest income to earning assets ratio, loans to deposits ratio and NPL ratio) and country-specific variable (deposits to GDP ratio, banking activities restriction index, supervisory power index, monitoring index). The empirical findings, from a panel least square estimator, suggest that there is trade-off between concentration and bank stability. Higher concentration is associated with lower stability or higher probability of default. This result is also found valid when the sample is split into large and small size banks groups. Finally supervisory power moderates the impact of concentration on stability.

Once again, the concentration-stability issue is investigated for 10 central Eastern European countries in a study by Karkowska and Pawlowska (2017) where they collect bank level data for 136 banks for the period 1999-2015. They run panel GMM regressions where the dependent variable is the ROA based Z-score and the explanatory variables are concentration which is measured by the CR5 for assets and for robustness also by the HHI index. Bank size is the only bank-specific control variable used and two dummies are included one for foreign ownership and the other for crisis year defined by slowdown of GDP growth. The results find a negative significant coefficient for CR5 which means that as concentration increases, stability drops. Foreign ownership and crisis dummies do not influence stability. However, bank size positively and significantly affects bank stability.

The bank market power-risk relationship is investigated for the Central Eastern European region by Lapteacru (2017). They collect bank level data for 304 banks from 10 CEE countries for the period 1995-2016. The bank stability measure is an "improved" Z-score index which as explained in Lapteacru (2016) corrects Z-score estimation using a stable distribution instead of the assumed normal distribution of ROA. The distance to default (DD) measure, as defined by Merton (1974), is another bank stability measure used which measures the bank's distance from a default event. Market power is measured with the LERNER index and with a normalized HHI index which takes values between zero and one regardless of the number of banks. The control variables are the total assets, an income diversification index, the ratio of high-quality assets (loans to banks and gov. securities and cash) to high quality liabilities (current deposits and deposits from banks and cash collateral), bank regulation index and GDP growth rate. The relationship between market-power and bank risk is estimated employing, firstly, the panel data regressions and secondly the two-step GMM both with time-fixed effects. Both linear and nonlinear (squared term of LERNER variable) relationships are evaluated with both DD and Z-score as dependent variables and HHI and LERNER as the main explanatory variables. The findings argue in favor of a positive relationship between market power and bank stability when LERNER is used. However, when HHI is used then bank fragility increases as bank concentration is becoming stronger. As regards the nonlinear relationship between Z-score and LERNER (squared term) the findings support a nonlinearity but with an exceptionally low inflection point that makes it ineffective.

A later study by Arben and Toci (2018) looks into the relationship between competition and bank risk taking policy. To this end they gather data from 292 banks operating in 15 central and southeastern European countries from 1999 to 2009. They estimate the PR-H statistic measure of bank competition, and they obtain from the study of Efthyvoulou G, Yildirim C. (2014) the LERNER index for each country. They also estimate the HHI concentration measurement. The loan-loss provisions to total loans ratio is the measure for the banks risk-taking. Among the other explanatory variables the competition variable are the bank assets, equity to total assets ratio, non-interest income to total assets ratio, loans to total assets ratio, growth rate of loans, net interest rate margin, the property rights protection index and two dummies to for foreign or domestic ownership and for EU or non-EU country's membership. They apply the fixed effects vector decomposition method and estimate the regressions. The findings suggest that for the whole sample of countries, an increase in bank competition is associated with a reduction of bank risk-taking. However, when banks are split into EU and NON-EU members the results suggest that an increase in competition is reduces risk for EU countries, but the opposite happens for non-EU countries. The above results do not change when the LERNER index is used. The market concentration index has a negative significant coefficient suggesting that more concentrated markets make banks reduce their risk-taking behavior.

The question of whether the bank market institutional and supervision framework affects banks' risk-taking directly or indirectly through bank market competition is given an answer in paper by Agoraki et al., (2011). The sample data set includes 546 banks operating in 13 Central Eastern Europe countries and covers the 1998-2005 time period. The bank risk-taking choice is measured either by the NPL ratio or by the Z-score bank stability index. The LERNER index is estimated to measure Bank-level competition. From the World Bank database they collect data for the capital requirement index, supervisory power index and activity restrictions index to represent the regulatory and institutional framework for each country. They use panel data and GMM system regressions with either the NPL ratio or Z-score as dependent variables. They find that when market power increases, the risk-taking (NPL) gets lower and that when market power increases bank stability improves (Z-score drops) and hence both results support the competition-fragility view. When interactions terms between market power and supervisory/institutional variables are estimated, the results indicate that capital requirements and supervisory power directly negatively affect risk-taking, and the stabilizing effect of capital requirements is lower when market power is high.

The impact of bank concentration and efficiency upon bank stability and how this differs between early transition countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania and Poland) and late transition former Soviet states (Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Tajikistan, Ukraine and Uzbekistan) is explored in a study by Djalilov et al., (2015). They collect data from 254 banks and the period covered of 2000 to 2012 is split into a stable 2000-2006 period and a financially turbulent 2007-202 period. The bank stability dependent variable is the Z-score while the main explanatory variables are bank concentration proxied by the HHI-assets and technical efficiency index estimated with the stochastic frontier model. GDP growth, inflation, loan loss provisions to total loans ratio and a foreign ownership dummy are the control variables. The paper applies both GLS and MLE random effects estimators and the findings support the concentration-fragility view for late transition countries during the stable period while, for the same period, the results from early transition countries support the concentration-stability view. The technical efficiency impact on stability is negative for both the stable period and the financial crisis period.

A sample of 1121 banks from 22 transition countries from south-east Europe and ex-soviet republics over the 1998 to 2016 period is the data set employed by a study Li (2019a) in order to investigate the impact of bank competition and banking reforms on bank stability. Four stability measures are used: the Z-score, standard deviation of ROA and ROE and NPL ratio. LERNER, H-statistic and HHI index are the proxies for competition. The bank-specific control variables are total assets, equity to assets ratio, loan loss provisions to gross loans ratio, net interest income to total earning assets, customer deposits to total assets and fixed assets to total assets. The country controls are GDP growth, inflation and a dummy for crisis period. Bank reforms are measured with an index taken from IBRD (International Bank of Reconstruction and Development) and seven indices for regulation, restrictions and deposit insurance institutional taken from Barth et al. (2013). Fixed-effect panel data and two-stages Least Squares estimators are used and the findings confirm that competition and bank reforms enhance stability. Having a deposit insurance scheme is negatively related to financial soundness.

Evidence for the relationship between competition and financial stability from CIS countries brings a study by Nabiyev et al. (2016). The sample contains annual bank level data from seven post-soviet countries during the period of 2001-2013. The PR-H statistic is estimated and is used for the competition measure. They then use a logistic probability analysis where the probability that an episode of a banking crisis (defined when the NPL ratio of a bank reaches 10%) will occur depends on a number of explanatory variables. These variables include the competition index, a concentration index, credit growth, broad money to total reserves ratio, political stability, and government effectiveness index. They then run a logit model and results show that banking competition does not influence financial stability, but instead macroeconomic and institutional factors are significant. Also, credit growth significantly decreases the likelihood of a banking crisis.

The impact of competition on stability is investigated for the Commonwealth of Independent States (CIS) countries including Russia by Clark et al (2018). The sample set includes 333 banks from 10 CIS countries over the period 2005-2013. The dependent stability variables are measured by the Z-score and NPL ratio. The main explanatory variable is the competition measured by the LERNER index and control bank-specific variables, such as, total assets, loans to total assets, fixed assets to total assets, and country specific variables, such as GDP growth, a legal rights index and a supervision power index. They run a dynamic panel data regression applying the Instrumental Variables GMM model both with dependent variable NPL and Z-score and the results for the whole sample of banks and for Russian banks alone indicate that as market power increases credit risk and overall default probability also increase. In other words, the competition-stability hypothesis is accepted.

Three Central Eastern Europe countries and members of E.U since 2004 is the geographic area studied by Cuestas et al. (2019) when exploring the relationships among concentration, competition and financial stability. Their sample contains 40 commercial banks from the three Baltic countries where 21 banks are from Latvia, 10 banks from Lithuania and 9 banks from Estonia. The period under examination starts from 2000 and ends in 2014. The concentration measure is the market share of each bank's assets to total bank market assets and competition is proxied by the LERNER and efficiency-adjusted LERNER indices. Bank stability is measured by the classical ROA-based Z-score and bank risk-taking is measured by the loan reserves to gross loans ratio. They run two-step least square regressions with either the LERNER or the loan loss ratio regressed upon either the LERNER or the market share competition index. Controls variables are the bank size, fixed assets to total assets ratio, non-interest income to total income ratio and liquid assets to deposits and short-term funding ratio. The results indicate a significant and robust U-shape relationship between the Z-score and LERNER index and mixed results between loan loss reserves ratio and the LERNER or Market share competition measures.

How changes in bank market concentration and presence of foreign banks impact on financial stability is examined by Karkowska and Pawłowska (2019) for ten CEE countries. The sample includes 136 banks and covers the period 1999-2015. Z-score is the dependent bank stability variable whilst bank concentration is measured by CR5 and the foreign bank presence is the percentage of the total banking assets that are held by foreign banks. The control variables are loans to total assets, loans to deposits, regulatory capital to total capital ratios and unemployment rate. Estimation is conducted within a dynamic panel data GMM 2-step model. Five models are estimated: one for the whole bank sample and four more related to different bank CR5 concentration percentages (60%, 70%, 80%, 90%). The results with all banks included support the concentration-fragility view and this effect is stronger as bank concentration is getting higher. The results also in all models show an insignificant influence of foreign banks on bank stability.

3.3.6.1 Summary

- There are 14 studies reviewed of which only two take a country sample from the CIS block. The other studies refer to CEE countries. Almost all the papers (14) were published between 2014 and 2019. The length of time covered starts after mid 90's and range from 6 years (2007-2012) to 22 years (1995-2016).
- Bank stability is proxied by the Z-score in 10 studies while NPL and LLP are used in 5 and 2 papers, respectively. Distance to default and distress episodes are alternative stability measured used.
- LERNER is the favourite competition measure used in seven studies, PR-H statistic in four studies while Boone is not employed at all. Concentration indices of CR3, CR5 and HHI-a are used in 5 studies as standalone concentration indices.
- The estimation techniques vary from the 2SLS, GMM (8), PP-OLS (4), LOGIT model to Cloglog hazard models.
- The results overwhelmingly support the concentration – fragility or competition – stability hypothesis. Especially when, in five studies, only concentration measures are employed (CR3, CR5, HHI-a) there is full consensus of the results in favour of the concentration-fragility view independently of the number of countries included or the time covered. This result agrees with the study by Sysoyeva (2020) for the EUROPE region splitting their sample into 15 and 12 countries groups with the latter mainly including new entrant CEE countries. Furthermore, when the LERNER index is used competition is positively associated with more stability while PR-H statistic give either no significant results or supports the competition-stability view. The above findings suggest that banking competition in countries with low degree of competition, high bank concentration and banking restrictions can play a stabilizing role for the financial system in these countries.

3.3.7 Asia region

The ASEAN (Southeast Asian Nations) association of 5 Asian countries is the geographical area chosen for a study by Noman et al. (2017) which empirically examines the bank competition-stability issue. Bank level data from 180 commercial banks over the period 1990-2014 is their observations sample. The measures of financial stability used in this study are the Z-score and NPL ratio and equity to assets ratio. The competition measures cover both structural and non-structural indices with the LERNER, PR-H statistic and HHI being estimated. The control variables are the total assets for bank size, net loans to total assets ratio for assets composition, cost to income ratio for operational efficiency and foreign bank and deposit insurance dummies. They apply the two-step GMM estimation method and the results from the linear model support the competition-stability view independently of the measure of stability (Z-score, NPL and assets ratio) and competition (LERNER and PR-H) are used. However, when the concentration HHI is used they find no significant relationship with any measure of stability. In the non-linear model with the quadratic LERNER and PR-H independent variables the results support a U-shaped relationship between competition and stability only for the quadratic PR-H competition index.

A sample of 191 banks over the period 2000-2014 in three Asian countries: Zheng et al., (2017) uses India, China and Bangladesh with the purpose of investigating simultaneously how competition and bank specific variables affect risk, capital and efficiency. The dependent variables are bank risk proxied by the NPL ratio, capital is measured with the equity to assets ratio and efficiency with cost inefficiency computed using SFA for each country. The explanatory variables are the BOONE competition measure and bank specific variables such as total assets, non-interest income to total assets, interest income to total assets, ROA, deposits to total assets ratio, loan to deposit ratio and loans to assets ratio. Additionally, GDP growth and inflation are the development explanatory variables. Using a two-step GMM estimator, results from the estimated effects on risk show that higher level of competition and capital strength make banks take more risk. Regressions run for estimation of effects show that higher competition induces banks to hold lower capital. Finally, when effects on cost efficiency are estimated, the results demonstrate that as competition increases banks behave in a more cost-efficient manner. Overall, in a more competitive banking market environment Asian banks in these three countries take more risk, hold less capital and improve their cost inefficiency.

The relationship among competition, concentration and bank stability when financial inclusion is considered is investigated in a paper by Dutta and Saha (2019). Their data sample covers the period from 2004 to 2014 for 11 Asian emerging countries. The financial inclusion index is the number of bank branches per 100,000 adults derived from World Bank. Competition is measured with the Boone index and concentration by the 3-bank concentration ratio. Bank stability is proxied by the Z-score index. The control variables are the capital to total assets ratio, liquid assets to deposits and short-term funding ratio and broad money to GDP ratio. PP-OLS and GMM empirical estimates give contradictive findings where higher competition promotes stability, but higher concentration (CR3) influences negatively bank stability. Financial inclusion always promotes bank stability.

An early study by Soedarmono et al. (2011) examines whether, after the late 90's Asian crisis, Asian banks' market power enhances their stability. They collect bank-level data from 607 commercial banks in 12 Asian countries over the 2001 to 2007 period. To account for bank stability they use the Z-score based on ROA and ROE, the equity to assets ratio and the ratio of total capital to risk-weighted assets. Explanatory variables are the LERNER market power index, bank specific variables such as loans to deposit ratio, loan loss reserves to total loans, loan growth rate, operating expenses to total assets ratio (technical efficiency) and total average assets(bank size). GDP growth rate and inflation rate are the country specific explanatory variables. Results from panel-OLS fixed effect and GMM regressions indicate that although greater market power is associated with better capitalization its effect on overall bank insolvency is positive However, this bank insolvency rise is mitigated by the higher economic growth.

The straightforward competition-stability relationship is the area of investigation in a paper by Fu et al. (2014). 14 Asian countries (Australia is included) is the geographic coverage of their sample and the time period is the eight years span 2003-2010. The banks coverage varies year by year ranging from a minimum of 423(2003) to a maximum of 565(2007). They then apply a GMM panel data estimator of their basic model where the dependent stability variable used is either the Z-score or the Merton's probability to default measure. The explanatory variables are competition proxied by the LERNER conventional and efficiency adjusted indices with CR3 standing for bank concentration. Control specific variables are used, such as, total assets, net interest income to total earnings assets, capital to assets ratio, a dummy for the existence or not of a deposit insurance scheme, a crisis dummy that takes value 1 for years 2008 and 2009 and real GDP growth. Institutional indices of activity restrictions, financial freedom and property rights are included in the set of instrumental variables used. Empirical results support the competition –stability view since the LERNER index has a negative association with bank risk. However, the results also show a negative relationship between concentration (CR3) and stability which support the concentration stability view. Finally, the authors argue that "the results also confirm that bank concentration is an insufficient measure of bank competitiveness" (p.72).

The question of whether banking competition affects the risk-taking policy of banks is given an answer in a paper by Liu et al., (2012). The data used is bank-level data for 4 Asian countries (Indonesia Philippines, Malaysia, and Vietnam) with bank andyear observations of 447,261,311 and 197, respectively. The sample period is 1998-2008. The PR-H is used as the competition index but in six variations. These variations are the result of two models of revenue equation where the PR-H statistic is estimated with a dependent variable of either the interest revenue or the total revenue. These two models are estimated with three estimation techniques (pooled OLS, fixed Effect GLS and one-step GMM). They also include a concentration index which is the ratio of the three largest banks assets to total banks assets (CR3). For stability, apart from the commonly used Z-score, is also proxied by the loan loss reserves to total loans ratio and the ratio of total loan provisions to total loans. Liquidity, lending activity, foreign share in banks assets and regulation environment are the control variables. The results from the six PR-H statistic measures of competition are not homogeneous. When competition (PR-H) is regressed upon the ratios of loan loss reserves and loan loss provisions to total loans the negative and significant coefficient implies that competition does not induce banks to higher risk-taking and this effect is stronger with large banks than with small banks. However, when the dependent variable is the Z-score, the coefficient of PR-H competition index becomes positive and non-significant. Finally, the same results are obtained for the CR3 concentration measure.

The simultaneous effect of efficiency and competition on bank stability is investigated in a study by Hien et al. (2019). Data from ninety nine commercial banks operating in four Asian countries: China (25), Hong Kong (23), Malaysia (22) and Vietnam (29) are selected in order to calculate efficiency, competition and stability measures. Two Z-score indices based on ROA or ROE are the dependent stability variables. Two cost efficiency scores derived from SFA and DEA estimation methods and three competition LERNER indices (conventional, efficiency adjusted and funding adjusted) and HHI and CR3 concentration indices are the basic explanatory variables. Bank-specific variables such as total assets, non-interest income total revenue, loans to assets, deposit market share and an ownership index are included in the set of control variables which also include GDP growth, inflation and a crisis dummy with value one for year 2009. After the analysis of efficiency, competition, and stability by country the GMM estimator results in all model variations suggest that lower competition and higher concentration, especially when CR3 is used, are associated with higher stability. In other words, the competition-fragility view is given support. The HHI index is positively related to stability but non-significantly in any model variation.

The bank consolidation and bank concentration that took place in the Asia Pacific region after the late ninety's financial crisis and its effects upon bank stability is examined in a paper by Machrouh and Soedarmono (2009). Their sample consists of annual data for 607 commercial banks from 12 countries in the Asia and Pacific region for the period 1999-2007. The competition is proxied by the LERNER index and adopting the methodology used by Uchida and Tsutsui (2005) they compute LERNER for the bank market by country. Bank risk is measured primarily by the ROA-based Z-score index and the standard deviation of ROA. Bank performance indices (average ROA and ROE) are used to examine if competition affects bank risk increase through bank moral hazard to acquire more profits and capital. The results from fixed effect and GMM estimations suggest that the higher market power as a result of bank consolidation policy is associated with lower bank stability although capital and bank performance increase, the latter enhances banks' moral hazard that finally erodes bank stability.

The impact of banking market competition on banks' risk-taking behavior and how such behavior alters during crisis periods is examined by Soedarmone et al. (2013). Their empirical estimates are based upon a sample of 636 commercial banks operating in 11 Asian countries covering a period from 1994 to 2009. The market power or degree of competition for each period per country is measured by the LERNER index using panel data techniques. Risk-taking is measured by four ratios: the risk assets to based capital ratio, total equity to total assets ratio and standard deviation of returns to equity and of returns on assets. Two Z-scores based either on ROA or on ROE measure insolvency. Control variables are bank and country specific. They apply 2 stages Least Squares econometric technique with fixed effects corrections. The empirical results for the whole period of examination support that higher market power or lower competition is associated with higher risk-taking and a less stable banking system. However, when focused on the first crisis period of 1997-1999 higher market power is accompanied with more stability whilst in the second crisis of 2007-2009 the results are opposite. Further examination of each country's bank's reaction to the crisis indicate that in countries with too big to fail banks the length and time recovery differ and affect the overall results.

The effect of competition on financial intermediation and bank stability is empirically investigated by Soedarmone and Tarazi (2015) and the case study is the Asia Pacific region bank market. The data set includes annual bank-level data of 686 banks from 12 countries from 1994 to 2009. However, four countries' banks: China, Hong- Kong, India, and Indonesia, count for 53% of total banks. Financial intermediation is measured by the bank loan growth and to assess bank stability they use the non-performing loans ratio, the standard deviation of ROA computed from a three-period rolling window and the deposit growth rate. The competition is measured by the LERNER index and for its calculation for the bank market by country, the methodology used by Uchida and Tsutsui (2005) is employed. Bank specific control variables such as the capital adequacy ratio, deposits to assets ratio, non-interest income to total income ratio and bank size are included in the set of explanatory variables together with country specific ones such as the degree of economic freedom and foreign exchange reserves assets growth. Their panel data model is estimated with the two-step GMM method and the findings strongly support the positive effect of competition on bank loan growth and bank instability. Banks with more market power are more unstable. Finally, they highlight that as market power increases instability, depositors react by reducing their deposits.

The link between charter value and systemic bank risk and how this relationship is affected by a credit sharing information model is investigated for a group of Asian countries by Rusmanto et al. (2020). They collect, for the period from 1998 to 2012, annual bank level data for 173 publicly traded banks from 10 Asian countries of which three countries, China, Japan and Indonesia, count for 73% of the total banks included. There are two proxies used for systemic risk. The first proxy is the "bank idiosyncratic risk" which is estimated within a rolling OLS regression using weekly data for bank stock returns and stock market returns and the second proxy is the co-movement of bank stock returns which is an exponentially weighted moving average correlation for bank stock return data. They also consider capitalization as a dependent variable measured either by the total equity to total assets ratio or by the total capital to total risk-weighted assets ratio. Bank charter value is measured using the TOBIN's Q ratio defined as the ratio of market value of equity plus the book value of liabilities to total assets. Concerning credit information sharing they use three indices measuring the depth and coverage of credit bureau and registry. Bank specific and country specific variables, such as, total assets, total loans to total assets ratio, cost to income ratio, liquid assets to deposits ratio and a stock market volatility index together with the ratio of stock market capitalization to GDP are included. Results from a GMM estimation model suggest a negative relationship between charter value and systemic risk but a positive one with capitalization in banking. Credit information sharing does not significantly influence the charter value effect on systemic stability although the effect is improved with lower quality credit sharing information.

Another recent attempt to explore the relationship between bank competition and bank stability within the context of the Asian region is taken by Vo et al. (2020) but contrary to the conventional view they investigate whether competition is dependent upon bank risk-taking choices. Their theoretical background that the bank's risk-taking policy is adjusted so not to affect competition is based upon the study by Spierdijk and Zaouras (2017) which express the LERNER index as a function of risk and other non-risk variables and suggest that differences in the LERNER index might be a result of difference in risk-taking behavior. Vo et al. (2020) collect annual data for 564 banks from 9 Asian countries for the period 20011-2015. Competition and bank risk taking are measured with conventional LERNER and ROA based Z-score indices, respectively. The control variables are the bank size, non-interest income to total income ratio, cost to income ratio and concentration in assets index. With competition as the dependent variable they run OLS and the findings for the total sample and for small and large banks groups support a non-significant effect of risk upon the competition either in simple or with risk interactive variables models. The latter contradicts the results for Europe where risk is found to be a significant explanatory factor of competition variation by De Guevara et al. (2005). Only bank size and income diversification are found to be negatively but significantly related to bank competition.

Another recent study by Aminul et al., (2020) empirically assesses the effects of bank competition on bank stability and bank capitalization. To this end they use a balanced panel data set from 63 banks from five South East Asian (ASEAN) countries over the period 2009- 2017. Competition is measured by the conventional index LERNER, the ROA based Z-score index measures banking sector stability and banks' capital strength is measured by the total capital to risk-weighted assets ratio. Bank assets, liquid assets to total assets ratio, total operating expenses to gross revenue and the loans to total assets ratio are the control variables. A two-step GMM model is estimated for each country and findings support the competition–stability view for Malaysian and Singaporean banks but for Indonesian and Thai banks the competition-fragility view is supported. No significant relationship is found for the Philippines' banking sector. However, the effect of competition on capital ratio is positive and significant for all countries' bank market except for the Philippines.'

How bank stability is affected by the bank market power and its interaction with income diversification policy of banks is explored in a paper by Nguyen et al., (2012). Their sample includes 151 commercial only banks operating in four Asian countries (Bangladesh, India, Pakistan and Sri Lanka) for the period 1998-2008. The income diversification is measured as the ratio of non-interest income to total assets and market power with the LERNER index in conventional and funding-adjusted form while a CR3 concentration index is included. Bank stability is measured with the Z-score index. Control variables include total assets, bank share in deposits and loans, total cost to total income, equity to assets ratio, net interest income to total earning assets and dummies for state, foreign and Islamic banks. Banking restriction, banking freedom indices and a dummy for the financial crisis are also included. In order to estimate the association of market power, income diversification and stability they run two regressions with income diversification and bank stability as dependent variables using the GMM estimator. LERNER and its interaction with income diversification are included among the explanatory variables. The results show that LERNER alone does not significantly affect the stability but when it interacts with the income diversification variable becomes positive and significant which indicates that banks with higher market power are less (more) stable when their income results from traditional (non-traditional) activities.

A recent study by Alvi et al. (2021) investigates if and how banks' efficiency (cost to income ratio) plays a role in the relationship between competition (LERNER efficiency adjusted index and BOONE) and bank stability (Z-score). To their end collect bank balance sheet data for 88 commercials banks from four South-Asian banking sectors (Bangladesh, India, Pakistan and Sri Lanka) for the period 2012-2018. Total assets, LLP, NIM are the bank specific control variables while GDP growth rate, inflation and real interest rate are macro specific control variables. The authors argue that the results from a two-step system GMM estimation technique signifies "that efficiency is transmission variable in the relationship between bank competition and stability in South Asian region."(p. 9) since cost to income efficiency variable is statistically significant when either LERNER or BOONE competition indices are used. However, they do not comment on the findings concerning the competition-stability issue itself.

Indeed, the negative statistically significant coefficient for both LERNER and BOONE support the competition-stability and competition-fragility views, respectively.

A recent paper by Muizzuddin et al. (2021) examines the impact of institutional quality in the competition-stability relationship for the Asian banking sector. The dataset covers 427 banks from 11 Asian countries- where 199 and 126 banks are from China and Japan respectively- covering the period 2011-2019. Competition and stability are measured by the LERNER and Z-score indices, respectively. The institutional quality is proxied by the Worldwide Governance Indicators (WGI). These institutional quality variables, such as voice and accountability, political stability and the absence of violence, government effectiveness, regulatory quality, the rule of law, and control of corruption, range from approximately −2.5 (weak) to +2.5 (strong) governance performance. Bank control variables include total assets, LLP ratio, equity to assets ratio, NIM, deposits to total assets ratio. GDP growth and inflation rate are country-specific variables. The estimation method employed is the instrumental variables with GMM estimators and the results from the three separate equations estimated (stability-competition, stability- squared competition and stability- competition-institutional quality indices) provide robust evidence for the competition-fragility view.

A study by Chalid D.A. et al. (2019) aims to empirically identify the determinants of bank stability in the ASEAN-5 countries group (Indonesia, Malaysia, Singapore, Thailand, and the Philippines). The data sample consists of 64 listed commercial banks for the period from 2007 to 2014 and stability is measured with the Z-score index. The determinants were categorised into four groups which are national framework (political stability and rule of law indices), market structure (HHI-loans index), bank specifics (total assets, equity to assets ratio loans to assets, net interest income to total income, net interest expenses to total assets, ROA, credit growth, and economic conditions (GDP growth, unemployment and inflation rates, real interest rate and housing price index). The fixed effect with the generalised least square model was employed to estimate eight regressions with a variation of independent set of variables. Results show that a higher level of political stability promotes bank stability but a higher level of the rule of law decreased the level of bank stability. Bank market concentration is negatively related to bank stability giving support to concentration-fragility view.

3.3.7.1 Summary

- We have reviewed 17 studies. In eight studies China or/and India and Japan are included in the country sample. There are also three papers that focus exclusively on the ASEAN 5 countries. The number of countries included in the data set range from 4 to 12. The majority of the studies have data starting after the 1997 crisis but there are three papers that use a time period that includes the 1997 crisis period. All the papers are published using data after 2009 and half of them appear during the period 2017-2020.
- Once more, the Z-score is the prevailing stability measure used in eleven papers while the NPL, LLP risk variable is used in only three studies. The standard deviation of ROA, equity to assets ratio and Distance to Default are alternative proxies for bank solvency. One study uses systemic risk which is proxied by the banks' stock returns volatility.
- LERNER remains the favourite measure of market power index, employed in ten studies while Boone and PR-H are used twice each. CR3 and HHI are the concentration indices that are used seven times accompanying the main non-structural measures of competition.
- The estimation methods employed are mainly the system GMM, which is used eleven times, the PP-OLS and Generalised Least Squares (GLS).
- The findings of most studies converge to the competition-stability view. This result is reinforced from the results of five studies that explore the competition stability issue without its interplay with efficiency, capitalisation, economic growth, income diversification and financial inclusion. The study that finds support for the competition-fragility view is the one by Hien T.P., et al (2019). However, this study has a limited representation of the Asia region with only four Asian countries and excluding the crisis period characteristics that may have biased results. In addition, findings from a similar study with three Asian countries by Zheng et al. (2017) agrees with competition-fragility view but stability is measured only with the NPL risk-taking measure and not with the overall stability which may give support to the opposite view.

3.3.8 China region

The most recent study by Bashir et al., (2021) explores not only the bank competition and financial stability relationship but also the intermediate role of banking sector transparency in this relationship. The authors collect annual bank level data for 164 banks over the fifteen years period of 2000-2014. The dependent financial stability variable is proxied by the Z-score, NPL and equity to assets ratio. Competition is measured both by the LERNER and BOONE indices. Transparency is estimated as an index derived from 17 weighted sub-indices according to Nier (2015) and another World Bank index taken from Barth et al. (2013). The control variables are total assets, the ratio of non-interest expenses to gross revenue, net loans to total assets, GDP growth rate, inflation, dummies for global crisis years and for state-owned bank or otherwise and the economic freedom index. They estimate a two-step GMM model for a set of regressions and the findings, when the competition direct effect on stability is estimated, support the competition-stability when LERNER or BOONE competition indicators are employed. However, the indirect effect of competition through transparency, which is the interaction variable, provides results that support the competition-fragility view. When the CR5 and HHI concentration measures are used they find that high concentration tend to be related to higher NPLs and higher risk of default supporting the concentration-fragility hypothesis.

The impact of bank transparency and competition upon non-performing loans is examined by Bashir et al. (2017). They collect annual financial data for 116 mainland Chinese commercial banks for the period 2000 to 2014. The main explanatory variable of bank transparency is measured with an index constructed from the outcome of the answers to four questions related to information disclosure following the methodology of Semenova (2012) and Andrievskaya and Semenova (2016). Competition is measured with the LERNER index. Bank size, credit growth, ROA, operating expenses to operating income, interest income minus interest expenses over total assets, GDP growth, inflation, unemployment rate, two dummy variables for state-owned and listed banks and budget deficit as percentage of GDP are the control variables used. They employ a two-step system GMM dynamic panel and estimate six regressions. The findings indicate that "high banking system transparency reduces NPLs but not in the case of government-owned banks, whereas high competition in the banking market increases NPLs. Macroeconomic determinants have a significant effect on NPLs, especially inflation, real interest rate and real GDP. Finally, bank-specific determinants, such as, bank profitability, and size has a significant effect on NPLs" p. 1524.

The risk-competition nexus for the Chinese banking sector is investigated in a paper by Hussain and Bashir (2020). After different screening criteria their sample boils down to 67 banks covering the period 2000 to 2012. The NPL ratio, the Z-score index, equity capital to assets ratio and risky assets total assets ratio are the risk and stability measures used while competition is measured by the LERNER and BOONE indicators and concentration by CR5 and assets, loans and deposits based HHI indices. Bank size, liquid assets to total assets, ROA, loan to non-financial institutions to total loans ratio, crisis and foreign ownership dummies are the control variables. Results from panel GMM model estimation support both the competition- stability and competition-fragility views depending on the competition measure used and its effect upon overall stability or credit risk. The findings support the U shape relationship between competition (LERNER index) and credit risk (NPL ratio). However, when market power is measured by the BOONE index, the competition-stability hypothesis supported. No relationship is established between competition and concentration and overall risk (Z-score index). However, the concentration index of CR5 supports the concentration-stability hypothesis. Finally, when bank risk is measured by the risk assets ratio its negative relationship with BOONE indicator supports the competition-stability view.

The interrelationship among bank credit risk, competition and efficiency for the Chinese banking market is explored in a paper by Tan and Floros (2018). They collect bank level annual observations from 100 commercial banks of which 83 are City Commercial banks, 12 are joint-stock commercial banks and 5 are state-owned commercial banks. The period covered is from 2003 to 2013. The competition measure is the efficiency-adjusted LERNER index and there are four bank risk measures: credit risk proxied by NPL ratio, liquidity risk proxied by liquid assets to total assets, capital risk proxied by the banks' capital to risk-weighted assets and insolvency risks estimated from stochastic frontier analysis. Efficiency, technical or scale, is estimated from Data Envelopment Analysis (DEA). Bank size, noninterest income to gross revenue, ROA, bank assets to GDP are control variables. They use the Granger causality method and a GMM model to compute the relationship among competition, risk and efficiency. Among other things, the findings suggest that less competition is associated with higher credit and insolvency risk which support the competition-stability hypothesis. In addition, higher efficiency leads to higher credit and insolvency.

The relationship between competition, profitability and risk in the Chinese banking sector is the research focus of a study by Lee and Hsich (2013). They collect data for 171 Chinese banks which break down to 49 joint-stock banks,31 trust and investment, 94 city banks and 28 other banks. The period covered is from 1993 to 2007. Competition is measured by the HHI and CR4 concentration indices, stability by the Z-score, NPL and the volatility of ROA and ROE. Profitability is proxied by ROA and ROE. Control variables include bank assets, equity to assets ratio, loans to assets ratio, liquid assets to total assets, loans to deposits and the difference of non-interest expense minus non-interest revenue divided by earning assets. Using the two-step GMM estimation method they run two set of regressions with competition and other control variables regressed upon the profitability measures and then on risk measures. The regressions are run for the whole sample and for diverse types of banks. The results for the full sample reveal that an increase in bank concentration improves bank profitability and in parallel reduces bank risk supporting the competition-fragility view. When distinct types of banks are considered, the stability of joint-stock banks is reduced when the concentration increases and this effect is much stronger than for the whole sample. While for city banks the results give support to the moral hazard view.

The cause-and-effect relationships among bank competition, bank risk taking, bank innovation and bank profitability are empirically estimated by applying the structural equation modelling (SEM) technique for the Chinese banking sector by Hu and Chi (2016). They collect data from the annual financial statements of 14 commercial banks over the period 2004 to 2014. Profitability is proxied by ROA, ROE and net interest income to interest earning assets ratio. Bank risk taking is measured by the Z-score, NPL ratio and risk-weighted assets to total assets. Competition is proxied by the CR4, HHI and BOONE index. Finally bank innovation is measured by the cost efficiency index technological gap ratio estimated through a cost function and stochastic frontier analysis. They estimate path coefficients from a SEM where competition is considered as an exogenous only-cause variable with both direct and indirect effects upon the other variables. The results show that competition, no matter the proxy used, directly promotes innovation, increases profitability and reduces risk-taking. Furthermore, innovation and risk taking are the intermediate channel through which competition improves further improves profitability.

How bank risk is affected by bank profitability and competition is examined in a paper by Tan et al. (2020). A sample of 100 commercial banks (5 state-owned, 12 joint-stock and 83 city banks) over the 2003-2015 period is selected. The bank risk is decomposed into credit risk measured by the NPL ratio, liquidity risk measured by liquid assets to total assets, capital risk measured by the equity to assets ratio and insolvency risk measured by the Z-score index. The main explanatory variables for the above types of risks are competition proxied by the LERNER and HHI indices and profitability measured by ROA. The control variables include total assets, non-interest income tot total income, loans to private sector to GDP ratio, market capitalization of listed banks to GDP ratio, GDP growth and inflation rate. Fixed effect and random effects panel regression results suggest that higher competition is associated with higher levels of all the types of risk considered which is in line with the competition-fragility view.

The two-way causality between competition and systemic stability is the research focus of the study conducted by Su et al., (2020). They collect quarterly data for major Chinese banks over the period from 2004-Q1 to 2019-Q4. Bank competition is measured by the CR4 concentration index considering that banking concentration and competition are simply the inverse of each other. They consider the NPL ratio as a proper measure for systemic stability. In order to examine the causal relationship between CR4 and NPL they apply the Granger causality technique. Specifically, they apply for the full-sample residual-based bootstrap method in order to capture any structural changes (non-constant parameters) that might occur in the full-sample time series. They find one-way causality from competition (CR4) to systemic stability (NPL) and establish that banking competition improves systemic stability. However they also estimate the sub-sample causality bootstrap rolling- window model and find the existence of bidirectional causal relationship between CR4 and NPL. This causality from CR4 to NPL is particularly evident in the time period 2015/Q2- 2016/Q1. The overall findings support the competition-stability hypothesis and are in accordance with the developments in the Chinese banking market within the period 2012-2014 which is characterized by higher competition, lower moral hazard and higher stability.

The role of competition as one of the transmission channels of Chinese monetary policy upon banks' risk-taking behavior is examined by Kang et al. (2019). They take a sample of 47 commercial banks over the period 2006-2016. The monetary policy tools are the statuary reserve ratio, prime lending rate and broad money supply growth rate. The transmission channels are valuation effect proxied by the growth rate of real estate prices, the searching for yield effect proxied by ROA, a dummy variable for being a systematic bank for the insurance effect and LERNER index for the competition effect. Bank risk is measured by Z-score, the risky assets to total assets ratio and the NPL ratio. The control variables are the total assets, assets to liabilities ratio and capital to assets ratio. The paper estimates a dynamic panel GMM model where the transmission channels variable along with the monetary policy instruments and control variables are regressed upon the three-bank risk dependent variables. The results confirm a significant positive effect of monetary policy on bank risk. As far as the competition effect is concerned, competition increase causes a bank risk increase, but when monetary policy instruments interacts with competition, the results indicate that a higher level of bank competition contributes to less bank risk in a case of expansionary monetary policy.

The effect of bank competition on all types of bank risk is analyzed in paper by Tan and Anchor (2017). Taking a sample of 100 banks (83 city, 12 joint-stock and 5 state-owned banks) over the period 2003 to 2013 they break down overall bank risk into credit risk proxied by NPL, liquidity risk proxied by liquid assets to total assets ratio, capital risk proxied by regulatory capital to total capital ratio and insolvency risk proxied as the deviation of the current value of Z-score and the maximum Z-score, the latter computed by stochastic frontier method. Using a two-step system GMM estimator competition proxied by an efficiency adjusted LERNER index together with control variables of total assets, non-interest income to total revenue ratio and total overhead expenses to total assets are regressed upon the four types of bank risks. The Findings suggest that there is a linear relationship between competition and four types of bank risk and higher levels of competition within each bank type are associated with greater capital, liquidity and credit risk but lower default risk.

In a paper by Hou X. et al. (2014) the authors estimate the technical efficiency of Chinese commercial banks using a semi-parametric DEA model and then examine the effect of bank market structure and risk taking on it. They use data for 44 major banks (4 major state-owned are included) for the short time period 2007-2011. The relationship between competition and risk-taking arises indirectly from the estimated relationship between technical efficiency and bank market structure and risk taking. The market structure index used is the HHI-deposits concentration index while the capital and credit risk are measured with the equity to assets ratio and LLP ratio, respectively. Control variables are the size, ROA, loans to deposits ratio and GDP growth. The results suggest that when competition is more intense and market power is reduced banks improves their technical efficiency which is however positively associated with credit expansion and risk taking. In other words when bank concentration soars banks take more risk due to improved technical efficiency.

A straightforward exploration of the competition-stability nexus for the Chinese banking sector is performed by the Hou S. (2021). The authors collect data from 22 banks (4 state-owned, 10 joint-stock and 8 foreign-funded commercial banks) for the period 2008-2016. Competition is proxied by the LERNER index and the Z-score and NPL measure bank stability. Total assets, loans to assets ratio and a dummy for year 2015 representing the collapse of the stock market are the control variables. Results from the GMM model estimation support, in the linear form, the competition-stability view when Z is used but the competition-fragility view is supported when NPL is employed used. However, the statistically significant nonlinear results for both Z and NPL show that a critical level of competition endorses both competition-stability and competition–fragility views in an inverse U-shaped relationship.

The impact of bank competition on efficiency and stability is explored in a study by Xia et al. (2021) focused on the Macau banking sector. Macau since 20-12-99 has joined China with the status of an independent economic region. The authors collect data from 26 banks (out of a total of 29) with 19 being branches of foreign banks and cover the period 1999-2016. Competition is measured by the LERNER index, stability by the Z-score with ROA and ROE and by the ROA-sd or ROE-sd (standard deviation) and efficiency score is estimated using the DFA parametric approach. Four control variables are used: total assets, loans growth, loans to total assets ratio and operating expenses to total assets ratio. Results from GMM model estimation verify that competition positively affects efficiency. As regards the effect of competition on stability, the estimated coefficient signs support the competition-stability view but in all cases (Zroa, Zroe, ROAsd, ROEsd) are non-significant and the authors produce the view that "bank competition does not impact bank stability in Macau."(p.171).

3.3.8.1 Summary

- We reviewed 13 studies with data sets consisting of between 14 and 171 banks and with coverage periods of on average 11 to 15 years with almost for all sampling periods starting in the early 2000s.
- The Z-score and NPL are the main stability measures used in 8 and 13 studies, respectively. Alternative measures used are equity to assets ratio, liquid assets to total assets and risk assets to total assets.
- The LERNER market power proxy is used in six papers and the LERNER –adjusted in one. The Boone indicator is used in two papers along with LERNER index and

in one paper is the only competition index employed. The HHI concentration index of HHI is used in most studies and is present ten times.

- The estimation method used is mainly the system GMM and in one paper the Granger causality test is employed.
- The results from the above studies mainly give support to competition-stability although the competition-fragility view is also supported in few studies. However, the most recent study by Bashir et al., (2021) can be considered a 'full study' since it: a) employs a large sample set of 164 banks b) uses both LERNER and BOONE competition indices c) uses CR5 and HHI-a concentration indices d) uses Z-score stability and NPL risk-taking measures and d) the estimation method is the 2-step GMM system. Their result supports the competition-stability view for both competition measures while the concentration-fragility view is found valid for both concentration measures. A similar study by Muntazir and Bashir (2020) with a sample set of 67 banks also provides overall supports for the competition-stability view. A very recent study by Hou (2021) finds an inverse U-shaped relationship between competition and stability.

3.3.9 Africa region

A conventional empirical study of the impact of bank competition on bank risk-taking in seven Sub-Saharan African countries is given in Bosiu (2018). The data includes an unbalanced sample of 797 banks operating in South Africa, Zambia, Tanzania, Nigeria, Uganda, Angola and Kenya between 2001 and 2015. The dependent variable of bank risk-taking is the non-performing loans (NPL) ratio while the main explanatory variable is the LERNER index measuring bank competition accompanied with ROA, loan to total assets ratio and GDP growth control variables. The results for the whole sample support the franchise value hypothesis since a positive and significant relationship between LERNER and NPL is established.

An early paper by Moyo et al. (2014) makes use of a sample of 16 SSA (Sub-Saharan Africa) countries over the period 1995 to 2010. The 662 banks observed during this period are classified as distressed or not and 59 failures, 26 merges and 577 survivals are recorded. They then proceed by estimating a banking crises/distress prediction model applying a duration model with time-varying covariates, another term for survival analysis. The list of explanatory variables in the survival function estimation includes bank specific variables such as the equity to assets ratio, loan to assets ratio, trading income ratio, cost to income ratio loans provision to loans ratio and bank size. Competition is proxied by the H-statistic. A number of macroeconomic, institutional and dummies for national, private and foreign banks are also included as explanatory variables. The prediction success of the overall survival analysis model reaches 87% correct classification of bank failures. The results indicate that bank-specific factors are good predictors and the competition for the whole period but especially in the post-reform period comes with a significant positive sign which translates to reduction of bank distress and improvement of bank stability.

A recent paper by Brei et al. (2020) investigates the relationship between competition and stability in 33 Sub-Saharan African countries over the period 2000-2015. To this end bank-level data for 221 commercial banks is collected of which 81 are domestic and the rest subsidiaries of foreign banks (86 from other African countries, 48 from advanced economies and 6 from emerging countries). The stability proxy choice is the NPL ratio, and the efficiency adjusted LERNER index is used for competition. The control variables are bank size, income diversification loans to total assets ratio NIM, government debt as a percentage of GDP and a rule of law variable. They use GMM system estimator and run 7 basic regressions with NPL as dependent while competition, bank specific, macroeconomic and institutional variables are added one by one as explanatory variables. In all the estimated equations the competition variable comes with a significantly negative coefficient which supports the competition-fragility hypothesis. However, the estimated coefficient for the squared variable of competition is also positive and significant which gives robust evidence for a nonlinear relationship, a U-shaped relationship between competition and stability. An Interesting result is that the presence of foreign banks does alter the linear and nonlinear relationship between competition and bank stability.

Boadi et al. (2020) empirically examines how loan portfolio concentration affects the banking sector stability. The study employs panel data for 4,346 globally operating banks from 49 African countries covering the 2001 to 2017 period. Stability is measured by the NPL ratio and the Z-score index. The explanatory variables employed are total assets, total assets growth rate, cost to income ratio, deposits to assets ratio, interest expenses to interest bearing liabilities, equity to assets ratio, bank years of operation, GDP growth, inflation rate, real interest rate and crisis dummy. The main explanatory variable is the income diversification measure which is proxied with two HHI indices for net operating income and non-financing income and two loan portfolio diversification measures: the Shanon entropy and the distance measure. Results from the GMM estimator suggest that income diversification does not improves bank stability, but loan concentration reduces banks' credit risk and enhance bank stability.

Another study to directly estimate the effect of competition on stability is Hope et al. (2013). They collect data for 170 commercial banks from 10 African countries over the brief period of 2005-2010. They employ three proxies for bank stability, the Z-score the NPL ratio and the ROA although this is a measure of bank's profitability. Competition is proxied by the LERNER index and by two concentration indices, HHI for assets and HHI for deposits. Total assets, gross loans to total assets ratio, fixed assets to total assets ratio and activity restriction together with banking freedom indices are the control variables. The linear model is estimated using the GMM estimator. The results, when NPL is the stability measure used, support the completion-fragility and concentration-stability view for the LERNER and concentration measures. However, when the Z-score stability measure is used, the competition-fragility is less evident in terms of statistical significance and concentration-stability is only valid for HHI-d. Finally, foreign ownership of banks is a factor that enhances bank stability.

The simultaneous modeling of interrelationship among competition, stability and capital regulation is complemented by a study Akande et al. (2019) using a sample of 440 banks from 37 Sub-Saharan countries for a period from 2006 to 2015. In order to estimate the direct and indirect effects of competition and regulation on stability they apply the Structural Equation Modeling (SEM) technique which is normally applied in social science. SEM is a recursive rather than a simultaneous system of assumed one-way directional-cause equations between a set of exogenous and endogenous variables. These equations are then estimated with OLS and the best fit recursive set of equations (model) is selected. In this study stability, proxied by Z-score, is the only endogenous variable while the exogenous variables are various regulation ratios on capital, on liquidity and on asset quality. Competition (LERNER index) is both exogenous, influencing stability and efficiency, and endogenous influenced only by regulation. Overall, the results (summation of direct and indirect estimated coefficients) suggest a 'strong interrelationship among competition, regulation and stability in the banking system' (p 75). Disentangling the recursive effects, firstly, capital regulatory variable has a strong negative effect on competition and a positive effect on stability and secondly competition and efficiency have a strong positive effect on stability. The positive coefficients in the direct and indirect linkages between LERNER and Z-score support the competition-fragility hypothesis although the authors argue that "..capital regulation causes competition, which in turn causes efficiency and then stability of the bank system. This confirms competition-stability view hypothesis" p.73.7.

Banking stability and its determinants is explored for 32 Sub-Saharan countries for the 2000–2014 period in a study of Dwumfour (2017). They specify a model where bank stability, measured either by Z-score or by NPL, is the dependent variable and the explanatory variables are competition proxied by the BOONE indicator, concentration proxied by the share of assets of five biggest banks of total banks, Net interest Margin, foreign banks to total banks, banking access index and banking system regulation index. They use OLS-PCSE and Fixed Effect GMM estimation methods. Apart from the robust result of a positive effect of NIM on stability in all varieties of model specifications, it is also found that the effect of competition on stability supports the competition-fragility hypothesis. However, the concentration effect on stability varies depending on the measure of stability used. They find evidence of the concentration-stability view and if that when large banks in concentrated markets are well regulated, stability could be improved.

The mediation role of bank efficiency in the competition-stability relationship is examined in a paper by Akande and Kwenta (2017). Their sample covers 37 Sub-Saharan countries over the ten-year period of 2006-2015.The numbers of banks included varies from a minimum of 160 in 2006 to a max of 440 in 2015. The interesting feature of this empirical study is that apart from LERNER index estimation for measuring bank competition they also estimate the so called 'Instrumental variable of competition.' This variable is the difference of two production equation frontiers estimated by SFA. The first frontier is unconditional and measures the max income achievable from a given level of assets, but the second frontier is a function of competition and measures the max income achievable conditioned on bank-level competition. The difference between the second and first frontier's efficiency scores is used as the 'Instrumental variable of competition.' Then, they proceed with GMM estimation of their model where stability proxied by the Z-score or ROA and ROE are regressed upon competition proxied both by the LERNER index and their instrumental competition measures. The results of a significantly negative coefficient of the LERNER index and a positive coefficient of 'instrumental competition' document that competition enhances stability and further that competition, through promoting efficiency, influences stability positively.

The impact of market power on efficiency and stability is investigated in a paper by Kouki and Al-Nasser (2017). They collect bank level data from 127 banks operating in 31 African countries for the brief time period of 2005-2010. The Z-score is the stability measure used while the conventional and efficiency adjusted LERNER indices are the proxies for competition. The bank efficiency scores are obtained by employing the non-parametric DEA method. These efficiency scores along with ROA and ROE profitability ratios and the Z-score are the dependent variables in a number of equations estimated using LERNER indices as basic explanatory variable along with bank specific control variables such as total assets, total loans to total deposits and equity to total assets. The country specific variable is the real per capita GDP growth and institutional control variables of voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption complete the set of control explanatory variables. Institutional indices are drawn from Kaufmann et al. (2011). The results from pooled panel OLS show significantly positive coefficients of the LERNER index and the 'instrumental competition' variable with the Z index suggesting that competition erodes stability and higher market power is associated with bank stability.

Empirical evidence about the relationship between banking competition and stability from West Africa is given in a recent study by Cobbinah et al., (2020). For the period 2000-2014, they collect from the World Bank database data for 10 West African countries for the Z-score and BOONE indicators representing stability and competition correspondingly. Furthermore, from the same database they collect data for the presence of foreign banks ratio, regulatory quality, and political stability indices. Their estimation methods are firstly a panel Vector Autoregressive model and secondly use the variance decomposition technique. The first model's findings support the competition-stability view and consider competition beneficial to stability while in the second model they discover that half of the variation in stability (Z-score) can be explained by competition variation.

The effect of financial freedom and of competition on bank-risk taking behaviour is examined in a paper by Banyen (2021). Their geographic context of the analysis is five African regional economic communities consisting of 47 African countries. Their sample includes data for 407 banks and the period covered is 2007-2014. The sample is divided into five groups based on regional economic community membership to allow a sub-regional comparison of competition stability effects. Risk-taking is measured with NPL ratio and Z-score while competition and financial integration is measured by the LERNER index and Heritage foundation financial freedom index, respectively. Banking control variables include the total operation cost to income ratio, total assets, equity to assets ratio, loans to assets ratio, LLP ratio while the usual macro variables of GDP growth, real GDP growth and inflation rate are also included. The fixed and random effects models are run to examine the potential effect of financial freedom and competitiveness on the risk-taking behaviour of African banks and the results firstly find an overall positive effect of financial freedom on risk-taking fragility hypothesis although this is not found in one regional community. Secondly, higher monopoly power enhances stability thus supporting the competition-fragility view although a U-shaped relationship is also found to be supported. Finally, the estimated interaction term of competition with financial freedom suggests increased financial freedom and competition promote bank stability, despite rising nonperforming loans. These findings suggest that competition changes from increased financial integration enhance bank stability in Africa.

The effect of bank concentration and competition on bank stability is explored in a paper by Nyangu et al. (2021). The sample includes 149 banks of four African countries (Kenya, Tanzania, Uganda and Rwanda) which comprise the East African community. The period covered is 2001 to 2018. Concentration is measured by the CR3 and HHI indices and competition by the LERNER proxy. The Z-score measures bank stability. The control variables include total assets, equity to assets, loans to assets and noninterest income to gross revenue indices. Three dummy variables are present to indicate the foreign-domestic ownership, private-government ownership and global crisis years–non global crisis years. Banking sector development is measured as the ratio of banking sector assets to GDP. Lastly GDP growth, inflation and the real interest rate are the macro control variables. The relationship is estimated with a two-step GMM system and the results support both the concentration-stability and competition-fragility view while a U-shaped relationship is not established.

The Sub-Saharan region of Africa is selected by Akande et al. (2018) in order to explore the relationship between competition and bank-risk taking. 37 countries and 440 banks are selected for the period 2006-2017. The LERNER index is the competition proxy used and risk-taking is measured by five proxies such as LLP, LLP to equity ratio, off-balance sheet obligations to equity or to assets ratios and equity to assets ratio. Control variables are the ROA, ROE, total assets, GDP growth, inflation and a corruption index.

Results from GMM model estimation, among others, strongly support the competition-fragility when the LLP, LLP to equity ratio and Equity to assets risk-taking proxies are used but competition increases bank-risk when measured with the two off-balance obligations indices. Size is strongly positively related to bank risk-taking in all measures.

3.3.9.1 Summary

During the last 20 years the African banking market has made progress in banking technology, and financial intermediation. Furthermore, SSA countries have liberalised their financial systems creating a favourable environment for foreign bank entry. Such reforms have enhanced competition in the banking sector. However, the banking environment is still considered somewhat shallow and relatively oligopolistic.

- The studies reviewed sum up to 13. All, but one has a starting year of their sample between 2000 and 2006. The countries covered range from only seven to forty-nine and all belong to the Sub-Saharan area with many studies excluding South Africa due to the heterogeneity of its banking sector as mentioned before. Many of the studies (9 out of 13) were published in the period 2017 to 2020.
- Bank stability is measured with the Z-score in seven studies while three studies utilize only the credit risk NPL, or LLP ratio and one study use cases of failed, merged and survived banks. Concentration measures are rarely employed.
- LERNER market power index is dominant while the Boone and PR-H are used twice and once respectively.
- The results overall tend to support the competition-fragility and concentration-stability view. One study finds a U-shaped relationship, and another find that competition enhances stability. Considering the low degree of banking market competition in Africa as well as the underdevelopment of its financial sector, the competition boost reflected in reforms and foreign bank entry seems not to be a positive factor for improving banking stability. This result when compared to China result discussed above, is opposite although again a non-competitive banking sector (due to state controlled closed banking system) was reformed by relaxing restrictions and opening up to foreign bank entry. This is not strange since the effect of an increase of competition from a very low level on stability is not empirically established as unidirectional.

3.3.10 United States of America

The pioneer study concerning the US banking system by Keely (1990) initiated the academic debate about whether bank competition enhances or erodes bank default risk and bank stability. He collects annual data for 150 Bank Holding Companies over the period 1970 to 1986 in order to answer the question of why the deposit insurance scheme was associated with many bank failures in the 80's. A deposit insurance scheme provides moral hazard for excessive risk taking by banks and the role of competition is considered crucial in reducing charter value and induces banks to high risks and ultimate failure. The market power is measured with the Tobin's q ratio estimated as the market value of assets divided by book value of assets. Bank risk is a measure of bank default risk proxied by the market-value capital to assets ratio and by the average interest cost on large certificates of deposits (CD) estimated as the ratio of total interest paid to average outstanding value during a year. Control variables are used including total assets growth, ratio of demand deposits to total deposits, loans to total assets ratio, foreign deposits to total deposit ratio, book value of assets, 3-month and 20-year Treasury bill and Treasury bond rate. Pooled time-series cross section regressions are run with the two risk measures as dependent variable and the findings suggest that the cause for bank failures recorded during eighties was increased competition which compressed charter value (Q ratio) and pushed banks to take more risk and consequently faced with high probability of default.

The paper by Brewer and Staidenberg (1996) builds upon Keely' rational that franchise value decreases due to lower concentration or higher competition which makes banks risk averters and enhance their stability. However, they empirically extend Keely's empirical testing with quarterly data for 100 S&L banks covering first quarter 1985 to fourth quarter 1989. They run OLS regressions with time fixed effects with a dependent of variable bank risk measured by the return on bank equity and its standard deviation and TAP capital ratio while franchise value is the market to book value ratio. The findings confirms Keely's results and support the moral hazard hypothesis and that S&L banks with lower franchise value have an asset portfolio with higher risk.

The paper by Demsetz et al. (1996) explores the relationship between franchise value and risk taking and extends the empirical analysis of Keely (1990) by estimating the effect of Franchise value on several types of bank risk. Their sample includes 100 BHCs (Bank Holding Companies) covering the period 1986-1994. The franchise value (FV) is the Tobin’s q ratio and the bank balance-sheet risk measures used are the capital to assets ratio, loan to assets ratio, commercial and industrial loans to assets ratio and loan portfolio HHI concentration index. They run two regressions one with FV, bank size and growth in personal income in each state as explanatory variables for the four balance –sheet risk measures and another regression where all-in-risk, systematic risk and firm specific risk are explained by FV, size, growth in personal income in each state and capital to assets ratio. From those regressions the result is that banks with higher FV have lower risk because of safer loan portfolios and higher capital position. These results are in line with the Keely (1990) findings and hence support the competition fragility hypothesis. A less competitive environment is associated with more efficient banks, safer portfolio choices and hence more stable banks.

In a paper by Gan (2004) the competition stability relationship is decomposed into two parts to firstly check if competition reduces franchise value and then if reduced franchise value enhances bank risk taking. Using data on 252 Texas thrift institutions, which are involved in real estate lending activities, the paper estimates two measures of risk. The first is the real estate loans as a percentage of assets and the second is deposits from brokers to total assets. Concentration and competition are both included as dummy variable and take value one if there is one thrift bank in town and if there are four or more thrifts in town, respectively. Franchise value is measured as the earnings before extraordinary items normalized by the book value of assets. The regressions results provide evidence that concentration leads to higher franchise value and that higher franchise value makes thrifts follow a prudent risk-taking policy.

Following the seminal theoretical study by Boyd and De Nicolo (2005) that challenged the view of a competition-stability trade-off the Boyd et al. (2006) expands their initial theoretical model to allow for banks to hold risk-free bonds and finds once again that “risk of bank failure is strictly decreasing in the number of firms” p 29 and loans are increasing as the numbers of banks increases. They then proceed with an empirical test of their theoretical model. They use two set of samples. One is related to the US banking market and the other is an international sample covering 134 countries. Here we consider the US sample set which has the peculiarity of being a cross sectional sample of 2500 banks for only one period, July 2003. Also, the banks included are those operating in rural non-Metropolitan Statistical Areas. The HHI is computed in diverse ways. The concentration index is used as a competition measure and is taken from a special database of the Federal Reserve Board. Furthermore, they format the bank sample by deleting all banks that operate in more than one deposit market area in order for the sample to represent competition conditions matched up with the HHI deposit index. The stability index is the Z-score and for control of bank heterogeneity they include total assets, non-interest operating cost to total income, total loans to total assets and the economic size of the market. Additionally, three variables are included to account for economic conditions at county level: the growth rate in labor force, unemployment rate and the ratio of rural farm population to total population. They run a set of regressions employing fixed effect OLS and GMM models and findings of a negative coefficient between HHI and Z-score supports a negative relationship between competition and risk-taking or more precisely a positive relationship between concentration and stability. Also, the findings support their model prediction that more competition is associated with a higher level of loans.

An innovative paper by Bushman (2015) using a text-based measure of bank competition examines the overall effect of competition on individual and systemic bank risk. The period under examination is 1996 to 2012. The text-based competition measure is based on the banks' K-10 filing report released every year. The researchers calculate how many times the word competition appears in the K-10 filing and then divide it by the total words in each K-10 report and finally this ratio is adjusted to be on a per 1000-word basis. The dependent bank risk-taking variables are the Z-score, Merton's Expected default frequency and the value at risk of the market value of equity. Systemic risk is proxied by the systems market value of equity VaR. A number of other banks, stock market and macro state specific variables are used as explanatory variables. The findings from the pooled OLS regressions overall provide robust evidence that as competition increases, individual bank risk and contribution to systemic risk also increase. Also an increase in competition drives down the value of equity and assets values.

The relationship between concentration in the USA banking market and individual bank stability is investigated by Crimmel (2016) in the second chapter of his doctorate dissertation. He takes a large sample of 13,000 commercial banks excluding BHCs and collects quarterly bank level data over the Q3:1994 to Q4:2013 period from bank call-reports. The banking sector concentration is measured with assets-based Cr3, CR5, CR10, HHI index and in order to estimate the role of bank size in the concentration-stability relationship he also uses the interaction term between concentration and bank size the latter measured with total assets. The individual bank stability variable is proxied by the Z-score but also individual components the equity to assets ratio, ROA and standard deviation of ROA are separately used as dependent variables. Control variables are off-balance sheet assets to total assets ratio, net loans to total assets, non-interest income to total income ratio, net interest expenses to total income, ratio of life insurance industry assets total banking system assets, Chicago Fed financial condition index, binary variable for crisis 2007/Q4-2009/Q2, recession periods dummy, GDP growth, inflation rate, 10-year treasury bill rate, and total assets (bank size). Running fixed effect instrumental variable and 2 stages GMM regressions with dependent variables the bank risk, results document a key role of bank size in the concentration-stability relationship but also a significant coefficient, in all regressions run, for the quadratic form of concentration. The findings verify that the stability-concentration relationship varies with the bank size (total assets) and that both concentration-stability and concentration-fragility are supported. For small banks (less than 1 billion of assets) as the concentration increases small banks hold less capital, decrease profitability and become less stable. As bank assets exceeds one billion the relationship becomes a U-shaped from an inverted U-shaped form. For the large banks as concentration exceeds 35% and over banks are more capitalized, increase profitability and increase their stability.

The doctoral thesis conducted by Bandaranayake (2018) explores the relationship between bank competition and stability. The study employs a sample set of 883 banks from the US banking market covering 72 quarters for the period 2000-2017. Competition is measured with the H-statistic and LERNER and BOONE estimated with average and marginal cost. The alternative measures for stability are the Z-score, NPL ratio and Distance to Default. The control variables are bank specific such as total assets, non-interest income to total income and loans to total assets, country level specific variables are not included. Results from the fractional logistic and correlated random effects estimations vary with the competition measure and stability measured paired. When the Z-score is used as the stability measure, the competition measures H-statistic, LERNER, and Boone document a positive relationship between competition and financial stability. The same effect is recorded when Distance to Default is used but all coefficients are non-statistically significant. However, when NPL is used to measure bank-level stability, the LERNER and Boone measures are positively and negatively associated with NPL respectively which leads to a positive relationship between competition and stability. The H-statistic is always insignificant. Finally bank size, irrespectively of regression model used is always significant and positively associated with bank stability. The author concludes that "Overall, no consistent evidence relating bank competition and financial stability was found using these data on US banks." (p235) and there is unambiguous evidence that supports Zigraiova and Havranek (2016) results that "show that the relationship between bank competition and financial stability changes with the definition of the measure used for stability" (p 235).

Whether market power increases or reduces loan risk is examined through the effect that competition in loans and deposits markets has on Non-Performing Loans in a paper by Wang (2018). This study follows the reasoning of Arping (2017) that deposit-taking and lending activities are interconnected and that the relative strength of competition in deposits and loan markets affects interest margin and hence the Non-Performing Loans. To assess this effect, the research collects quarterly aggregated data from all insured commercial banks and saving institutions in the U.S.A from 1984 Q1 to 2016 Q3 for Deposit rate, interest margin, loans to deposits ratio and change in deposits. OLS regressions are run with NPL the dependent variable and secondly estimate impulse response functions within a VAR model of changes in the Deposit rate, interest margin and NPL. The results show that an increase in NPL is associated with higher deposits rate and lower interest margin which is consistent with the risk-shifting model and give supports to the competition-fragility view.

Another study that supports the competition-stability hypothesis for the US banking system is Goetz (2018). They verify that higher levels of competition due to removal of interstate bank entry barriers enhances bank stability. They use 103.106 bank-year observations of 8142 commercial banks covering the period from 1978 to 2006. They estimate OLS equations with the bank stability proxied by Z-score and NPL used as the dependent variable. There is no direct competition index used but instead they estimate four indicators that reflect the gradual relaxation of entry barriers and the magnitude of state threat using relative deposits, out-of-state banking markets that can enter the bank's home market by distance and relative size. The control variables to capture bank specific differences are the total loans to total assets ratio, total assets and capital to assets ratio while the bank market structure is proxied by the concentration index HHI of deposits across banks in a market. As said before results in any equation variation model confirms that the relaxation of entry restrictions increase competition which in turn increases banking stability. Further the increase in competition boosts profitability and lowers the amount of non-performing loans.

In a paper by Corbae and Levine (2018) they provide a theoretical banking framework for an imperfectly competitive banking market which endogenizes the bank market structure. Solving the dynamics of the model makes it possible to connect to charter values. The model predictions are that intensifying competition lowers franchise value and induce banks to take higher risks and mitigate stability. To support their theoretical proposal they refer to a previous study by Jiang et al. (2017) where in order to identify the impact of competition on risk-taking and stability they take a sample of 446 bank holding companies (BHC) for the period 1987 to 1995 which amounts to 2634 BHC-year observations. The risk-taking measures are not derived from bank accounts but instead they use stock price information and their returns and volatility. Competition measures are not estimated from structural or nonstructural measures but instead they create a time-varying competitiveness measure by using information on the one hand on the development of each state's regulatory restrictions on interstate banking and on the other hand on the cost to a BHC of establishing a subsidiary related to distance between headquarter and the location. Panel regressions in which the unit of analysis is a BHC-year observation are run and the control variables are total assets, deposits to assets ratio and capital to assets ratio. Their findings support the competition-fragility view since they find that an increase in competition (as measured by banking restriction relaxations) reduces charter value and increases risk-taking through investing in non-conventional products with high return but substantial risk.

The investigation of the impact of competition upon bank stability in the light of the recent financial crisis events is performed in a paper by Akins et al. (2016). Their sample consists of 7,351 banks covering all states and the unit of analysis is the commercial bank. The competition or concentration index at state level used are the HHI and CR3 based on deposits. Risk-taking indicators such as interest margin, Tier1 for capital adequacy, assets risk, cash to deposits ratio for liquidity, and ROA for bank performance are the dependent variables upon which concentration measures along with total assets, loan to assets ratio, share of uninsured deposits are regressed. The findings at the bank level for the pre-crisis periods suggest that more competition leads to lower interest rates charged and for banks' loan portfolios to become less risky and this in turn reduce banks fragility and improve stability. They also run regression for the crisis period of the bank market where they examine the impact of competition on regulatory enforcement actions after CAMEL ratings and bank closures and the overall results continues to support the view that greater competition reduce banks' failure.

Finally, they examine the effects of competition on risk-taking in real estate market and find that competition positively affects housing prices. Overall, they argue that within the United States, greater competition is accompanied with greater stability.

The effect of increased competition due to the deregulation and gradual lifting of intra and interstate bank entry restrictions in United States on bank fragility in the period before the 2008 financial crisis is investigated by Marsh and Sengupta (2017). They argue that allowing entry of Large Bank Organizations (LBO) into counties has intensified the competition faced by the small (in terms of assets and branches in other counties) community and regional banks. Within this environment of increased competition small banks reacted with an increased share of real estate loans in their credit portfolio. To this end the authors collected detailed data for deposits both by location and branches of U.S depository institutions for the period of 1990 to 2005. The LBO activity is measured either by their total county level deposits held or by two HHI indices based on market shares at county level either of LBOs or of their branches' deposits. The local banks' change in shares of their total assets in each of their loan categories is the dependent variable. The authors run regressions with the explanatory variables being the LBO activity and the results overall suggest that competition increased due to deregulation and increased county and regional banks' loan (real estate loans) portfolio risk and hence their fragility increased following LBO intrastate entry . In other words, the competition-fragility view is supported.

The opposite results to the previously reviewed paper are found in a very recent paper by Cao et al. (2020) when they investigate how the increase in competition due to the intra-state and inter-state deregulation in US banking market has affected bank stability. The sample set consists of bank-level annual observations from 1976 to 1994 for 18,012 banks operating in 49 States. The 3-year or 5-year rolling window Z-score index measures the dependent bank stability variable. The main explanatory variables of deregulation shock are measured with two dummy variables for intra-state and inter-state. The total assets size of each state and its growth, commercial and industrial loans to total loans ratio, loans to total assets ratio, liquid assets to total assets ratio and interbank borrowing are the control variables along with the usual macro variables by state. The results from a set of regressions of the main and robustness checking models give evidence in favor of the view that the increase of competition due to regulation shock enhanced bank stability. The paper also found a nonlinear relationship between competition and stability with competition increase having a strong positive effect on bank stability only in the less competitive environment prior to the deregulation shock.

In the most recent study by Naaman et al. (2021) they make use of detailed loan size data by county and investigate firstly if there is difference in risk taking behavior between commercial banks and credit unions in the US financial market and secondly how competition affects such risk taking behavior. Their sample consists of 636 commercial banks and 636 credit unions with each credit union matched with one bank covering all counties. The period covered is 2010 to 2017. Three measures of risk taking are used: the Z-score, the NPL ratio and the ratio of loans written off to total loans. Competition is measured with the HHI concentration index and the LERNER competition index. The study include controls variables of total assets, ROA, equity to assets ratio, total loans to total assets, total deposits scaled by lagged loans and a binary variable with 1 for credit unions and zero for commercial banks. Also, the loan portfolio decomposition into real estate, consumer and commercial loans is included in order to capture the potential credit losses. Empirical models with either the HHI or LERNER Index are estimated using OLS and the results show that credit unions are taking less credit risk compared to commercial banks. As far as the effect of competition is concerned, the findings document that competition, measured by the HHI index, reduces risk taking in banks but, as competition increases, credit unions engage in more risk-taking. When the LERNER competition index is used the results vary depending on the risk-taking measure used. However, the coefficients estimated show a positive relationship between LERNER and Z-score being stronger in case of commercial banks and also positive with the NPL ratio with no difference in effect between commercial and credit unions.

The question of the effects of bank competition on bank risk-taking policy and stability is one of the topics analyzed in the doctoral thesis (chapter five) of Muharam (2019). After analyzing the competitive conditions that characterize the U.S commercial banking industry and the impacts on the intensity of competition in the lending market they run a set of regressions to explore the competition-stability nexus. The sample uses unbalanced bank-level data and consists of all banks from 39 US states over the period of 1987-2012 with a total of 130,000 observations. Stability is captured by a set of proxies: Z-score estimated with ROA and ROE, Loan loss provisions to total net loans, standard deviation of ROA and ROE and equity to assets ratio. The LERNER index is the competition measure used and the control variables are bank specific such as total assets, total assets growth, loan to assets, non-interest operating expenses to total operating expenses, non-interest income to total operating income, and loan loss provision to total net loans and state specific such as GDP growth, inflation and a crisis dummy for 2007-2009 years. The results provide evidence of a significant positive effect of competition on measures of stability and thus support the competition-stability hypothesis. Furthermore, the results within the crisis period suggest that banks are more fragile during a crisis period and increase their capital ratio to compensate for the reduced franchise value.

How diversification among various types of bank loans and the bank market concentration impact upon bank stability are the issues explored in the paper by Shim (2019). The authors collect quarterly bank level data from US states over the 2002-2013 which amounts to 136,400 observations. The diversification of loans is estimated using the HHI index for six types of loans and the market diversification is computed as the sum of squares of the percentage of total deposits across all banks in each statistical area by the HHI. Stability is measured by the Z-score index. Bank specific variables are total assets, non-interest income to total income, liquid assets to total assets, brokered deposits to total assets, core deposits to total assets, a dummy for Bank Holding companies, a dummy for De novo banks and a dummy for banks supervised by FDIC. State specific variables are the differences between state unemployment rate and the national rate and between the state-level GDP growth and national GDP growth. The results from multivariate OLS regressions with fixed effects provide evidence that loan diversification improves banks' solvency and positively affect bank soundness and market concentration enhance bank stability supporting the concentration stability view. Furthermore, loan diversification positive effect on bank stability is strengthened in high concentrated markets.

There is an agreement that changes in competition affects bank charter value but the after effect on stability is still debated. A paper by Jijun (2012) empirically evaluates how bank stability is affected when charter value changes due to the presence of competition. The sample chosen includes all the publicly traded Bank Holding Companies in the US for the period 1990-2006. The number of banks in the sample varies from year to year from a minimum of 322 (year 1990) and continuously rising to a maximum of 478 (year 1999) with a downward trend afterwards. The charter value is estimated as the ratio of the market value of assets to the book value of assets and stability is represented by a range of alternative measures for total risk (the standard deviation of daily stock returns for a given bank in a given year), systemic risk (the coefficient of the market index in annual regressions of a bank's daily stock returns on the CRSP equal-weighted index), Firm specific risk (the standard deviation of the residuals in annual regressions of a bank's daily stock returns on the CRSP equal-weighted index), Nonperforming loans/total loans and the Z-score. The control variables are total assets, equity to total assets, net income to total assets, non-interest income to total income and noninterest expenses to total income. Using 2-step GMM estimating model results with all alternative risk measured used provide evidence of a U shaped relationship between charter value and bank risk with bank risk decreasing as charter value is increasing but after a level of charter value any further increase make bank risk rising .

3.3.10.1 Summary

- There are 18 case studies reviewed for US regarding the competition-stability issue. The first study that raised the issue of competition-stability was published in 1990 by Keely (1990) and empirically argues that competition contributes to instability of banks. Although there are 3 studies up to 2006 half of the studies (9) are recorded within the period of 2017-2021. The availability of detailed banking data allows many studies to cover long time periods of 20 years and more.
- The stability measures used follow the typical range with the Z-score used in ten studies and NPL and LLP in six. Alternative measures used are Equity to assets ratio, standard deviation of ROA and ROE and risk weighted assets to total assets.
- Competition is measured with a wide range of direct and indirect measures. The LERNER index appear in four studies and the Boone only once. PR-H has not been used so far. The HHI and CR concentration indices of appear in six studies. Some studies proxy competition indirectly by the Tobin-q ratio or charter franchise value while others estimate an entry barrier index or an inter-state regulation index to represent an increase of competition.
- System GMM and PP-OLS dominate the estimation methods while logit models are employed twice.
- The majority of the results in argue in favour of the competition-fragility or concentration–stability views. The studies that find a positive relationship between competition and stability indirectly measure competition through inter-state relaxation of bank entry restrictions and find that such reforms have increased competition and also increased stability. Finally, a study by Bandaranayake (2018)

strongly argues that such a relationship is non-existent for US banking data and one study by Jijun (2014) finds a U-shaped relationship when charter value is used as an alternative measure of competition.

Once again, we observe that in the US banking market which is considered a highly competitive bank market a further increase of competition is not related to stability enhancement but rather hurts bank solvency. This result. on the one hand, is in line with results from Africa, although the African region is characterized by low bank competition but very high bank concentration, and on the other hand, is opposite to the results from China where an opening of the state-controlled banking market and increase of competition has had positive effects on bank stability. Once again the effect of competition on stability does not seem to depend on the initial low or high level of market power but on other bank specific and country/regional factors with competition a supporting role.

3.3.11 Latin America

The relationship between bank market competition and risk-taking for Latin America is the research focus on a paper by Tabak et al. (2012). They gather bank level data from 376 banks operating in 10 Latin American countries covering the 6 years period of 2003-2008. The BOONE indicator is selected to represent banking market competition. Regarding the stability although they employ the Z-score concept they first calculate it for each of the three years so that the Z-score becomes a panel data variable and second they estimate the "stability efficiency" Z-score . This Z-score index is estimated by using SFA technique in order to consider the difference between the bank's current stability level and the maximum stability (Z-score) level as calculated (by SFA) under the prevailing economic and regulatory conditions. Control variable such as size, capital ratio, liquidity and foreign ownership are also included. The results assert a nonlinearity relation (U shaped) between competition and stability and hence both competition-stability and competition-fragility views are supported. That is that banks operating at a low or high level of competition are more stable than those operating at a medium level of competition. Large banks are also more stable in competitive markets and capitalization has a positive impact on their stability.

The role of efficiency in the competition-stability relationship is investigated in a study by Kasman and Carvallo (2014). A sample of 272 banks from 15 Latin America countries is selected for an eight-year period of 2001-2008. The two competition indicators of conventional BOONE and LERNER and the Z-score stability measure are estimated. Furthermore, applying the SFA technique the revenue efficiency scores are also estimated. These variables are the inputs to a dynamic panels Granger causality system, in order to establish dynamic relationships among these variables. The Granger causality results on the one hand support the view that more competition leads to more stability when revenue efficiency is included in the causality equation and on the other hand the overall result evidence the ‘quite life‘ hypothesis since competition is found to Granger cause efficiency.

The significant foreign bank entrance and the wave of bank mergers that occurred in the Latin America countries in the 90’s and its effect on bank risk is examined in a paper by Yeyati and Micco (2007) In this paper for the years from 1996 to 2002, bank-level data and income database for eight Latin American countries (Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Mexico and Peru) are used to estimate the PR-H competitive parameter for each country and year. Foreign penetration is measured as the ratio of foreign owned shares of a bank to total bank shares. The concentration measures are CR3 and CR5 and bank risk is measured by Z-score. The results from OLs and Weighted Least Squares (WLS) regressions confirm that increased concentration caused by consolidation and increasing presence of foreign banks have no impact upon competition and banking stability. Further results suggest that foreign penetration causes lower competition which then reduces bank risk implying that foreign presence weakens bank risk-taking. However foreign-owned banks are found to be more risky than non-foreign owned ones.

A recent study that investigates the bank risk determinants in Fourteen Latin America countries has been undertaken by Martinez-Malvar and Baselga-Pascual (2020). Their sample consists of a panel data set of 13,365 observations, from 14 countries, for only retail-commercial banks as classified by the BIS business model classification and the period analysed ranges from 1999 to 2013. The bank risk dependent variable is the Z-score index and the main explanatory variables are the individual risk variables from the CAMELS’s rating system. Furthermore, bank size, four regulation and supervision indices extracted from World Bank database along with five macroeconomic factors and the HHI concentration index are included as control variables. The GMM and OLS results confirm that a) higher capital adequacy reduces bank risk, b) asset quality, as proxied by net loans to total assets, is negatively related to bank risk and c) liquidity, as measured by the loans to deposits ratio, is positively related to bank risk. The coefficient of the HHI concentration index in both GMM and OLS regressions is negative supporting the concentration –fragility view but is non-significant.

3.3.11.1 Summary

The banking industry up to the 90's was characterised by significant barriers and restrictions to foreign entrance. Since the early 90's the region's financial and banking system has undergone significant deregulation and other structural reforms that allowed the liberalization of interest rates, intensive privatisation of state-owned banks and encouragement of the entrance of foreign banks for branch establishment and consolidation. As a result of this evolution the underlying structure of bank market changed with a huge increase of foreign banks activities through privatisations, merger and acquisitions and Greenfield investment. Consequently, within a few years foreign banks' share of total market assets increased from a low range of between 0.0% (Mexico) and 19% (Chile) in 1990 to a range from 62.0% (Chile) to a 90.0% (Mexico) in 2001 (Maguilansky et al., 2014). These remarkable changes are expected to considerably influence the bank market competitive environment since the number of banks in major Latin America countries has dropped from 550 in 1996 to 390 in 2002 (Yeyati and Micco,2007). The same study finds that the average value of CR3 and CR5 for the 1996-2006 period is 47% and 61% respectively and also argues that "foreign penetration appears to have led to a less competitive environment" (p. 1635). These sudden and fast structural changes in most Latin America countries were followed by country crises mainly in 1994/5 for Mexico which was known as the 'Tequila crisis', the 1995 and 2001/2 Argentina crises and 1998/9 Brazilian crisis.

- The Latin America region is the least explored with regard to the competition-stability issue with only four studies reviewed. Three of them were published in years 2007, 2012 and 2014 while the most recent one is in year 2020. As expected, the foreign bank penetration and its effect on banking competition and stability is the core subject of these studies.
- Stability is solely measured by the Z-score in all the papers reviewed.
- The competition proxy is LERNER in one study, LERNER and Boone together in another and H statistic in a third one. The concentration indices HHI, CR3 and CR5 are used in the last study.
- The estimation mechanisms are the GMM, Weighted -LS and the Granger causality test.

- The findings from the first relevant seminal paper by Yeyati and Micco (2007) argue that increased bank concentration (CR3, CR5) has no effect upon stability (Z) however foreign bank penetration reduces competition and since competition is found to negatively affect bank risk (competition-fragility) the outcome is that foreign banks enhance banking stability. The other paper by Kasman and Cavallo (2014) asserts a U-shaped relationship between competition and stability and the most recent paper (2020) exploring the bank risk determinants find that bank concentration plays a non-significant role. Overall, the small number of studies limits the robustness of any conclusions.

3.3.12 Global and international approaches

Following the seminal theoretical study by Boyd and De Nicolo (2005) that challenged the view of a competition-stability trade-off the Boyd et al. (2006) expands their initial theoretical model to allow for banks to hold risk-free bonds and find once again that "risk of bank failure is strictly decreasing in the number of firms" (p 29) and loans are increasing as the numbers of banks is increasing. They then proceed with an empirical test of their model. They use two set of samples. One is related to the US banking market and the other is an international sample covering 134 countries. Here we consider the international cross-country sample set of 2,600 banks from 134 industrialized countries for the period 1993-2004. The HHI is computed in numerous ways, the concentration index is used as a competition measure and is taken from a special database of the Federal Reserve Board. Furthermore, they format the bank sample by deleting all banks that operate in more than one deposit market area in order for the sample to represent competition conditions matched up with the HHI deposit index. The stability index is the Z-score and for control of bank and country heterogeneity they include total loans to total assets, total assets and cost to income ratios and the macroeconomic variables of GDP per capita, GDP growth, population, inflation and exchange rate. The GMM model estimations provide evidence that more competition as measured by HHI index is related to lower banks' failure probability and therefore they deny the competition-fragility view. However, once again the use of HHI as a competition indicator might be insufficient to measure market structure and market power. Furthermore, more competition (lower HHI) is associated with higher loan to assets ratio, a result that "favors more as opposed to less competition in banking" p 29.

A cross-country analysis of a panel of 59 countries (including USA, Canada, Australia, Japan and 23 European countries is conducted by Boudriga et al. (2009) to explore the impact of the regulation regime and other bank-specific factors on nonperforming loans. They use aggregate data drawn from the IMF Global Financial Stability Report for 2007 which provides data for 95 countries. After filtering the data through data availability criteria they end up with 59 countries covering the period 2002-2006.The ratio of nonperforming loans to total loans is the dependent variable. There are four regulation indices used to capture the regulatory framework drawn from the Barth, Caprio and Levine surveys II (2002) and III (2006) that measure the capital stringency, the supervision power, the supervisory authority's independence and the supervisory demand for reliable information disclosure. Institutional variables are the corruption index, the democracy index, a rule of law index and a financial development index. Other bank-specific variables are also included such as regulatory capital to risk weighted assets minus the required minimum capital, bank provisions to nonperforming loans, ROA, state banks, foreign banks and a concentration index of the percentage of assets held by the five largest banks (CR5).With regard to the ownership structure, foreign bank participation is higher than state property with respectively mean values of 33% and 14%. A panel fixed effect pooled regression model is run and the findings strongly support the view that nonperforming loans are not affected by regulatory framework but only by bank-specific variables. The bank concentration CR5 index appears in all model specifications with a negative and significant coefficient which translates into lower bank risk-taking as concentration gets higher.

How the degree of market power influences the stability and efficiency of banks is explored in a paper by Turk-Ariss (2010) where they collect bank level data for 821 banks from 60 countries covering Africa (14), South East Asia (8), Central Eastern Europe (20), Latin America (14) and the Middle East (4). The period covered is 1999-2005. Cost and profit efficiency measures are estimated using parametric stochastic frontier analysis. Competition is measured with the LERNER and efficiency-adjusted LERNER indices while stability is proxied by the Z-score and risk-adjusted ROA and ROE. The control variables are the loans to assets ratio, total assets, foreign bank ownership dummy, GDP per capita and legal rights index. They use Tobit regressions for estimating the effect of market power on profit and cost efficiency and separate regression for the market power effect on bank stability. The results indicate that cost efficiency is reduces and profit efficiency increases as market power increases. Overall stability is also boosted as market power increases, a result that supports the competition-fragility view.

A data set from 40 countries (10 Eastern European, 13 Middle Eastern and 17 Western Europe countries) with 1,929 banks of which 1,621 are from Western Europe covering the period 1999 to 2008 is employed by Mirzaei et al. (2013) to empirically test the effect of market structure on profitability and stability. Profitability is proxied by ROA and ROE while stability is proxied by the Z-score index and by the interest coverage ratio computed as the ratio of profit plus interest expenses to interest expenses. Market structure is measured with the concentration index of CR4 and with HHI-assets for a robustness test. Bank specific control variables are the loan-deposit interest spread, total assets, equity to assets ratio, overhead expenses to total assets ratio, off-balance sheet activities to total assets, growth of total loans and dummies for ownership and bank age. Additional country and institutional explanatory variables are the total credit to GDP ratio, total value of bank share traded to average market capitalization ratio, a deposit insurance dummy and GDP growth rate. They estimate fixed effects regressions with the Least Square Dummy Variable (LSDV) procedure for both the emerging and advanced countries data sets. The results suggest that there is no effect of market power on profitability in emerging countries, but such an effect is present for advanced countries. They also find that market concentration negatively affects profitability in emerging countries but positively in the case of advanced economies. When Z-score is the dependent variable, the results support the concentration-fragility view for advanced economies while for emerging countries such a view is not significantly supported.

Another global cross-country study by Azofra et al. (2013) examines how the relationship between bank concentration and profitability and stability has been affected by the financial crisis. They make use of a data set consisting of 15,399 banks from 28 major OECD countries over the period 2002 to 2009. Market concentration is measured by the HHI-assets and also by the market share in terms of the assets of each bank. The risk of banks is proxied by the Z-score index. The bank specific control variables are a cost-efficiency index computed from a Fourier cost function applying the stochastic frontier approach, the equity to assets ratio, loans to total assets ratio, total assets, loans to deposits ratio and a dummy variable for pre-crisis that takes value of 1 for years 2002 to 2007 and zero otherwise. Two set of regressions with profitability and bank risk measures being the dependent variables are run using the two-step GMM system. The findings from the profitability regressions support the view that market concentration has no significant effect upon profitability in the crisis period but such an effect is positive and significant before the crisis period. The findings from bank risk regressions show that before the crisis the relationship between bank concentration and risk takes an inverse U shape. However, the effects of concentration on risk within the crisis period is linearly negative but always significant and hence there is no support for the idea that higher concentration also increases bank risk.

A sample of 55 emerging countries covering Asia, Africa, Europe and Latin America is used in a study by Amidu and Wolfe (2013) in an attempt to estimate the relationship between stability and bank competition considering any effect of competition upon banks' income diversification. They collect data from 978 banks for the eight year period 2000-2007. Two income diversification indices are constructed. First a revenue HHI index with net interest income, non-interest income and net-operating income being its components and second a non-interest HHI index after breaking non-interest income into its parts (commission income, trading income and other operating income). The bank insolvency risk is measured with the traditional Z-score along with the NPL ratio and the study additionally uses the risk-weighted ROA and ROE and equity to capital ratio. Competition is represented by the LERNER index and the H-statistic. The authors run two sets of regressions applying 3SLS where firstly the competition LERNER index or H-statistic and income diversification index together with bank specific variables (loans to assets, deposits to total liabilities, ROA and total assets) are regressed upon the various solvency measures and then regulation control variables (financial reform index, supervisory power, capital stringency and property rights) and country specific (GDP growth and inflation) are added. The other set of regressions has as dependent the diversification income index and either the LERNER or H-statistic is the main explanatory variable along with the bank specific variables. From the first set of regressions' results the competition-stability view is validated across the various solvency risk measures and the second set of results show that as competition increases banks are pressured to diverse their income and credit risk is reduced. Altogether, the positive effect of competition on income diversification enhances bank stability. In other words. income diversification is the pass-through channel for competition to affect positively banks soundness.

A non-linear link between competition and stability without imposing any specific form (e.g. quadratic) of non-linearity is examined by Kanas et al. (2018). To do this they use a semi-parametric generalized additive model (GAM) which does not presuppose any specific linear or non-linear form of relationship between competition and stability. They use a large sample of 7,227 banks from the US (7,014), U.K (160) and Canada (53) over the period 2009-2015. The dependent variable is bank stability which is measured with the NPL ratio and the main explanatory variables are the LERNER and BOONE (in robustness tests) competition indicators and the regulatory quality index representing the intervention policy and all three variables are taken from World Bank database (GFDD). Bank specific variables such as ROA, total revenue, net income, total deposits, total assets and country specific variables of debt to GDP ratio and the CR5 concentration index are the control variables. The authors first run a linear model with the LERNER competition index and find that lower competition is associated with higher bank risk and hence higher stability supporting the competition-stability view. However, the positive coefficient of the concentration index with NPL supports the concentration-fragility view. When they run and estimate the non-parametric nonlinear model the results show that the relationship between competition (LERNER) and stability is not in a U-shaped form but in nonlinear form with several turning points. These turning points depend on the level of competition. Variations of stability and competition can accommodate both the competition-stability and competition-fragility views depending on competition levels. Finally. intervention quality is found to be an important determinant of the competition –stability relation.

An answer to the question of how competition affects bank risk is given in a paper by Anginer et al, (2014). To this end they collect bank level data from 1,872 publicly traded banks in 63 developed countries from 1997 to 2009. The interesting characteristic in their study is that although they use the Z-score for the bank stability index they also use the Merton's distance-to –default (MDD) measure. Furthermore, in order to measure systemic stability, and not only bank stability, but they also regress changes in banks MDD on changes in average MDD of all other banks in a given country and the R-squared obtained is the systemic stability measure. Competition is measured by the LERNER index and by the PR-H statistic whilst concentration indices of HHI for assets and CR3 for assets are also included. The competition and concentration indices along with groups of control variables such as bank size, funding structure, business model, profitability, institutional, regulation and supervision variables are the independent variables regressed upon the MDD stability dependent variable in the logit models they estimate. The results from the baseline model indicate that a decrease in LERNER index i.e. an increase in competition causes a reduction in systemic risk. Overall, the results also indicate that higher competition makes the banking system more stable through the diversification of banks' risks-taking policies. Further weak supervision and strict monitoring cause systemic risk to increase.

The role of competition and concentration in explaining the crisis of 2018 when housing price and capital are also considered is examined in a paper by Barrel and Dilruba (2020). They use a data set of 19 developed countries (USA, UK, Canada, Japan, Australia, New Zealand and 13 European countries) over the period 1996 to 2017. The country explanatory variable used for concentration is CR5 and for competition are the LERNER and BOONE indicators. Those three indicators are taken from the World Bank's GFDI database. Furthermore, the bank adequacy capital ratio which is the Basel III regulatory indicator taken from the OECD banking database and the real house price growth taken from the BIS database complete the set of explanatory variables for the basic test. The dummy bank crisis variable is in accord with the definition used in Laeven and Valencia (2018). Since the dependent variable is the banking crisis dummy, the authors run a set of logit probability equations relating the probability of a crisis occurring with particular competition, concentration, real housing price and capital assets ratios. They use the one period and three periods lagged capital and real house price growth respectively and also the current and one period lagged values for the LERNER and BOONE indicators. When the CR5 is used alone without competition indicators the results suggest that a decrease of concentration over time or across countries is accompanied with a higher likelihood of a crisis incidence. However, when the logit model is estimated with the presence of concentration and the two competition indicators alone or together the results suggest that there is limited evidence that competition influence the likelihood of a financial crisis but concentration remains positively related to a lower probability of a financial crisis. Moreover, the results suggest that the more capital is held the lower probability of facing a bank crisis. Overall, firstly concentration and to a lesser degree competition reduce crisis incidence and secondly results for European countries show the concentration indicator to be insignificant in contrast with market power (competition) indicators.

One of the first studies to use large number of countries to answer empirically the question of whether competitive banking systems are more stable is a paper by Schaeck et al. (2009). Using a cross-country sample of 45 countries for the period from 1980 to 2005 they estimate the competition H-statistic index and concentration CR3 index. The stability measure is a dummy variable taking the value of 1 if a systemic crisis occurs as recorded in the Demirguc-Kunt and Detragiache (2005) banking crisis episodes paper. Control variables are mostly country–specific: the GDP growth Rate, Rate of change of the GDP deflator, Real interest rate, Depreciation Change in the foreign exchange rate, Terms of trade , domestic credit growth to the private sector, moral hazard index Indicator, Activity restrictions index, Entry restrictions index, foreign ownership, Government ownership, Official supervisory power, Private monitoring index and Capital regulatory index. They run both duration and logit models and they conclude that they "find no support for the view that more competitive systems are more susceptible to systemic crises" (p. 730) and that banking concentration is rejected as a competition proxy since these indices measure two separate dimensions of the banking sector.

A paper by Bandaranayake et al. (2018) using the same concentration, competition and control variables and the same time horizon used by Schaeck et al., (2009)-(SCW) they replicate the estimates from the SCW method. However, in order to check the robustness of the SCW results they report results using, first, updated data from same sources for all variables used over the 1980-2005 period, second, using the same time horizon but expanding the observations from multiple sources, third, keeping the same sources but expanding the sample period to 2014 (1980-2014), fourth using the period 1980-2014 and observations from multiple sources and finally using the time period of 1980-2014, updating both concentration and competition indices and control variables. The result from this replication exercise is that the findings do not support the SCW results. Although concentration is negatively related with crisis as in the SCW study the H-statistic is not significant in any of the alternative five estimating frameworks. Furthermore, when the H-statistic is replaced with either LERNER or BOONE the SCW competition estimates become insignificant. This paper raises a more general question of whether the results on the competition-stability issue are indeed influenced by the method, time horizon and variables used.

The first attempt to examine the effect of bank concentration on bank crises was made by Beck et al. (2003) and was also investigated in a later paper by Beck et al. (2006). Both papers use data from the banking sectors of 70 and 69 (2006 paper) countries for the 1980-1997 period. They identify bank distress episodes and choose 47 cases that can be characterized as bank crises events. These form the basis of the crisis dummy variable used as a dependent variable in the logit model estimated. The concentration measure of CR3 is the explanatory variable of concern. The control variables includes GDP growth, external terms of trade, inflation rate, exchange rate depreciation, credit growth and measures of bank regulation and supervision the latter coming from Barth et al. (2001, 2004). The findings confirm, first, that concentration in the banking sector has a stabilizing effect and reduces the likelihood of a banking crisis, second, that entry and activity restrictions increase banking system fragility and third that policies promoting competition throughout the economy reduce the likelihood of a bank crisis.

The distinction among bank loan-risk, equity capital risk and the overall bank risk is considered in a paper by Berger et al. (2009) in order to explore the relationship between bank competition and stability. They collect bank-level data for 8,235 banks (of which 7,565 are U.S banks) from 23 developed countries of which 12 are from Europe, UK, US and Japan covering the period 1995-2005. The risk/stability dependent variable is either loan risk proxied by NPLs, or the overall bank risk measured with the Z-score index or the capital risk proxied by the capital to assets ratio. The bank competition is measured by the LERNER index and bank concentration by the assets or loan based HHI index. Bank size, loans to assets ratio, fixed assets to total assets ratio, foreign ownership dummy variable, GDP per capita and legal right index are the control variables employed. Findings from the GMM system regressions estimation show that when competition increases banks overall risk (measured by Z-score) also increases giving support to the competition-fragility view but they also find that higher competition and lower concentration are associated with lower bank loan risk (measured by NPL) giving support to the competition-stability view. So, given the results the authors argue that "even if market powers in the loan market results in riskier loan portfolios, the overall risk of the banks need not increase" p 114.

The largest panel data set for 206 countries between 1994 and 2015 is used in a paper by Munoz-Mendoza et al. (2020) in order to investigate the bank competition, income diversification and bank stability relationship. The data for all countries are derived from the GFD World Bank database. The authors distinguish between financial stability measured by Z-score and banking risk measured by the NPL ratio. Competition and concentration are proxied by the LERNER and CR5 indices, respectively. Bank diversification is measured by income diversification as non-interest income to total income ratio. GDP growth, inflation rate, a political stability dummy, capital to assets ratio, deposits to GDP, ROA, domestic credit to GDP and gross margin ratio are the control variables used. The GMM estimator is applied, and panel regressions results reveal that more bank market power and a more concentrated banking system enhance financial stability (measured by Z-score) and lowers bank risk (measured by NPL ratio). They also find a strongly significant non-linear relationship between concentration and financial stability suggesting that prominent levels of concentration are associated with lower bank stability. Finally, the results show a positive relationship between income diversification and bank stability.

A recently published IMF working paper by Teng et al. (2019) explores the impact of bank profitability upon financial stability. The authors first develop a theoretical model to capture the links between bank profitability, business models and financial stability and then attempt to empirically test their propositions derived from the theoretical model. To this end they collect data for 308 banks from the U.S., 115 banks from developed European countries and 8 Non-US and Non-European Global Systematically Important Banks (G-SIB) covering the 2004 – 2017 time period. The list of European countries is not presented. Financial stability is separated into idiosyncratic risk and systemic risk with the former concerning the bank level and the latter the banking market level. Measures for idiosyncratic risk are the value-at-risk (VaR) and Moody's Expected Default Frequency (EDF) and for systemic risk the proxy is the ΔCoVar measure as initially proposed by Adrian and Brunnermeier (2016) which is estimated using quantile regressions on weekly data for equity returns on banks and the bank sector. Competition makes its appearance as one of the explanatory variables of risk in the bank characteristic set of variables (tier1 capital, operating expenses to operating income ratio and problem loan to assets ratio). Furthermore, business model ratios (non-interest income to revenue, deposits to liability ratio and asset to equity ratio) are the other set of explanatory variables. In terms of the results on how competition affects the financial risk the authors produce two conflicting results. Firstly, the LERNER competition index is negatively associated with idiosyncratic risk which implies that higher market power (lower competition) is accompanied with lower risk (VaR) supporting the competition – fragility view. Secondly, there is a positive relationship between LERNER and systemic risk which supports the competition-stability view. The opposing results are justified on the grounds that excessive market power of some important banks may increase the risk of the system but it is not explained how. It is worth mentioning that when they run regressions for assessing the determinants of profitability, competition is not among the explanatory variables.

The relationship between bank competition, concentration and credit risk is explored using country panel data for 52 countries during 1998 and 2016 period in a study by Yagli (2020). Credit risk is measured by the NPL ratio and its volatility (low or high). The main explanatory variables are the LERNER and BOONE competition and CR5 concentration indices. GDP per capita, unemployment rate, credit to deposits ratio and foreign bank ownership ratio are the control variables. Panel regressions are run for the whole sample and for countries with high and low NPL volatility. The results are mixed and contradictory. When LERNER is used there is a significant negative relationship with NPL in three regressions run with the full sample, with high and low NPL volatility country groups supporting the view that higher market power is related to lower credit risk. However, when BOONE or CR5 are employed no committed relationship in any sample countries group is recorded. In addition, the LERNER-NPL relationship is stronger when the country sample of high NPL volatility is used.

A recent study by Tu et al., (2020) examines how the geographical allocation of loans to advanced and emerging markets can affect bank risk. Their data set includes 53 global countries covering the period 2004-2016. The dependent variables are the Z-score and the ratios of ROA and ROE to their standard deviations. The diversification of loans is measured for each banking system by an HHI index which is estimated as one minus the sum of the squared shares of lending funds to domestic, advanced and to emerging economies to total loans. Other explanatory variables are the NPL to capital ratio, liquid assets to total assets, non-interest expenses to gross income, bank deposits to GDP, the value of total shares traded to average real market capital, GDP growth and inflation. A concentration index of assets CR3 is also included. The authors adopt the GMM estimation method. The findings suggest that loans flows to advanced markets increase bank insolvency while loans flows distributed to emerging decrease bank insolvency. Furthermore, higher market concentration (CR3) is associated with lower risk adjusted profits (ROAsd, ROEsd) and a non-significant relationship is recorded with the Z-score stability measure.

Another paper by Davis et al., (2020) using a sample of 112 countries which are grouped into developed and emerging countries provide estimates for the relationship between capital adequacy, bank competition and four measures of aggregate bank risk for different country groups and time periods. The time period covered is from 1999 to 2015. Their dependent variables of macroprudential relevance were drawn from the World Bank Global Financial Development Database (GFDD), The bank stability dependent variable is proxied by NPL, loan provision to loans, Z-score index and a crisis dummy. The capital explanatory variable is the aggregate leverage ratio and the regulatory capital/risk-adjusted assets ratio. The LERNER index measures competition. Other control variables are bank specific and these are the share of noninterest income in total income, the ratio of bank loans of deposit money banks (conventional banks) to assets for deposit money bank and the ratio of deposits of deposit money banks to their assets. Estimates from panel difference generalized method of moments (GMM) support the competition –fragility view when controlling for bank capital for both advanced and emerging countries.

The usage of both structural and non-structural measures of competition in order to explore the linkage of competition with financial stability within a sample of 81 countries is attempted by Laowattanabhongse and Sorasart (2017a). Their sample covers the period from 2000 to 2013 and both developed and developing countries are included. Concentration measures of CR3 and CR5 and competition measures of LERNER and H statistic are used while the financial stability dependent variable is represented by the Z-score index or the total equity to total assets ratio. The paper uses a set of bank-specific factors which include cost to income ratio, ROA, a revenue diversification index and NPL and a set of country-specific characteristics such as GDP growth, inflation rate are the control variables. The authors run fixed effect panel regressions and the findings when LERNER and H statistic are used give support to the competition-fragility view and when CR3 and CR5 are used the concentration-stability view is supported.

Diallo (2015) uses a large sample of 145 countries for investigating the competition effect upon the banking systems fragility as measured by banks' probabilities of experiencing a crisis. The time period of 1997-2010 covers 8 crisis years and 6 non-crisis years and 101 countries without banking crises and 45 with banking crises. The BOONE, LERNER and adjusted LERNER indices are competition proxies and the variable of stability is a crisis dummy variable. There are also number of institutional control variables derived from the World Bank WDI such as the real interest rate, private credit and legal rights index, real interest and financial reforms variables such as the Legal rights index, Deposits insurance, legal origins, corruption, index of property rights in 2004, case law (measures the source of law), enforceability of contracts, and creditor rights. The concentration CR3 index is also included. The two estimation methods of logit probability and duration models are used and the main results "provide support for the "competition-fragility" theory but do not support the "competition-stability" hypothesis" (p. 84).

In a paper by Behr et al., (2010) the authors first built up a theoretical model in order to show how market structure enhances or mitigates the effectiveness of capital regulation for controlling bank risk taking. Their model is based upon the framework developed by Allen and Gale (2000) where banks accept deposits and choose their loan portfolio in order to maximize profits. The regulatory authorities introduce capital regulation and increase capital stringency to control bank risk taking but their success depends on bank market structure. The theoretical model's results argue that low concentration enhances capital stringency in reducing risk taking but at highs level of concentration the capital regulation effect is ambiguous. To validate the above hypotheses from the model the authors test them with a cross-country sample for 61 countries and 421 banks for the year 2006 when available or 2005 otherwise. NPL is the risk taking measure. The Banks' market structure is measured by the CR5 concentration index and makes use of its median value to separate banks into those with low and high assets concentration levels. The OLS results indeed validate the theoretical hypotheses. It is worth noting however that in a regression where both capital regulation and its interaction with concentration index are regressed upon the NPL, the authors report that capital regulation reduces NPL but the interaction term is positively related to NPL. Thus one could argue that as bank concentration increases, risk taking is also significantly increased and finally stability is reduced.

Doll (2010) in his master's thesis, in order to estimate the relationship between concentration and competition and bank stability, collects bank-level data from 76 countries excluding economies in transition and four Latin America countries as countries with outlier behavior covering the eighteen years from 1990 to 2007. The bank concentration is measured with the CR3 and CR5 indices and bank competition with the H-statistic. Bank stability is a dummy crisis variable where the crises periods of countries are taken from Demirguc-Kunt and Detragiache (2005) and Laeven and Valencia (2008). Deposit insurance, capital stringency, activity restrictions, foreign ownership are among the set of regulation and institutional indices used as control variable along with standard macroeconomics ones. A set of logit probability models are estimated with concentration or/and competition being the main explanatory variables. The results from all model specifications that control for institutional, regulatory and macroeconomic variables support the concentration-stability view or that higher banking concentration is associated with more bank stability. Furthermore, it is also found that competition is detrimental to banking stability, in other words, the paper supports the competition-fragility hypothesis.

A sample of bank level data from 800 banks operating in 79 worldwide countries for the period 1995 to 2010 is employed by Forssbaeck and Shehzad (2011) in an attempt to empirically test if bank competition influences their risk-taking behavior. Risk is measured at the bank level by the assets-risk NPL ratio and by a market-risk stock return volatility measure. The LERNER index computed for loan and deposits market separately measures competition at the bank level. Bank level control variables include total assets, fixed assets to total assets, equity to total assets and cost to income ratios. At the country level a CR3 concentration index is estimated and two dummy variables indicate whether a deposit insurance exists and the strength of such a deposit insurance scheme. Regressions are run with NPL and stock return volatility being the dependent variables. The findings show a strong positive effect of competition in loans and deposits markets on risk taking for both measures of risk. They also argue that this competition-fragility effect is conditional, to a substantial extent, on the existence of deposit insurance protection which induces a moral hazard-risk relationship.

The empirical investigation of the possible determinants of non-performing loans and hence bank stability is the research focus of a cross-country study by Ozili (2019a). The sample includes a global set of 134 countries which is also split into six regions and covers the period 2003-2014. Data are derived from Global financial development indicators database of the World Bank. The explanatory variables include, first, a set of bank-specific ratios such as cost to income, loan to deposits, non-interest income to total income, loan loss provisions to non-performing loans and equity capital to total assets, second, a set of financial sector development indicators such as bank deposits to GDP, bank loans to GDP and foreign bank assets to total assets. Banking competitiveness is measured by the LERNER index and a concentration index. Cross-country Fixed effect OLS results show that, on the one hand, countries with concentrated banking markets have higher non-performing loans and are less stable and on the other hand countries with higher competitive banking markets record a lower level of non-performing loans and are more stable. Also. the presence of foreign banks is positively associated with NPLs. The regressions run for the six regional sub-sample data sets, do not include concentration but only competition which has now a positive coefficient but is not statistically significant.

An answer to the question of whether bank market competition has an effect upon banks' financial stability in the form of liquidity risk-taking is given by a study of Jeongsim (2018). He constructs a bank-level panel data set for 10,561 banks in 25 OECD countries from 2000 to 2010. Market power is proxied by the LERNER index and along with bank-specific variables such as nonperforming loans to total loans and the equity to total assets ratio and a set of country-specific variables is regressed upon the dependent liquidity risk which is measured by four ratios a) the undrawn credit lines to total assets b) wholesale funds to total assets c) liquidity creation to total assets and d) liquid assets to total assets. The fixed effect regression and the GMM estimates give evidence that as market power increase banks take more liquidity risk that enhances stability and therefore the competition-stability hypothesis is supported. However, the results show that during the 2008 financial crisis period the response of liquidity risk–taking to greater market power varies between small and large banks. Large banks do not change their liquidity policy but small banks react by reducing their liquidity risk.

A study by Li (2019b) explores the influence of both bank capital and competition on bank risk-taking behavior. To this end they use the accounting data of 7,620 banks from 118 countries over the period 2001 to 2016. Bank stability is proxied by the Z-score, NPL ratio and standard deviation of ROA and ROE. Competition is proxied by both the LERNER and H-statistic indices. To measuring capital structure they follow Košak et al., (2015) and use two ratios. The first is the capital to total risk-weighted assets (Tier 1) and the second is the difference between the total capital ratio and Tier 1 (Tier 2). They use control, bank specific, variables such as total assets, deposits to total assets, commercial loans to gross loans, liquid assets to total assets and a dummy for domestic or foreign ownership. Regulatory variables such as capital stringency, supervisory power and banking activities restrictions are also employed. Results from the estimated regressions using the GMM method show that greater market power makes banks to reduce their risk-taking policies. The results also indicate that capital structure as measured by Tier 1 and Tier 2 has a positive and a negative effect upon bank risk, respectively. However, the results for the interaction of competition and capital structure results suggests that competition induce banks to hold more capital which in turn reduces bank risk in the case of Tier 1.

A recent cross-country study by Saha and Dutta (2020) analyzes the relationship of financial inclusion, competition, concentration with financial stability. To this purpose they collect banking sector data for 92 countries which are grouped according to income and economic development criteria, for the period 2004-2014. Bank stability, as measured by the Z-score index, BOONE competition index and CR3 and CR5 concentration indices are extracted from GFDD World bank database while the four financial inclusion proxies are calculated using Principal Component analysis with primary data derived from the FAS (Financial Access Survey) database of the IMF. Control variables such as total assets, loan loss provisions, GDP per capita, broad money to GDP and a dummy variable for financial crisis period are also derived from the GFFD database. The authors employ 2SLS and 2-step GMM estimation methods to regress in various forms the competition, concentration and financial inclusion variables upon the stability Z-score index. The results argue in favor of the competition (BOONE)-stability and concentration (CR3, CR5)-fragility views. It was also found that competition improves stability in low-income and emerging countries and concentration causes instability in the latter group of countries group. The relationship between financial inclusion and stability is found to be U-Shaped and competition increases efficiency which leads to lower default and an increase in stability.

A non-classical approach to investigate the concentration fragility nexus is taken by Carbo-Valverde et al. (2013). They use a non-linear approach adopting a non-dynamic panel threshold regression model to investigate how financial stability is affected by market structure as measured by the number of banks, branch expansion decisions and productivity of the branches. In respect of these factors there is proposed to be a threshold such that competition influences the fragility of the financial institutions differently above (high-regime) and below (low-regime) this threshold. To empirically test their views they collect bank level data from 23 OECD countries for the period 1996-2010. The financial stability measure is proxied by the Z-score and competition by LERNER, CR5, HHI-a and the interest mark-up controlling for bank's size and deflated by total assets. The threshold variables are the number of financial institutions, number of employees per branch and number of branches per bank, these data are extracted from OECD banking statistics. Bank- specific control variables are NPL, equity to assets ratio, net interest income to gross interest and dividend income, noninterest expenses to net interest margin, fees commissions to total assets. The country control variables include GDP growth, inflation, real lending interest rate, government debt to GDP and a political constrain index. Their first test is to check the existence of thresholds running a panel threshold regression allowing for zero and single threshold. The critical threshold values of market structure variables are 229 financial institutions, 15 bank branches and 17 employees per branch. Findings at the country and bank level certify the different effect of competition on stability in countries which are above or below these threshold values. In countries with less than 229 banks, more than 15 branches and less than 17 employees per branch competition promotes financial stability. However, in countries with more than 229 banks (high regime) lower competition, through consolidations, is associated with lower stability. Therefore, both competition-stability and competition-fragility are coexistent depending on the three market structure variables used.

An early study by Bretschger and Kappel (2010) using a long sampling period from 1970 to 2007 collects data of 160 countries to investigate the issue of whether banking concentration enhances stability or fragility and to discover the importance of the profitability and interest rate channels through which such positive or negative effects are affected. The bank stability or fragility measure used is the binary systemic financial crisis variable as defined and recorded in Laeven and Valencia (2008). The profitability channel is measured by the net income to total assets ratio (ROA) and the interest rate channel by the Net Interest Margin (NIM) while bank Concentration is the assets of the 3 largest banks to total assets (CR3). All these variables are taken from Beck et al. (2000). The control variables are cost to income ratio, overhead costs to total assets, stock market capitalization to GDP, stock market turnover ratio, stock market value traded to GDP also taken from Beck et al. (2000) GDP per capita, GDP per capita growth, inflation, current account balance to GDP are extracted from the World Development Indicators database of the World Bank. A deposit insurance binary variable is also included and is taken from Laeven and Valencia (2008). They then estimate one and two stage binary response models (logit, probit, cloglog) to estimate the effect of concentration, profitability and interest rate channels on bank financial crisis binary variable and then use the GMM method to estimate the effect of concentration on the ROA and NIM channels. The findings support the lack of direct effect of concentration on financial crisis but such effects appear through the two channels which give support both to the concentration-stability effect through the profitability (ROA) channel and the concentration-fragility effect through the interest rate (NIM) channel. The paper further explores the issue with the sample split into developed (high income) and developing (low income) countries groups. For the latter group, the channels effects give support only to concentration-stability while for developed group both the concentration-stability and concentration-fragility effects are validated.

The effects of capital market development and bank concentration on bank soundness is investigated in a study Dima et al., (2014). They collect data for 63 developed countries covering the time period from 1997 to 2010. All the analytical data used is taken from World Bank Global Financial Development database (GFDD). Bank competition is proxied by the LERNER index but the CR3 and BOONE are also used in the robustness tests. Stability is measured with the Z-score index although in the robustness test the paper uses Non Performing Loans to total loans and Capital to assets ratios. The capital market development is represented with the ratio of total value of all listed shares in the country's stock market to GDP. Two control variables: loan to deposits and non-interest income to total income ratios are used for measuring bank's efficiency in resources and income allocation, respectively. The paper runs panel pooled OLS and then generalized least squares methods in order to correct biases from autocorrelation while in the robustness test it uses the 2 steps GMM method. The results from all methods give always a positive significant coefficient between LERNER and Z-score variables supporting the competition-fragility hypothesis. When the sampling period is split into pre-crisis and crisis time periods this positive effect is much stronger in the former period. When countries are split into groups with large (28) and small (35) banks based on whether the bank's assets are above or below the sample average, competition is still associated with fragility and this effect is stronger again in the crisis period 2007-2010. The breakdown of countries into OECD and Non-OECD groups of countries has no effect on the findings about the effect of competition on stability. When BOONE and CR3 are used as alternative measures of competition once more the findings verify the competition-fragility view. This view, however, is reversed when the stability measure used is the NPL ratio. With regards to the capital market the variable is found to exercise a positive and significant effect upon bank soundness and contributes to bank stability. The results from robustness tests signify that the competition, capital market and soundness relationship is sensitive to the choice of proxies for the examined variables.

A paper by Bandaranayake (2019), in order to examine whether competition increases or decreases the likelihood of a banking crisis, is updating the bank crises database of Laeven and Valencia (2018) covering now the period 1996-2017 for 61 countries. Both the LERNER and Boone competition indicators are employed while bank crisis is a measure of bank stability taking the value zero or one if a bank crisis occurred. Three estimation methods are used: the fractional logistic, duration and logit models. The results give mixed evidence of the impact of bank competition on stability depending on the techniques and proxy measures used. Specifically, when the logit and duration models are estimated the competition-fragility view is significant with the LERNER competition proxy but the opposite view of competition-stability appears significant when the Boone competition index is used. Bank concentration appears in all methods but is not significant. Furthermore, when stability is measured with Z-score index the results do not change. Overall, the author argues that results confirm those of Zigraiova and Havranek (2016).

The implications of the Islamic banking market structure on risk and stability are empirically examined by Ali Abd Elrahman. (2012) using a sample of 39 Islamic banks operating in 17 Islamic countries (10 banks from Asia, 12 banks from Africa and 17 banks from the Middle East) for the period 2000-2008. There are three risk measures used: Z-score, NPL and capital assets ratio measuring the overall risk, the loan portfolio risk and the capital adequacy risk correspondingly. The explanatory variables are only the competition LERNER index and the two concentration indices of HHH-loans and HHI-deposits. No other bank control variables are used apart from GDP per capita and inflation rate. They run three pooled least square regressions with the three risk measures and the results vary. Firstly, the increase in market power or concentration is associated with an increase of the loan portfolio risk (NPL) supporting the competition-stability view. Secondly, when the overall risk (Z-score) is considered an increase in market power make banks less stable and that result favours the competition-fragility view. However, the author argues that the result from the regression with the capital/assets ratio as the dependent variable tie up the previous contradicting results. Indeed, the results showed that market power is positively related to stability since it is related to higher equity level. So, although market power makes banks take more credit risk the higher capital levels that arises makes the overall risk lower.

3.3.12.1 Summary

All studies included under the GLOBAL group are cross-sectional and handle a very large number of observations.

- There are 33 studies reviewed. The number of countries included in their sample range from 25 to 206 countries. Depending on the scope of the study there are studies that focus only on developed or developing countries, studies that use only OECD countries, studies that cover countries from many continents and studies that mix countries of all development levels. Studies are chronologically spread evenly over the period 2003-2020 with years 2010, 2013 and 2020 recording 4, 6 and 5 studies, respectively. Most studies cover a period of 10 to 15 years and there are only two studies that cover very long time periods such as 1980-2014 and 1970-2007.

- The Z-score and NPL ratio are the most frequently used stability measures in 16 and 13 studies, respectively. Seven studies use a binary crisis variable and one the Distance to Default measure.
- The LERNER, Boone and PR-H non-structural measures of competition are all employed in 18, 6 and 7 studies, respectively. Concentration measures of HHI, CR3, CR4, CR5 are usually employed along with the main competition index. In five studies both LERNER and Boone are present.
- GMM system and PP-OLS are the estimation methods employed and seven studies, those with binary crisis variables, use the logit model.
- In such types of studies, one would expect it to be difficult to produce consensus about the competition-stability nexus due to the non-homogeneity of the very large number of countries included. Surprisingly enough no matter what mix of countries is sampled or competition and stability measures used the findings overwhelmingly support the view that competition does not improve stability. There are only 4 studies that support the opposite view. If one considers these studies as an "average" estimation of the competition-stability nexus then we should deduce that competition is not a factor that helps banking market stability.

3.3.13 BRICS

A first attempt to explore the interrelationship among market concentration, risk-taking and bank performance for the BRICS countries is a study by Zhang. et al. (2013). The authors collect bank level data from the banking markets of Brazil, Russia, India and China for the period 2003-2010. The bank market concentration is measured with the CR5 index and the risk of banks is decomposed to liquid, market, capital and overall risk with the latter proxied by the loan loss reserves to NPL ratio. The control variables are GDP growth, net interest margin, non-interest income to total income, share of foreign owned banks' assets, stock market importance. The authors focus on the effects of various bank risks and bank concentration on bank performance. The estimation technique is the SFA where a structural form of the variables is firstly specified and then the error term is decomposed to a random and an inefficiency term. This study estimates a common frontier composed from all banks in the sample and employs an output distance function approach using input and output bank variables. The results show that bank concentration worsens bank performance and as authors conclude this support the "quite life" hypothesis i.e., as market power increases and monopoly power is higher banks are taking higher risks and their performance deteriorates.

How bank competition and bank income diversification affect risk taking is the question that a study by Gupta and Moudud-OI-Huq (2020) tries to answer providing empirical evidence from the BRICS banking sector. Bank-level data for 1,137 banks from BRICS (Brazil, Russia, India, China and South Africa) countries over the period 2000 to 2015 is the sample set used. Competition is measured with the BOONE taken from the World Bank database. Bank risk measures are the stability risk proxied by the Z-score, the credit risk measure proxied by the NPL ratio and the total risk measured by loan loss provisions to total assets or to total loans ratios. Total assets, equity to total assets ratio, banks assets to GDP ratio, GDP growth and inflation are the control variables. The empirical equation models for the full sample and for each country separately are estimated with the two-step GMM approach. In the first set of regressions without quadratic and interaction terms of competition with large-small banks separation findings show that BOONE index has a significantly negative coefficient with NPL and Loans Loss Provisions (LLP) but not with the Z-score. This means that as competition increases credit risk also increases. Revenue diversification increases credit risk (NPL) but reduces total risk (LLP). The regressions per country member confirm the heterogeneous effects of competition and income diversification on bank risk. Results from the interaction of the competition index and bank size shows a positive association of small banks with credit risk (NPL) and a negative association of large banks with total risk (LLP). Overall, the relationship of competition with credit risk (NPL) or total risk (LLP) is significant but its relationship with bank stability as measured by Z-score is not significant.

Le and Tran (2018) investigate the effect of bank competition on bank liquidity risk in the case of BRICS countries. They use a panel bank data set of 1,629 mostly commercial banks over the 2001 to 2016 period. Bank liquidity risk is measured with the Net Stable Funding Ratio (NSFR) which is a liquidity standard introduced in the Basel III, BASEL (2014) agreement. The NSFR is the ratio of the available amount of stable funding to the required amount of stable funding. Competition is proxied by the LERNER index and together with the bank-specific (equity to assets, loans to total earning assets and total assets) and country-specific (GDP growth and inflation) control variables are regressed upon the NSFR variable. Findings from estimation of bank fixed-effect panel regressions with and without the control variable come with a significantly negative coefficient between LERNER and NSFR which indicates a decrease in liquidity risk when competition level increase. Furthermore, they test for a non-linear relationship but it is rejected as insignificant. The authors admit that results suffer from endogeneity bias and suggest the need for new estimation methods in the future.

A recent study for the BRICS region by Moudud-Ul-Huq (2020)investigates the role of bank competition completion on bank performance and risk–taking behavior. To this end data for the period 2000-2015 is collected for 1,137 banks which are split every year into large and small size. They proxy bank performance with cost efficiency estimated with the SFA method and net interest margin. Stability is measured with the Z-score and competition with the LERNER index and two HHI concentration indices based on loans and assets. The control variables are total assets, equity to assets ratio, non-interest income to total operating income ratio, bank sector assets to GDP, financial freedom index, GDP growth and a dummy for crisis years 2007, 2008, and 2009. The relationships are estimated using the two differences GMM and three stages least squared models. Stability is not found to differ between large and small banks but large banks are more efficient than small banks The findings show that bank competition has a substantial impact on bank performance and risk-taking behaviour in the region. Both lower competition and higher concentration are related to higher bank profitability and lower cost efficiency. It was also found that less competition promotes bank financial stability by reducing credit risk (NPLTL) supporting the competition-fragility view. A nonlinear relationship between competition and risk (stability) is found and confirms the “competition-fragility” view which is valid more for small than large banks.

3.3.14 Single countries based on unique identifiers.

The short-term and long-term effects of market power on bank risk are examined in a study by Ariefianto et al. (2020). A data set of 43 listed Indonesian banks is selected over the 2000 to 2016 period. The dependent variable of bank risk and stability is measured by the Z-score and its ratio components such as average ROA to standard deviation of ROA ratio and average equity to assets divided by standard deviation of

ROA and also by the loan loss provision to total loans ratio. The bank market power (competition) is measured by the LERNER index and together with the operating expenses to operating income ratio, equity to assets ratio, loans to total assets ratio and total assets are regressed upon the group of stability measures. The estimation technique applied is a two-step dynamic panel data model in order to capture any time lag effect of market power on stability. Therefore, in all regressions run there is a one and two years lagged LERNER index. The results indicate that in the short run (with no time lag or a lag of one year) higher market power is associated with higher bank risk but in the long run (two years lag) higher market power is associated with lower bank risk. These results remain valid no matter the bank risk measures used. Finally, market power positively affects the capital to assets ratio with a two year lag which can be considered as a reaction to increase the capital cushion in response to a short-term increase in the bank risk.

The presence of Islamic banks and its role into the competition-stability debate is examined in a study by Rizvi et al., (2020). Their sample consists of yearly financial data for 71 Indonesian banks of which 64 are conventional for the period 2005 to 2016. Competition is proxied by the BOONE indicator and concentration by the HHI index. Bank stability is measured by the Z-score index and loan loss provisions to total loans ratio and profitability by the ROA and ROE ratios. The role of Islamic banks is measured by the market share of Islamic banks in terms of assets and a dummy for being an Islamic bank or otherwise. The control variables include the cost to income ratio, loans to assets ratio, total assets, total deposits, total loans and GDP per capita. The authors run first difference GMM panel data regressions with stability being the dependent estimates and the results, taking into consideration the Islamic presence and its interaction with competition variables, give support to the competition-stability theoretical view. Indonesian Islamic banks are found to contribute to overall banking stability although profitability remain unaffected.

The first study that explores the competition –stability nexus for Indonesian banking industry is by Mulyaningsih et al., (2016). For the period 1980-2010 using bank level data, competition is measured with the H-statistic and stability with the Z-score index although its components ROA, standard deviation of ROA and equity to assets ratio are also used. GMM model estimations support the competition-stability view. Finally, for all banks, regardless of size, adequate capital is found to be a crucial factor to cope with any shock in the market.

A direct approach to explore whether bank stability is affected by competition in the banking system of Indonesia is attempted by Yusgiantoro et al. (2018). They collect data from 122 commercial banks over the eleven year period of 2005-2015. The banks are split into five groups: state-owned, private-owned, regional developments banks, joint-venture banks and foreign banks. The stability dependent variable is the Z-score with the formula using the equity to total assets ratio or the ratio of total capital to risk weighted assets. Additionally, the latter two ratios are used separately as dependent variables to investigate the effect of competition on bank capital. Competition proxied by the LERNER index along with bank size of assets, cost to income ratio, loans to assets ratio and non-interest income to total assets ratio are the explanatory variables. No macro variables are used. The authors run panel regressions with diverse sizes and types of banks and the result for the overall sample is that higher market power is positively related to bank stability and capital ratios, a result that is mostly influenced by the strong effects discovered for large and private-owned banks. However, this result does not hold for state-owned banks and small banks since the findings support the competition-stability view and that higher market power enhance bank's instability. Overall, size and type of bank does affect the competition effect upon bank stability in the Indonesian banking market.

A paper by Nuraini (2019) asks if competition diminishes the stability of the Indonesian banking market. To give an empirical answer the author collects bank level data for 95 banks from 2001 to 2015. Competition is measured by the LERNER index and together with loan to assets ratio; operating expenses to operating revenue ratio and GDP growth are regressed upon stability measured by the Z-score index or the NPL ratio. Results from the GMM estimation model with both Z-score and NPL stability measures support the competition – fragility hypothesis. Furthermore, the significant coefficient of the quadratic form of LERNER index suggests a U shaped relationship between competition and credit risk or stability. Foreign ownership is calculated with a foreign equity capital based HHI index and found to be negatively related to bank stability.

An attempt to explore and compare the competition-stability issue between Islamic and conventional type of banks is taken by Rachmat and Prasetyo (2019). They collect bank level data for 106 conventional and 34 Islamic operating in Indonesia for the five years period 2011- 2015. The measure of competition used is the H-statistic and the stability measure is the Z-score. The control variables are the loan loss provisions to total assets ratio and the net interest margin separately computed for conventional and Islamic banks. Results from OLS regression estimations support the competition-stability hypothesis and show that the stability of conventional banks is higher than that of Islamic banks.

The impact of bank competition upon bank stability and its variation in financial crisis and normal periods is explored in a study by Hanggraeni (2018). It is the first paper that collects monthly data for all Indonesian commercial banks from Jan. 2002 to Dec. 2011. The dependent fragility variable is measured by NPL, loan loss provisions to total loans ratio and Z-score computed over 24, 36 and 60 months periods. The main explanatory variable of competition is proxied by four concentration indices including HHI and CR4 computed for loans and deposits. The control variables are: total assets, assets diversification index, overhead expenses to total assets ratio, the ceiling deposit rate and inflation rate and dummy variables for listed /non-listed banks, to indicate whether the bank is part of a bank holding group and another to indicate crisis periods, . They run a set of instrumental variable regressions with a GMM estimator and the results strongly support, for all alternative concentration and stability used, the view that higher level of concentration strengthens stability. However, during the global financial crisis period the results show that less competition is associated with more stability.

The impact of a financial conglomeration's interaction with bank competition upon bank stability and efficiency is examined for the Indonesian banking system in a paper by Supangkat et al. (2020) Their data set includes 90 commercial banks and 30 conglomerate banks for the period 2010 to 2017. In order to estimate the effect of conglomerate banks upon efficiency and stability they compute the Z-score and loan loss provision ratio as proxies for bank stability and a cost efficiency index by applying the DEA method. The presence of conglomerate banks is estimated by both the ratio of bank conglomerates divided by the number of all banks and the ratio of conglomerate banks' assets to total banking assets. Competition is measured by the assets-based concentration HHI index. The bank level control variables are total assets, equity to total assets, ROA, NPL, net interest margin and loans to deposits ratio. GDP growth, inflation and the exchange rate are the country control variables. Using a two-step dynamic panel data GMM model the authors run positive regressions with dependent variables of efficiency and stability. The results suggest a relationship between conglomerate variables and bank efficiency and stability (lower bank and credit risk). Furthermore, the results from the interaction variables between conglomerate and competition (HHI index) indicate that conglomeration's impact upon stability will be higher the higher is the level of competition.

The question of whether or not bank competition enhances banks risk-taking is explored by Khattak (2019). The paper takes the full sample of Malaysian banks for the period 2005-2016. After controlling for bank and country specific factors the relationship between competition and stability is computed with the GMM system estimator. The results give robust evidence that competition encourages banks to take more risk and therefore the competition-fragility view is supported. Furthermore, when the sample is split into Islamic and Conventional banks, an increase in competition is associated with higher bank risk independent of bank type although for conventional banks the effect is stronger.

The determinants of the ex-post and ex-ante credit risk or the non-performing loans and loan loss provisions respectively is investigated for the banking sector of Malaysia in a paper by Hajja (2017). The authors collect annual data for 19 commercial banks for the period 2002 to 2013 and construct three samples with all 19 banks, with the 11 foreign owned banks and with the 8 domestic banks. The proxies for ex-post and ex-ante credit risk are the ratio of nonperforming loans to total loans and the loan loss provision to total assets ratio, respectively. Explanatory variables include the bank charter value which, following Williams (2013, 2014), is proxied by the ratio of current and saving deposits to total deposits used also by Williams (2013). Other explanatory variables are the equity to assets ratio, the operating expenses to operating income, ROE, fixed assets to total assets, non-interest income to total income for managerial efficiency net FDI to nominal GDP, GDP growth, money supply growth, lending interest rate and a crisis dummy. Two estimators the fixed effect 2SLS and the random effect 2SLS are used to estimate the three sets of regression corresponding to the three sample sets. For the full sample, the results show that the charter value significantly reduces the ex-post and ex-ante credit risk supporting the charter value hypothesis. When the foreign and local banks sample sets are used the findings show that charter value reduces ex ante credit risk for both local and foreign banks but the reduction of NPL it is only observed for foreign banks. The authors also argue that the finding for the full sample that an increasing capital ratio is associated with higher levels of ex ante and ex post bank risk, support the moral hazard hypothesis. Such support, however, is also found for foreign banks only.

How the strength of the competition and stability relationship is influenced by the operation of distinct types of banking such as Islamic and conventional in Malaysia is investigated in a study by Mansor et al. (2019). They collect bank level data from 21 conventional banks and 16 Islamic over the period 1998 to 2016. Competition is estimated at the bank-level with the LERNER index and concentration at the market level with CR3 both for Islamic and conventional banks. NPL ratio is the proxy for the bank risk. The control variables are the total assets, equity to assets ratio, loans to total assets, non-interest income to total income, GDP growth, inflation and two dummy variables for crises in years 1997/98 and 2008/09. Using Least Squares Dummy Variable (LSDV) and bias-corrected LSDV estimators they estimate a set of regressions with full sample and interaction terms for Islamic and Conventional banks with concentration and competition measures and the findings support the competition-stability view especially for conventional banks whereas Islamic banks' risk is neutral to competition. This is the opposite result about Islamic banks than that found in Albaity et al. (2019) where the fragility effect was found strong enough for Islamic banks in the MENA region. This might be due to the coverage period or the stringency of Islamic banking in the regions covered. Another result is that the market concentration in conventional (Islamic) banks reduces (increases) credit risk.

The comparison of bank stability between Islamic and conventional banks as well as its main determinants is examined in a study by Alaeddin et al., (2019). The authors select the Malaysian banking system and collect data for 27 conventional and 15 Islamic over the period 2005-2016. The dependent variable of bank stability is measured with the Z-score index and is compared in the pre-crisis, crisis and post crisis periods for Islamic and conventional banks and they find that Islamic banks have a lower level of stability than conventional banks. Furthermore, when splitting the sample into small and large banks they find that the stability of large and small Islamic banks is lower compared to large and small conventional. The explanatory variables are total assets, equity to assets ratio, loans to assets ratio, LERNER index, GDP, inflation rate and dummies for being Islamic or not and for the pre-crisis, crisis and after crisis sub-periods. The panel OLS estimation model provides estimates from regressions with the full, small and large banks sub-samples. The findings with respect to bank competition support the competition-fragility hypothesis for the full sample and the large banks sub-sample. For small banks, the competition does not affect stability.

Another recent attempt to compare the stability of Islamic and conventional banking in Malaysia is taken by Lassoued (2018). The sample includes 39 banks of which 22 are conventional banks and covers the 2005 to 2015 time period. Since the primary aim of the paper is to investigate the difference in stability between Islamic and conventional banks, proxied by the Z-score, among the bank-specific (total assets, ROA, ROE, Net Interest margin, Capital to assets, liquid assets to deposits, NPL, LLP, cost to income, deposits to liquid assets, non-interest income to total revenue) and country-specific (GDP growth, Inflation, Exchange rate) factors explored as possibly being responsible for such differences is the bank Concentration index. In their OLS and GLS estimations, the results suggest that Islamic banks have lower degree of stability. Focusing on the concentration index used, it is found that higher concentration significantly contributes to stability only for Islamic banks while for the whole sample or for conventional banks the results are positive and negative but not significant.

The competition stability relationship in the Thai banking sector before and after the 1997/78 financial crisis is explored in a study by Pisedtasalasai and Rujiratpichathorn (2017). Their data set consists of annual data for 9 commercial banks for the period from 1992 to 2013. The stability measures used are the Z-score and its components of equity to assets ratio and standard deviation of ROA. Competition is measured with the BOONE index (for loan market) which is computed for the whole period and for the periods before and after the 1997 crisis. The control variables used are the diversification income index, loan to assets ratio, operating expenses to total revenue ratio, loans to deposits ratio, total assets, GDP growth and inflation rate. Using the GMM estimator they estimate two set of regressions. One set with the explanatory BOONE indicator estimated for the whole period and the other set with the BOONE indicator estimated before and after the crisis year. The findings suggest that high market power and a low level of competition leads to a stable banking system. This competition-fragility state is also found in the periods before and after the crisis although for the after period the probability of default is diminished compared to before crisis period.

Again, Malaysia is the county preferred by Wahid and Dar (2016) to investigate the determinants of bank stability for Islamic and conventional banks and verify any difference in their stability. They use annual data for 17 Islamic and 21 conventional banks over the period of 2004-2013. For measuring bank stability the Z-score measure is chosen. The explanatory bank variables include the bank size, NPL ratio, net loans to total assets ratio, cost to income ratio, ROA, non-operating income to total income ratio and the PR-H competition index. Six regression models are estimated with an Islamic/non-Islamic dummy explanatory variable but separate regressions for Islamic and conventional bank groups. The results suggest that the factors that affect stability in both groups of banks are primarily bank size and secondarily the equity to assets ratio and income diversification. In all the estimated models where the competition is present as an explanatory variable the results come with a negative sign for Islamic banks and with a positive sign for conventional banks but these both findings are non-significant.

The impact of liberalization in the banking market during the 70's and 80's upon market power and risk-taking behavior by Spanish banks is explored in a study by Salas and Saurina (2003) which follows closely the methodology of Keely (1990). The authors take bank level data from 21 Spanish banks for the lengthy period of thirty-one years from 1968 to 1998. They run two empirical models. The first one estimates how the market regulatory reforms (15 measures affected in different years) and other bank specific variables impinge upon the market power of banks, measured by the Tobin's q ratio (market to book value of capital). The overall results show an average reduction of Tobin's q due to the regulatory reforms. The second model assess the impact of market power (Tobin's q ratio) on risk taking behavior measured by capital to assets or loan loss provisions to total loans ratios. Their results confirms that higher q (economic profits) relate to lower loan losses and higher capital ratios. Putting together the results of the estimated models, deregulation reforms through the increase of market power/economic profits lower the risk taking exposure of Spanish banks.

A case study for Spain by Jiménez et al. (2013) is inspired by and confirms the results of the study by Martinez–Miera and Repullo (2010) that finds a non-linear U-shaped relationship between bank competition and bank stability. Indeed Jiménez and Gabriel (2013) using a sample of 107 listed banks for the period 1998-2003 and collecting data on loans and deposits by Spanish provinces, find clear support of the Martinez–Miera and Repullo (2010) non-linear relationship between concentration and stability. Many market structure indices are considered in order to capture how differently competition effects stability through the loan and deposits markets. Competition is measured with the concentration indices of CR5 and HHI for loans market and competition measure of the LERNER index for credit lines, deposits market, loan market and receivables. Bank risk is represented by the NPL ratio. The control variables are the total assets, ROA, loans to firms to total loans. The results support the competition-stability view and this view is more "intense" when using the LERNER competition index.

Using detailed data for individual loans from Spanish banks to non-financial institutions from 1992 to 2007 Martin-Oliver et al. (2020) empirically test the effect of competition on loans’ risk of default. They derive the dependent dummy variable for loan default and non-default from the Spanish credit registry and then run regressions with competition (the number of branches in the province, total population and GDP per capita), HHI calculated by the number of branches in a province, bank specific variables such as total assets, loans growth rate, NPL ratio and equity to assets ratio, interbank interest rate and other macro at province and at country level variables being the explanatory variables. The results from the regressions support the moral hazard view since loan defaults decrease as the number of branches competition indicator increase.

The Norwegian banking sector is investigated in a paper by Nilsen et al., (2016) to inquire whether competition affects the Norwegian banks’ choice of their loan portfolio riskiness. The final dataset used for their empirical test include 11,502 quarterly observations from 1995-Q1 to 2014-Q4 from 125 to 147 banks depending on the specific period. The dependent variable is the NPL ratio. Competition is measured by the CR5 and HHI-assets based concentration indices and by an interest margin computed as the average interest rate charged on loans minus the 3-month interbank offer rate. The control variables are the ROA, Equity to assets ratio, market share in the loan market and the GDP growth rate. Results from using instrumental variable and within group regressions and the one-step GMM model show both positive and negative effects of concentration on bank credit risk. Indeed, both CR5 and HHI as linear and squared variables are positively related to NPL supporting a U-shaped relationship. This U-shaped relationship is also found when the interest margin instead of CR5 and HHI is used as the competition index.

The competition in the banking sector of Norway and how it influences bank stability is examined in a Master thesis by Holter (2019). Annual data from 176 banks accounts is utilized for the time period 1995-2017. The Z-score and NPL ratio measure stability while the concentration index CR5 and the HHI assets based index are the competition measures used. The control variables are the equity to assets ratio, total loans to total assets ratio, operating and administrative cost to total assets, personnel expenses to total assets ratio, interest expense to total deposits, operating and administrative cost to total income, dummy for ownership, inflation and GDP growth. The results from a GMM regression system model, with dependent variable either Z-score or NPL ratio support the concentration-stability hypothesis since HHI and CR5 is positively related to solvency. Checking for the non-linearity case provides support for a U-shaped relationship between concentration and stability.

The relationship between competition and bank risk is examined in the Italian banking sector by Marchionne and Zazzaro (2018). They collect bank-level data from the Italian banking association for 748 banks for the noticeably short period 2007 to 2010. Due to the short sample period covered the dependent bank risk variable used is the Altman's Z-score calculated as the weighted sum of five financial ratios. Competition is measured by the LERNER indicator. The control variables are the total assets, total assets growth rate, share of wholesale funding, loan to assets ratio, non-interest income to total income ratio, loan loss provisions total assets and Tier 1 capital ratio. The results from the OLS estimator give a positive relationship between Altman's Z-score and the competition LERNER index supporting the completion –fragility view but rejecting a non-linear risk-competition relationship.

The role of bank concentration in the relationship between bank performance and bank stability is explored by Barra and Zotti (2017) and Zotti (2019). Both studies use an analytical bank data set for the Italian banking sector by type (cooperative and non-cooperative), by region (Italy, South Italy and North Italy) and by size (major, large, medium, small and minor). The data is collected over the period 2001 to 2014 and the number of total banks included varies from 694 (2001) to 450 (2014). Bank performance is estimated with a profit and cost efficiency index derived from a stochastic frontier analysis. Financial stability is proxied by the Z-score indicator. The market structure in the paper Barra and Zotti (2017) is proxied with three bank market share indices for total loans, total deposits and total assets. However, in the paper Zotti (2019) market structure is measured with the HHI index (sum of squared market shares, in terms of total loans, of all banks in the same labor market area) and the market share of loans of a bank in a certain labor market area over all loans of all banks in the same labor market area. A set of dummy variables are used for region, time, type and dimension of banks. The control variables are total assets, equity to assets, loans to total assets, bank cost to total assets and deposits to loans ratios. A panel data GMM estimator is used and a set of regressions run for the full sample, for the cooperative and cooperative banks sub-samples and for southern and northern geographic dimension to account for the effect of profit and cost efficiency and of concentration in loans on stability (Z-score). The results first show a strong positive association of profit and cost association with stability especially for cooperative banks. Second when market share or the HHI indicator is used, the estimation based on the full sample finds that the concentration-stability hypothesis is sound for cooperative banks, however when regressions are run separately for cooperative and non-cooperative banks then although the results for cooperative banks keep supporting the concentration-stability view, the results for the non-cooperative banks support the concentration-fragility hypothesis. Overall, the results from both versions of the paper, with market shares and HHI index, agree.

The fact that in the last decade factoring firms, in contrast to banks, increased fund provision to firms, attracted research for examining the competition and stability issue for factoring firms and making comparison with banking institutions. A paper by Degl'Innocenti et al., (2020) examines the above issue collecting data for 75 commercial banks and 33 factoring firms in Italy for the 2008-2015 period. The LERNER index together with the HHI index when both banks and factoring firms are included is the choice for measuring competition. Stability is measured by the Z-score and by the bank's capital-At-Risk (CAR) based on the Earning of Risk calculation. The results from the fixed effect panel regressions estimated for both factoring and banks found that factoring companies are more stable than banks and the stability of both banks and factoring firms increases when market power increases. This supports the competition-fragility view for both type of firms although it is found to be weaker for factoring firms.

An interesting paper for the developed country of Germany is Kick and Prieto (2013). Their sample covers the 1994-2010 period for the German banking system (32,578 observations). The characteristic of their model is that apart from the Z-score used for measuring stability they use a unique database from the Bundensbank in which banks are rated with a degree of distress. Since distressed events are directly measured and are considered a much more appealing bank risk statistic, they use this special database to construct a binary variable which indicates whether a distressed bank event has occurred. Then market power variables such as the LERNER adjusted and Boone indices together with bank specific and macroeconomic control variables are used for their logit model estimation. The results depend on the competition index used. When the LERNER adjusted is used, competition leads to increasing instability but when BOONE is applied then a more competitive bank market coexists with lower level of instability.

The impact of the international expansion of banking activities upon bank risk, market power and their relationship is the research focus of a paper by Buch et al., (2010). They take advantage of their access to detailed accounting data for German banks and their branches and the external assets/liabilities positions of their subsidiaries abroad. The data includes a total of 2,235 banks of which only 28 banks are purely domestic and the period covered is from 2003 to 2006. First, they compute two internalization measures: the intensive and extensive margin. The first is based on a bank's foreign assets held to total assets share and the second the numbers of countries in which a bank holds assets. Bank risk is measured by the Z-score and by a dummy distress variable derived from the special distress events database held in Bundesbank. The LERNER index is the market-power measure used. The authors estimate a two-equation simultaneous model with the first having the LERNER index as the dependent and the second the dummy distress variable. A set of specific control variables for each equation are defined and along with internalization measures are regressed upon market power and bank distress. The simultaneous model estimation produce many interesting findings one of which states that the LERNER index is negatively related to the probability of distress or as market power increases the probability of distress is lower although the probability of distress is higher when internationalization is measured with the number of foreign countries in which the bank has a presence. It is also interesting that the market power is positively related to the foreign assets measure used which means that internationalization increases market power.

The U.K banking market is chosen for investigating the link between competition and stability in a paper by Zhanbalatova et al., (2018). Bank-level accounting data for 477 commercial banks is the sample set covering the period 2004 to 2014. The Z-score is the stability measure and competition is measured with the LERNER index and two HHI indices based on loans and deposits. After analyzing the magnitude of the above competition and stability indices they conclude that the small banks group has lower market power and is less stable compared to the large banks group. They then run a set of OLS regressions where each competition index and bank country specific control variables (total assets, NPL, Net interest margin, ROA and GDP growth) are regressed upon the stability measure and findings support the competition-fragility hypothesis.

However, when the three competition measures are regressed together upon stability the findings support the competition-fragility view only for HHI loans while the HHI for deposits and LERNER measures support the competition-stability view.

The next recent paper takes another developed country, United Kingdom, as the field of application of the competition–stability analysis. De-Ramon et al., (2018) use a sample of 250 banks for the period from 1994 to 2013. There is a variety of competition measures constructed: the LERNER, LERNER adjusted, BOONE and HHI. The overall bank stability measure used is the standard Z-score but also its individual assets and capital components: profitability, capitalization, volatility of profits, risk adjusted profitability and risk adjusted capitalization producing extra five risk indices. To account for bank-specific factors the authors include Bank size (Total assets), Provisions to assets ratio, Total loans to assets ratio, Wholesale to total deposits, non-interest revenue to total revenue, Mortgages to total loans ratio, Trading book to total assets ratio, Tier one capital to total assets ratio, Tier one capital to total capital ratio and non-interest expense to interest received. GDP growth, inflation and unemployment are the country–specific control variables used. The results from the OLS regressions on average support the competition-fragility view. However, the results from the regressions where competition is regressed upon the five Z-score components indices still support both views of competition-stability and competition-fragility. More specifically, the results show that an increase in competition increases profitability which supports the competition-stability view but decreases bank capital ratios and that is supportive of the competition-fragility hypothesis. The results from quantile regressions indicate that the effect of competition on stability is dependent on the bank's risk level. Increases in competition in minimal risk banks lowers stability in contrast to the case of high risk banks.

In a later paper by De-Ramon et al., (2020) they again examine the link between bank competition and solvency risk in the United Kingdom using the same data set as in the paper of 2018 i.e. 250 banks for the period of 1994 to 2913. However, this time they employ the quantile regression model for the whole sample and for different bank types. LERNER, BOONE and HHI are the measures of competition and the Z-score and its individual components are the stability measures. The control variables are bank-specific: the total assets, loan loss reserves to total assets, loans to assets, non-retail loans to total loans, noninterest revenue to total income, total capital minus capital requirement to risk weighted assets and the macro variables are GDP growth, inflation and unemployment rate. The results from quantile regressions do not differ from those reported in their paper of 2018. The regression results support the competition –fragility view. However, they find that for domestic banks and building societies, risk decreases with more competition whilst for foreign-owned banks they find the opposite, indicating that risk increases with more competition. Also, it is found that regulation is effective in moderating adverse links between risk and competition.

A first attempt to empirically explore the competition and bank risk-taking relationship in the Albanian banking market is taken by Dushku (2016). The paper uses bank-level data from 15 banks during the 2004-2014 period. The LERNER index is computed for loan and deposits market competition. The risk measures are the nonperforming loans to total loans ratio for domestic and foreign currency loans separately and the Z-score index. The controls variables are GDP growth, total assets, total loans to total assets ratio and ROA. The regressions results strongly support the competition-fragility view when total loans are considered but when competition is measured in the deposits markets the results support the competition-stability view.

In a set of papers published by Shijaku (2017a,b,c), he uses the same information set of quarterly data from 16 Albanian banks for the same time period from the first quarter of 2008 to the fourth quarter of 2015. The stability measure used, in all his studies, is a composite index which is obtained applying principal component analysis to the CAELS rating system's components (Capital adequacy, Asset quality, Earnings, Liquidity and Sensitivity to risk). In the 2017a paper the concentration-stability issue is investigated with four HHI indices based on liabilities, assets, deposits and loans and CR5. The two-step GMM estimation results support the concentration-fragility view and hold when using different concentration indices. In the studies of 2017b and 2017c they explore the relationship between bank competition and bank stability using the BOONE competition measure while LERNER, efficient adjusted LERNER and HHI indices are used when checking the basic results robustness. Estimation by the 2-step GMM panel method provides results that strongly suggest that an increase in bank competition improves stability even when the LERNER index is used for robustness checking. The 2017c paper also makes the split of banks into large and small and the findings still confirm that there is a positive relationship between competition and stability which is more pronounced for small banks.

A recent study by Tushaj and Sinaj (2020) investigates the effect of banking concentration on non-performing loans in the Albanian banking sector. They use quarterly data from 2005 to 2017. Concentration is measured with the CR3 for loans which together with total loans, average interest rate, exchange rate and ROA are regressed upon the NPL ratio. The results suggest a strong positive linear relationship between concentration and NPL but a U shaped relationship is also significant and negative.

Sanderson et al., (2018) analyze the relationship between bank competition and stability for the Zimbabwean banking sector. The sample used in the study includes 11 commercial banks for the period 2010-2016 using bi-annual data. Bank stability is measured by Z-score and NPL ratio while competition is proxy by LERNER index. The control variables are total assets, total loans to total assets ratio and a dummy for domestic or foreign bank ownership. GMM model estimation with either Z-score or NPL being the dependent variable produce results that support the competition-fragility hypothesis. Additionally, the study found that the bank size increase in terms of assets increases NPLs and lowers stability.

The highly concentrated Moroccan banking sector is used to explore the competition and stability relationship by Firano and Fatine (2018). Their sample is limited to eight banks and covers the 2001 to 2010 period. The H-statistic measures the competition proxy, HHI the bank concentration proxy and NPL the stability proxy. The results from panel regression using total assets as a control variable, show that concentration is positively related to stability and a convex nonlinear relationship between competition and stability is also established.

Using quarterly data for 5 domestic and 14 foreign banks operating in Zambia from first quarter of 2005 to the fourth quarter of 2016 a paper by Chileshe (2017) investigates the role of bank capitalization and size in the competition – stability nexus. To this end they use bank-specific LERNER competition index and Z-score with ROA and ROE versions for stability. The Bank specific variables are the bank size, capitalization and income diversification. Two panel regressions with NPL and Z-score as dependent variables are estimated and the results indicate that as competition increases bank risk-taking also increases and stability worsens.

The relation of concentration with bank risk-taking is explored for the Libyan banking industry by Troug and Sbia (2015). The sample consists of quarterly observations for 15 commercial banks covering a period from the first quarter of 2002 to the fourth quarter of 2012. The non-performing loan to total loans (NPL) ratio is the bank risk measure and competition is proxied by the HHI concentration index. Foreign assets to money supply, credit to the economy and inflation rate are the macro control variables. The OLS results give a significant negative relationship between concentration and NPL which authors translate as support for the competition-fragility hypothesis.

Bank concentration in the loan market and its impact upon banks' stability is investigated in a recent paper by Kusi et al., (2020) for the Ghanaian banking industry over the eight years period of 2007-2014. The classical Z-score index measures stability and competition in loan market is measured by four variations of the HHI index based on type of loans. Apart from a convenient HHI for each sector of the loan market estimated they go on estimating a variation index of the distribution of each bank's exposure to each economic sector and two indices which are based on the normalized absolute and relative difference between a bank's portfolio and the benchmark loan portfolio. The latter being each sector composition at the economy level. The control variables are the total equity to total assets ratio, total assets (size), non-performing loans to gross loans ratio, non-operating income to total operating income ratio, loans to total assets ratio and net income to total equity. They run different regression models with two-step GMM and random and fixed effects panel regressions in order to investigate the linear or nonlinear relationship between loan concentration and bank stability. The results from the linear regression conclude that higher concentration in the loans market reduces bank stability and hence support the concentration-stability view. However, in the nonlinear model regression findings reveal a U shaped relationship and at low level of concentration in loan market reduces stability but as concentration increases bank stability increases.

The concentration and competition effect upon the stability of the banking sector of Oman is the research area of a study by Mishra et al., (2014). An unbalanced panel of 114 observations from 17 banks for the 2006 to 2012 period is the sample set. The concentration measures include the CR2 and the HHI index and competition is proxied by the H-statistic. Financial stability is measured by the Z-score index. The bank-specific control variables are the loan to assets ratio and the capital to assets ratio. Analysis of the concentration and competition indices show that the Oman banking sector is highly concentrated and regression results reported only for CR2 indicate that higher concentration is related to lower stability.

Another attempt to identify and estimate the effect of financial and economic factors on banking sector stability in Oman is explored in a study by Al-shubiri (2017). The data set consists of six listed banks covering the period 2008-2014. The factors that are considered affecting bank stability (Z-score measure) are total assets, an income diversity index, HHI-assets concentration index, price to earnings ratio, GDP growth and inflation rate. OLS analysis with each of the factors and all together regressed upon the Z-score show a significant positive effect of income diversity and price to earnings ratio. However, concentration is found to positively but not significantly affect stability.

The banking sector of Jordan is selected in a paper by Rakan et al. (2020) to analyze the influence of competition and concentration on bank credit risk and stability. The sample consists of annual bank level observations for 17 banks over the 2005-2016 period. Concentration is measured by HHI based on assets and loans and the CR3, CR5 and CR7 indices while credit risk is measured by the NPL ratio and stability by the Z-score index. The control variables are ROA, liquid to total assets ratio, total assets, GDP and inflation rate. Using the two-step GMM model, the findings support the concentration-fragility hypothesis for all concentration measures applied. However, when LERNER is used as the competition measure higher market power results in higher and lower instability against Z-score and NPL, respectively. These results suggest that competition though increased risk-taking (NPL) by banks, improves the overall bank stability (Z-score). i.e. both the competition-stability and competition-fragility views are supported.

A recent study by Kabir et al. (2020) investigates the determinants of credit risk for banks in the Bangladesh economy. The sample includes 23 conventional and 7 Islamic private for the 2001 to 2008 period. Three risk variables: the Z-score, NPL and Distance to Default (DD) are the dependent variables. The explanatory variables Competition LERNER index along with bank-specific variables (total assets, gross loans growth, loans to deposits, equity to assets, net income to equity and non-operating expenses to total assets) and standard macro variables of GDP growth and inflation rate. The equations' estimation is based upon the two-step GMM system. The results find that the competition LERNER index is negatively related to all risk variables, both for conventional and Islamic banks but is only significant for NPL. This finding indicates that higher market power decreases banks risk and, ceteris paribus, make banks more stable or in other words the results are in line with the competition-fragility. Furthermore, overall the results are not different for Islamic and conventional banks and significant coefficients for all explanatory variables are found only when NPL is used as the bank risk variable.

Empirical evidence on the competition and systemic risk relationship from the Japanese regional banking market brings a paper by Hirata and Mayumi (2020). Their sample covers 56 out of 80 total regional banks for the period 1996-2016. The systemic risk measure is the CoVaR index which is the q percent value-at-risk of the aggregate regional bank stock return conditional on a bank's stock return. The adjusted LERNER index is the measure of mark-up for each bank and CR5 for loans is the concentration measure. The control variables are total assets, loan to assets ratio, profits less interest income to gross operating profits ratio, total debts to total assets, ROA, non-personnel and personnel expenses to total income, loan growth, GDP growth, 3-month Treasury Bill yield.. The findings support a negative relationship between mark-up (competition) and systemic risk. The authors argue that the contrasting findings from other cross-country studies is explained by the different business model of regional Japanese banks.

Whether competition and stability relationship varies among distinct types of financial institutions is the research question of a study by Liu and Wilson (2011). Japan's banking system is the choice to provide an empirical answer to the above question. They collect for the 2000-2009 period annual bank level data for six types of financial institutions summing up to 723 bank types. Two types, Shinkin and credit cooperatives account for 77% of the total 5,740 observations. The authors first estimate the 3-year rolling time window Z-score for each type of bank and check if the risk/stability ratio differs across them. In the next step they calculate the LERNER competition index and run panel GMM regressions with stability regressed upon competition, bank type dummies and the interaction of bank type with competition. The empirical analysis finds, firstly, a significant linear positive relationship between competition and stability supporting the competition-fragility hypothesis, secondly, that bank types with narrow geographical banking activities are more stable compared to bank types with international activities. Finally, they find that the strength of the positive relationship between competition and stability varies by bank type with different initial stability levels.

The effect of changes in capital regulations on banks' risk taking choices and hence upon the competition stability relationship is documented in a paper by Tongurai and Vithessonthi (2020). To assess these effects they collect annual financial observations from publicly traded Japanese banks over the 1993-2016 period. The key variables used are the HHI competition index based on loans and deposits market and the assets based CR5. LERNER and BOONE are used as alternative measures of competition in robustness tests. They drop the classical measures Z-score and NPL as ex-post measures of bank risk-taking and instead use the loan to assets ratio growth and the interest rate margin "which should better reflect the bank's ex ante risk-taking than other bank risk measures" p. 8. The bank specific control variables used are the equity to assets ratio, cash to total deposits ratio, ROA, NPL, bank total assets. Country economic conditions are proxied by GDP growth, broad money as percentage of GDP and net inflows of foreign direct investment as percentage of GDP. The key findings from Panel OLS, Difference-in-difference and dynamic panel GMM estimations are that competition is positively related to the risk-taking measure of loan growth and interest rate margin and that this positive effect is enhanced by the capital adequacy relaxation.

A first attempt to examine the effect of Turkish banking sector concentration on its stability is presented in a master's thesis by Ak Kocabay (2009). He collects annual data from 1990 to 2008 for all types of banks operating in Turkey either of domestic or foreign ownership. Two common stability measures of NPL and Z-score are regressed upon structural measures of competition CR3, CR5 HHI and the non-structural H-statistic competition measure alternately. Bank specific variables such as relative assets size, loan to total assets ratio, government bond and bills held to total assets ratio are control variables along with some commonly used macro-economic variables. The GMM model is estimated with alternative stability and concentration and competition measures. The estimations give no clear result. There are conflicting findings depending on the stability measured used. That is when NPL is used the concentration-stability view is supported but the concentration-fragility view is supported when Z-score index is used instead. However, when consideration is taken of domestic and foreign ownership, the results show a significant positive effect of competition on stability for both types of banks.

Hanedar and Bazzana (2010) investigates the effect of competition on bank risk-taking and overall bank risk for the Turkish banking sector within the 2001- 2009 period which is characterized by bank regulation changes and a sharp reduction of the number of operating banks. Their dataset includes bank level observations for 30 deposits banks. The measure for bank risk is the NPL ratio and for the overall bank risk is the Z-score index. The LERNER index, estimated for the first time for the Turkish banking sector, is the competition index along with a second one, called Market Power, and calculated as the difference between total revenue and total cost divided by total revenue. The asset share of the individual bank in the sector, the equity to total assets ratio, the net profits (losses) divided by the total assets and total revenues divided by the total expenses are the control bank-specific variables used along with the industrial production index. The results from the fixed-effects, random-effects and GMM models give "weak" support for the competition-stability hypothesis but "the findings of the study indicate that the effect of the market power on the risk-taking behavior of banks is not clear in Turkey after the year 2000" p.304.

Using quarterly data for 15 private commercial banks operating in Turkey for the period 2002 to 2012, Iskenderoglou and Tomak (2013) investigate the effect of competition on Turkish banking sector stability. The Z-score and NPL ratio are the bank stability measures and competition is proxied with the HHI concentration index computed for assets, loans and deposits. The control variables are total assets, deposits to total assets ratio and fixed assets to total assets ratio. The results from the GMM estimation method show no statistically significant effect of any concentration index on either NPL or Z-score stability measures. The only variable related positively to the Z-score is the bank size, that is, total assets.

The Turkish banking market is chosen by Kasman and Kasman (2015) to explore how bank concentration and competition affect bank stability. The sample includes annual bank level data from 28 commercial banks for the period of 2002-2012. Competition is proxied by the BOONE and efficient-adjusted LERNER indices while concentration is proxied by the HHI and CR5 indices. They estimate two equation models where competition and concentration indices along with control variables such as size and loans to assets ratio are regressed upon the NPL and Z-score. They estimate a linear equation model and another including a squared competition index variable searching for a nonlinear relationship. Results from the GMM regression model as regards the risk-taking behavior indicate that greater concentration is associated with greater bank risk but increasing competition improves bank stability. When the dependent variable is the Z-score stability measure, again the results suggest that less competition improves stability, but more concentration is related with less stability. These results combined, and assuming that concentration is not an adequate measure for competition, support the competition-fragility view.

Kasman and Kasman (2016) using the same sample as in their paper of Kasman and Kasman (2015) explore the impact of bank competition and size on bank profitability and stability. This time however they collect quarterly bank level data for all commercial banks operating in Turkey from the first quarter 2002 to the fourth quarter 2012. Income volatility is proxied by the standard deviation of ROA and ROE and bank stability is measured by Z-score computed with ROA and ROE. The explanatory variables are bank size proxied by total assets and competition which is measured with the BOONE indicator and two concentration indices of assets based HHI and loans based CR5. Bank size is total assets. Noninterest income to total income, equity to total assets, an inefficiency index and GDP growth are control variables. The results from system GMM regressions with dependent variables either income volatility (ROA and ROE) or bank stability (Z-score-ROA or ROE) indicate that income (profit) volatility is negatively related to bank size and positively related to competition supporting, according to the authors, the competition-fragility hypothesis. However, when the dependent is the Z-score the results show that the Boone and Z-score are positively and significantly related which translates into a higher stability when competition is higher, and hence competition-stability view is supported. Finally, the presence of concentration does not significantly affect stability.

The determinants of stability in the Nigerian banking sector is examined in a paper by Ozili (2019b). The data covers the 2003-2016 period. Among the independent bank specific determinants is the bank concentration and stability is proxied by the Z-score. The results from the estimation of a linear OLS regression indicate that when concentration increases stability is negatively affected.

A recent study by Pozo and Youel (2020) investigates the relationship between competition and risk-taking taking using a sample of 72 financial institutions operating in the Peruvian banking market from the period 2004-2018. The bank risk taking is measured by the NPL ratio and competition is measured by the CR4 and HHI concentration indices. The control variables are ROA, total assets, foreign debt to total credit ratio, bond issued by non-financial to total credit ratio, risk weighted assets to capital ratio and GDP growth. The results from regressions either based on an all bank-level sample or on bank-level data on loans on a regional basis, support a nonlinear relationship between competition and risk –taking but with an inverted U-shaped relationship.

The Mexican banking sector is chosen by Fernadez and Garza-Garzia (2015) to investigate the competition and bank stability relationship. The data includes annual information for 14 Mexican banks that covers 81% of the total bank market from the eight years period from 2001 to 2008. Competition is proxied by the LERNER index and stability by a rolling average of two years of Z-scores in order to capture the dynamics of bank stability and also by NPL ratio. The authors apply a GMM panel estimation method with both Z-score and NPL being the dependent variables and the LERNER index along with bank size, loans to total assets ratio and dummy for foreign or domestic bank are the explanatory variables. Results with the Z-score index being the dependent variable are supportive to the competition-stability view but when NPL is the dependent it is found that greater competition is associated with greater bank loan risk supporting the competition-fragility view. However, the authors argue that the estimated coefficients show that the positive effect of competition on stability outweighs the increase on loan portfolio risk caused by competition and hence the competition-stability view is the overall outcome of their empirical estimation. Finally, they find a significant and positive nonlinear relationship between LERNER squared and Z-score and NPL.

The interrelationships among bank competition, risk, stability and inefficiency are examined in a simultaneous equation system for the banking sector of Jamaica in a study by Bailey-Tapper (2009). The paper employs pooled quarterly data for the whole Jamaican banking sector covering the period from March 2000 to June 2008. A Seemingly Unrelated Regression (SUR) technique is employed for the four equations model estimation. The four equations have dependent variables of credit risk measured by NPL, competition measured by the LERNER index, stability measured by Z-score and inefficiency measured by an index computed by a stochastic cost frontier function. The explanatory variables differ from equation to equation. Credit risk is explained by stability, competition and inefficiency but also by the real estate loans to total loans ratio, the commercial and industrial loans to total loans ratio and total loans growth. Bank stability is explained by competition, inefficiency and credit risk. The results as far as the competition and stability relationship is concerned, show that for building societies higher competition increase bank insolvency risk but the results indicate the opposite for merchant banks.

The first study for the Brazilian banking sector that directly empirically evaluates for the relationship of credit risk with bank concentration is Chang et al., (2008). The authors collect semi-annual data for all Brazilian institutions providing credit to consumers and business for the period 2000-2005. The dependents variable is the NPL ratio measuring the bank credit risk and therefore bank stability. The concentration measure is the HHI-dual index which borrows the idea of duality theory. The idea of the dual analysis is to associate another series Y to the series X, which represents the market, and to its HHI. This dual concentration index formula is given as d=1-(1/n)*HHI where n is the number of banks which represents the fraction of the banks that do not have market participation . The normal HHI index is also used for checking the robustness of the results. The control variables are the loan market share which is computed as the ratio of the total loans of each bank to the total of loans of all banks, inflation rate, GDP growth rate, exchange rate risk and a dummy variable for public banks. The authors run a dynamic panel data fixed effect estimation model and the findings significantly document that concentration is contributing to lower bank fragility and therefore support the concentration-stability hypothesis.

A later study for the Brazilian Banking market by Tabak et al. (2015) investigates how banks' risk-taking policies are influenced by their degree of competition/market power. They take a sample of 76 commercial banks for the period 2001-2011. They calculate at the individual bank level base the NPL risk-taking and Z stability measures. Competition is proxied by the PR-H statistic and the bank's market share of total assets also calculated at the individual bank level. The control variables are the total banks' assets, equity to total assets ratio, profits before taxes to total assets ratio and total revenue to total expenses. Regressions are run at the bank level but results are reported at the average level. Results from Instrumental Variables OLS estimations indicate that banks with a higher level of market power are taking less risk-taking activities and this effect is reinforced by the capital level variation. This result supports the competition-fragility view.

The Colombian banking market is examined in a paper by Castaño and Torres (2019) to determine whether concentration and competition improve bank stability. The sample consists of 12 banks and covers the period 1995-2017. The Z-score measures the bank stability while concentration index is measured by the CR5 and HHI for the loan's indices. Competition is proxied with both the LERNER and BOONE measures. After controlling for bank specific variables such as loans to deposits, loans to assets, net interest expenses to total loans, interbank lending rate, exchange rate and a dummy for years when capital regulations changed they run a GMM regression with Z-score and HHI based on assets and loan indices and the results show a significant positive relationship, indicating that as concentration increases stability also increases. However, when LERNER and BOONE competition measures are alternatively used the results show a positive relationship with BOONE and LERNER suggesting competition improves and deteriorates stability, respectively. They also find a nonlinear relationship as a further increase of concentration at low levels enhance stability but becomes detrimental to stability at high level of concentration.

The impact of concentration and competition upon bank stability is investigated for the Indian banking system by Sinha and Sharma (2016). Their sample covers the period from 2000 to 2015 and the annual data comes from 68 scheduled private sector, public sector and foreign commercial banks. They use three measures of concentration, such as, CR5 and HHI for loans and assets and for competition they estimate the non-linear model for the PR-H index. The dependent stability variable is proxied by the credit risk measure of NPL and bank stability by the Z-score index. They run GMM regressions with bank loan risk (NPL) and bank stability (Z-score) separately against each concentration and competition index. The controls are bank-specific variables of bank size, bank liquidity, loans and capital. The linear and non-linear (squared concentration/competition term) are both estimated. The results from the linear form regression indicate a strong significant positive relationship between concentration indices and NPL and a negative one with Z-score, implying that higher concentration leads to riskier portfolio choices and lower bank stability. When the NPL or Z-score is regressed on the PR-H competition index the linear model results strongly support that an increase in competition and concentration leads to riskier loan portfolios and instability, respectively. Therefore, the linear model supports the competition-fragility hypothesis. However, the results from the non-linear model estimation gives also support for a U shaped relationship. Finally, the estimated relationship between competition (PR-H) and concentration (HHI assets and CR5) is found to be negative and foreign share of banks to increase competition.

Evidence for the effect of bank competition on financial stability is also provided by Surya Bahadur and Sharma (2016) from Nepal's banking market. Their data sample consists of annual observations from 26 commercial banks from the 1999 to 2012 period. Stability is measured by the Z-score index and the NPL ratio while competition is proxied by the concentration HHI and CR3 and CR5 indices. Panel OLS with fixed effects are estimated with Z-score and NPL ratio being alternatively the dependent variables. The authors argue that the overall results give support to the competition-stability view. However, such a result is supported from estimations where loan risk (NPL) is regressed upon the three concentration measures. In the regression with the dependent being the overall risk (Z-score), the two CR measures support the competition-stability view but with the HHI measure of concentration greater concentration is related to greater stability.

A study by Ghassan and Guendouz (2018) uses quarterly data in order to explore the factors that determine stability and their difference between Islamic and conventional banks operating in Saudi Arabia. The Saudi Arabian banking system consists of eleven banks but their sample contains only six banks of which two are Islamic. The data covers the period from the 1st quarter 2005 to the 4th quarter of 2010.The stability index is Z-score and the explanatory variables are total assets, loan to assets ratio, operating cost to assets and income diversity. Competition is proxied by the HHI index. Results from a panel GLS estimated model shows that Islamic banks reduce the stability index but "there is no real distinction in terms of stability between CBs and IBs"p.14. With regard to the concentration index they find that it has a significant negative coefficient which indicates that as concentration increases and competition decreases bank stability drops.

A data set of annual (2006-2015) bank-level observations from 24 banks (domestic and foreign) operating in the UAE banking market is used by Maghyereh (2018) in order to explore the effect of concentration on bank risk and stability. The author uses the HHI concentration index as an inverse measure of competition while NPL and Z-score are the financial stability measures. The control variables are total assets, cost to income ratio, liquid assets to total assets ratio, equity to total assets ratio and GDP growth rate are. Using OLS, fixed effects panel and the two-step GMM estimation models, the findings strongly support the view that an increase in competition is harmful for financial stability in UAE whether it is measured as credit risk-taking (NPL) or as overall stability (Z-score).

A study by Ijaz et al., (2020b) investigates the competition-stability relationship and whether it differs between conventional and Islamic banks. They use the Pakistan banking market and collect bank-level data for 9 Islamic and 29 conventional banks over the period 1996-2013. The LERNER index is the competition measure and Z-score the stability measure employed. The control variables are the total assets, net interest margin, total deposits, non-interest income ratio, capital to assets ratio, return on equity and capital adequacy ratio. The results from the estimation of the two-step GMM model indicate that competition adversely affects bank stability and this effect is stronger in the case of Islamic banks.

Another study that compares the relative impact of bank-specific and market-structure factors on bank stability of Islamic and conventional banks in Pakistan is Rashid et al. (2017). They use bank-level quarterly data for 10 conventional and 10 Islamic banks over the period 2006-2012. Bank stability is measured by the Z-score and the explanatory variables are the CR4 concentration ratio, income diversity (net interest income minus other operating income over total operating income), operating expenses to operating income ratio, loans to assets ratio, total assets, loan loss provisions to net interest income, profitability (ROA and ROE), GDP growth and inflation rate. Panel model estimation for the whole sample provides results where concentration, income diversification and profitability have a positive and significant effect upon bank soundness and stability. However, when differential effects of Islamic and conventional are estimated, the concentration effect on bank stability for both types of banks remains positive but not significant while the income diversity and profitability effect remains positive but significant only for Islamic banks.

What Indian banks' risk-taking policy is influenced by bank market competition changes is the research area of a paper by Sarkar and Sensarma (2016). The authors collect data from 37 banks over the period 1999/00 to 2012/13 and estimate five types of bank risks: NPL for default risk, loan loss provision to total assets ratio for asset risk, interbank borrowing to total borrowing ratio for market risk, equity to total assets ratio for capital risk and liquid assets to total assets ratio for liquidity risk. They also compute the deposits and loans based CR5 and assets based HHI concentration indices and for all competition measures they apply the H-statistic index. The control variables are ROA and bank size together with GDP growth.. They estimate the risk and competition relationship by applying a fixed effect panel regressions model. The results show a variety of relationships. An overview result is that all competition and concentration measures are positively although not always significantly related to all risk measures. Firstly, when the H-statistic is used alone, a positive but not significant positive effect on all risk measures is recorded. Secondly, CR5 (loans or deposits based) concentration positively and significantly affects default, assets and market risks. Thirdly, when both concentration measures are regressed upon the credit risk only the CR5 is positively and significantly associated with all risks. The authors conclude that increased competition “ameliorates the risks in banks’ assets books” and leads to greater bank stability.

Another study by Ghosh and Parida (2019) explores the competition stability issue and provides empirical evidence for the competition-stability nexus from the Indian banking sector. They collect annual data from 55 public and private banks for the period 2007/8 to 2017/18. The study measures competition using concentration indices of HHI, CR3, CR5, CR10 and the GRS index suggested by Ginevicius and Cirba (2009) as a more accurate HHI index where the accuracy is defined by the total difference between the relative value of market criterion bearers in the market and their value calculated by the formula of a particular concentration measure. Solvency risk is measured by the Z-score and credit risk by the NPL ratio. Bank size, net interest income to total earning assets ratio, interest rate income from credit, dummy variable for government-owned or not banks, GDP growth and inflation are the control variables. They run fixed and random panel regressions and among a variety of results is that the effect of concentration on stability differs depending on the type of risk. Specifically, concentration is positively related to NPL but negatively to Z-score providing support both to competition-stability and competition-fragility hypotheses.

A recent study by Rakshit and Bardhan (2020) examines the question of whether bank competition enhances or hinders financial stability in the Indian banking market. The authors collect bank-level annual data from 70 banks for the 1996 to 2016 period. The dependent stability variables are the equity to assets ratio, Z-score and NPL ratio. Competition is proxied by the LERNER, Adjusted LERNER and BOONE indices and concentration by the assets and loans based HHI indices. Total assets, the loans to assets ratio, non-interest income to total revenue ratio, non-interest expenses to total revenue ratio GDP growth, inflation, banking freedom index and a legal rights index are the bank and country control variables. The findings from a GGM regression estimation are mixed. When competition is measured with the LERNER index and stability is measured either with NPL (credit risk) or Z-score (bank solvency) the negative and positive respectively relationship supports the competition-fragility view. But when the concentration index HHI-loans or HHI deposits are used, the results show that as concentration increases credit risk is reduced but overall stability deteriorates.

Furthermore, when banks are grouped as public or private, the positive and significant relationship between LERNER and Z-score found for both types of banks support the competition –fragility view. Finally, the positive and significant squared LERNER index indicates a U-shaped relationship between competition and stability. Overall, the results favor the competition-fragility hypothesis.

A simplistic study of the competition and stability relationship for the Latvian banking system is make by Titko et al. (2015). Their sample is data for 16 Latvian commercial banks covering the period 2007 - 2013. They estimate the LERNER and BOONE competition measures as well as a score for stability. They run two simple OLS regressions with dependent stability measure regressed upon each competition index with no control variables. The estimates give contradicting results with LERNER supporting the competition-fragility view but with the BOONE results supporting the opposite view. The authors state that they "refrain from final comments on testing the stated hypothesis" (p.30) and consider "the most valuable contribution of the present paper is an updating of the data set on structural indices of the Latvian banking system" (p.30).

The effect of market power on both bank risk and stability for the Kazakhstan banking sector is examined by Pak and Nurmakhanova (2013). The sample set contains 19 domestic banks from a total of 39 for the period 2007-2011. Quarterly bank level data from the 2nd quarter of 2007 to the 3rd quarter of 2011 is used to compute the bank credit risk measured by NPL and the bank stability Z-score measure. Market power is the main explanatory variable and is proxied by the LERNER index. The control variables are the total assets, loans to total assets ratio, deposits to total assets ratio, state controlled banks dummy, GDP, and the consumer price index. Static and dynamic system GMM estimators are employed and the results show that higher market power is significantly associated with lower risk-taking and enhanced bank stability. Furthermore, non-linearity for both bank risk and bank stability is supported by the results.

Another analysis for the relationship between competition and stability in the banking market of Kazakhstan is performed by Turusbskova et al. (2020). They use bank-level data for the period 2011-2017 and compute the LERNER and BOONE competition indices and the Z-score stability index. The control variables are loans to deposits, cost to income, net interest margin and total assets. OLS results reject the hypothesis that competition improves bank stability when LERNER is used while when Boone is used the results are ambiguous. The research revealed no statistically significant relationship between the values of the LERNER index and the Boone indicator estimated for Kazakh banking sector. The hypothesis about the consistency between different competition measures is rejected. In turn, the hypothesis about the positive effect of competition on bank soundness is rejected only in the case when competition is proxied by the LERNER index. Using the Boone indicator as a competition measure, the results are doubtful.

An answer to the question of whether competition increases banks' failures, is given in a paper by Fungscova and Weill (2011). The authors use a panel dataset for the non-state-controlled banks operating in the Russian banking sector and collect quarterly data from Q1 2001 to Q4 2007 which ends up to more than 20,000 bank quarter observations. The dependent variable is a bank failure dummy and is constructed from a special database that keeps time records of all bank failure cases. The competition is measured by the LERNER index and they use five control variables: total assets, loan to total assets ratio, deposits to total assets ratio, government bonds to total assets ratio and a dummy for banks located in Moscow or not. They run panel logit regressions and the main finding is that as market power increases bank failure cases are limited. In other words, the competition-stability view is discarded.

A simplistic correlation analysis based on the relationship between banking market sustainability indicators and bank concentration with HHI-a indices for the Russian banking sector during the period of 2017 to 2019 is taken by Kladova and Gordeev. (2020). The sustainability indicators consist of capital requirements, credit risk, liquidity risk, market risk and profitability. The authors conclude that the bank consolidation process that took place in the period 2007-2009 has improved the financial sector's sensitivity to various risks and stability. Therefore, there is no trade-off between competition and sustainability.

Another study utilizing quarterly data to investigate and compare the relationship between bank competition and financial stability for two types of financial institutions in Korea is undertaken by Is Jeon and Lim (2013) The sample period starts in the first quarter of 1999 for commercial banks (CB) and in the first quarter of 2003 for mutual savings banks (MSB) and ends for both types of banks in the fourth quarter of 2013. The number of CB and MSB varies through the examination period due to restructuring and failure events. The number of MSB was 211 in 1998 and drops to 105 in 1998 and 93 in 2012. The number of CB banks starts at 26 in 1997 and drops to 17 in 2000 and further to 13 in 2012. The primarily competition measure used is the BOONE indicator with HHI and CR4 used as supplementary competition indices. Also, the paper uses a dummy competition index that takes the value of 1 for a significantly negative BOONE index and 0 otherwise. For bank stability measure the authors employ the Z-score by using ROA. They perform pooled OLS regressions and panel analysis with fixed and random effects with the Z-score being the dependent variable and the competition BOONE index along with bank size, profit ratio, loan to deposits and a dummy for foreign ownership being the explanatory variables. The results from a variety of regressions support the different effect of competition on the two types of banks. For MSBs, competition either presented by the BOONE or CR4 or CR8 and HHI enhances stability. For commercial banks when the BOONE measures competition it reduces bank stability and nonlinearity is present.

In order to investigate the influence of bank competition on the stability of Vietnamese banks Phan et al. (2018) collect data for the period 2006 to 2016 which results in an unbalanced sample of 27 banks. The Z-score and NPL are the stability and risk measures respectively and the LERNER index the competition measure. The control variables are the total assets, total assets growth rate and loans to assets ratio. Findings from the GMM method and fixed and random effect OLS estimators support the completion-stability view when Z-score is used and the competition-fragility view when NPL is used. Robust evidence is also found for a nonlinear relationship between Z-score and LERNER index.

A recent study by Nguyen and Tran (2020) explores the effect of bank competition upon bank profitability and risk taking using a sample of one state-owned and 36 joint-stock commercial banks operating in Vietnam from 2006 to 2015. They run two set of OLS regressions. The first set uses as dependent variables the profitability variables of ROA, ROE and the ratio of net interest income to total earning assets. The results imply that higher concentration as measured by HHI-assets index increase profitability when measured by ROE. Furthermore, bank size (total assets) is found to positively affect all three measures of profitability. The second set of equations use as dependent variables a bank risk variable proxied by the Z-score index and volatility of ROA and Roe measured by the ROA and ROE divided by their standard deviation. The results show that the concentration index (HHI) haa a positive but non-significant effect on Z-score and the volatility of ROA. In both set of equations they use total size, total loans, total loans growth and capital to assets ratio as control variables. The total assets (bank size) are always significant, and the results imply that larger banks have reduced profitability but increased stability (Z-score).

Another study by Minh et al., (2020) explores the effect of bank competition upon stability taking bank level data from 24 banks in Vietnam over the period 2008-2017. Stability is measured by the Z-score either with ROA or ROE and competition by the LERNER index. The control variables are total assets, the equity to total assets ratio, loans to assets ratio and loans growth. They apply dynamic panel estimation with fixed and random effects and the two-step GMM model. The results show a negative and significant relationship between the LERNER and Z-score, calculated either by ROA or ROE, which implies that the competition-stability view is supported.

A study by Zaghdoudi (2019) explores the effects of various bank risks on overall bank stability for the Tunisian banking system. The data set consists of 20 conventional banks over the period 2005-2015. The dependent variable of bank stability is proxied by the Z-score based on both ROA and ROE ratios and the main risk explanatory variables are the loans to assets ratio (Credit risk), the required economic capital (operational risk) and deposits to loans (liquidity risk). Furthermore, the interest margin to total assets, total assets, GDP growth rate, inflation and the HHI-assets concentration index are additional control variables. Panel data regressions are run, and the findings suggest that credit risk decreases bank stability while liquidity risk and bigger bank size increases stability. The findings also suggest that market structure (HHI index) does not have any significant effect on stability.

An analysis of the relationships between competition, efficiency and stability is conducted by Moyo (2018) for South Africa. The period covered is 2004-2015 for 17 local and international banks. Both the LERNER and BOONE competition measures are used whilst Z-score and NPL are the classical bank stability proxies. Different efficiency scores (technical, cost and profit) for each bank are estimated employing the SFA method. The control variables are the bank's age, total assets and also a binary for foreign/non-foreign banks. The results depend on the proxy competition used. The LERNER index give a negative relationship between competition and efficiency while the opposite result is found when Boone is used. Furthermore, using both LERNER and BOONE indicators show that competition enhances bank stability.

The banking sector of the South Africa is investigated by Zhou (2017) in his master thesis to add to the empirical research on the competition-stability nexus. He collects bank level data for the four big commercial banks, which account of 90% of total bank market assets, from 1990 to 2015 in order to compute the Z-score index of stability and three measures of competition: LERNER, efficiency adjusted LERNER and H-statistic index. The control variables are total assets, growth of assets, bank deposits to customer deposits ratio and equity to total assets ratio, are the bank specific variables where along with GDP growth, stock market capitalization, economic and financial freedom indices and concentration index. Data on all variables are initially extracted annually but they are then extrapolated, using the E-View program, to quarterly frequency. OLS model estimations with the LERNER index give support to the competition-fragility hypothesis although when the adjusted LERNER index is used a non-significant positive relationship with stability is found.

A recent study Rahman and Choidhurry (2021) examines the effect of competition and efficiency on stability taking a sample of 28 listed commercial banks operating in Bangladesh over the 2011 to 2018 period. Estimating a dynamic GMM model, the LERNER and Boone competition indicators along with cost to income ratio, fixed assets to total assets, loans to assets, loan loss provisions to total assets, equity to total assets, noninterest expenses to total assets, total assets and GDP growth and inflation rate are regressed upon the NPL or the Z-score stability measures. The results from the competition indices reveal significant coefficients that support the view that competition improves financial stability whether measured by NPL or Z-score.

Another study investigating the effect of bank efficiency and of the intense competition realized in the Bangladeshi banking market on bank stability is undertaken by Dutta and Saha (2021a). The sample consists of bank-level data for 30 banks over the period 2009-2017. Competition is measured with the BOONE indicator and the Z-score measures bank stability. Using Principal Components Analysis an efficiency index is computed from net interest margin, working capital and operating efficiency financial ratios. The control variables are bank size (total assets) and bank liquidity (loan to deposits ratio). Country control variables of governance and regulation indices are taken from World Bank database. The results from a two-step GMM estimator find a non-linear relationship between competition and stability implying that at low levels competition enhances stability but not in high levels. Finally, efficiency is found to contribute to financial stability.

The nonlinear relationship between bank competition and stability is explored again for the Bangladesh bank market by Dutta and Saha (2021b) using the same bank and period sample set as that of Dutta and Saha (2021a). Competition is measured by the BOONE indicator which is, however, estimated using the average and not the marginal cost due to data unavailability. Stability is measured with the Z-score. The control variables are the total assets, total assets growth, loan to deposits ratio, GDP growth and the broad money to GDP ratio measuring the financial depth. They employ the Hansen (1999) panel threshold model to identify the optimum competition threshold and then run the model for ranges above and below the optimum level of competition. The results identify a nonlinear relationship between competition and stability and show that financial stability is higher (lower) when competition is at below (above) the threshold level.

The effect of market structure on the development of non-performing loans in the Kenyan banking sector is empirically tested in a study by Ndede and Kavoya (2017). The sample contains all banks except one (42) operating in Kenya covering the years from 2006 to 2013. Market structure is represented by credit growth, size of bank, loans to assets and profits before taxes. Panel data estimation with fixed and random effects is employed with NPL being the dependent variable. The results document that less competition among commercial banks increased risk taking.

The Egyptian banking market with a sample of 27 banks from the period 2012 to 2018 is the country case study by Abdel-Wanis (2020) for the examination of how capital and banks' other characteristics influence the competition risk taking relationship. Risk taking is proxied by the Z-score index. Competition is measured by the HHI-deposits index and regulatory capital by the ratio of core capital to risk weighted assets. The bank specific control variables are total assets, total debt to total assets ratio, non-interest income to total operating income ratio and a dummy variable for public and private banks. OLS regressions show that higher levels of regulatory capital and lower concentration are associated with higher stability. The interaction of bank concentration with bank capital is positively associated with stability suggesting that the positive effect of higher capital on stability overcompensates the reduction in stability when concentration increases.

A paper by Vujanović and Fabris (2021) investigates the effect of bank concentration on credit risk and how the bank size affects such a relationship. They use quarterly data for eleven banks from the bank-centric system of Montenegro covering the period Q4/2004 to Q4/2016. The dependent variable is NPL while explanatory variables include a set of macroeconomic factors (GDP, employment, stock exchange index, real estate price and sovereign debt) of b) bank specific factors (total assets, loan level, loan loss provisions and bank capitalization) and c) the HHI-assets concentration index. They estimate the model with a fixed effect panel OLS method and results show that as bank concentration increases (competition decreases) bank risk also increases. Furthermore, the estimated coefficient of the interaction term of HHI and bank size indicates that as bank concentration increases credit risk is also increasing but much less in large-banks compared to small-sized banks.

The Kenyan banking system is explored in terms of competitiveness and stabilization and further their relationship is estimated in a paper by Kiemo and Mugo (2021). Competition is measured by LERNER index and PR-H statistic. Bank stability is measured with the Z-score estimated from the Altman's equation and by the Bankometer S-score again estimated by an equation using a selected group of CAMELS rating indicators for banks. The sample uses 37 banks out of total 43 and covers the period 2001-2017. GMM panel estimation indicates that competition promotes stability of banking market of Kenya.

The Ghanaian banking industry is the geo-area in a study by Anokye-Wusu and Opoku (2016) to put to the test the competition-stability issue. Balance-sheet data for 27 banks for the period 2007-2014 are their data sample. The competition index used is the PR-H statistic and NPL measures bank stability. There is no direct estimation of competition upon NPL but instead NPL is an additional factor in the reduced-form equation for estimating the H statistic of competition. The other factors included are equity to assets, other income to interest income, other non-earnings assets to assets and loans to assets ratios, funding rate, price of personnel expenses and price of capital expenses. They run a fixed effects panel OLS model and results verify that "as competition in the Ghanaian banking industry heightens or intensifies, the more loans given out by banks to customers are likely to go bad" (p. 8) which translates into support of competition-fragility view.

An attempt to investigate if bank competition has an impact on stability is taken by Vardar (2015) using a sample for 28 Turkish banks (11 private, 9 foreign, 5 foreign branches and 3 state-owned) covering the 2002-2012 period. Competition is measured by the PR-H statistic and bank concentration by CR3, CR5 and HHI-assets indices. Three alternative measures (Z-score, LLP ratio and standard deviation of ROA) are employed for measuring bank risk-taking and stability. Control variables are total assets, liquid assets to total deposits, total loans to total assets, off-balance sheet items to total assets, real interest lending rate and GDP growth. They estimate both static panel data model with fixed and random effect and dynamic GMM first difference model. , The main finding is that competition does not enhance bank-risk taking and are in line with the arguments of the "competition-stability" hypothesis. With regard to banking market concentration on bank risk-taking behaviour, the results support "concentration-stability" hypothesis.

Another study investigating the determinants of Indonesian banking systemic risk is taken by Wibowo and Wibowo (2017). They use monthly balance sheet data for 16 banks out of 33 listed banks from Jan. 2003 to Dec. 2013. Systemic risk measurement is based on the bank market value information by applying CoVar using banks' financial statements and stock returns of individual banks and banking systems returns. The measurement of individual bank contributions to systemic risk using ΔCoVaR and CoVAR is estimated using Quantile Regression, following Adrian and Brunnermeier (2011). Competition is measured with the PR-H statistic and concentration with the CR5 index. Bank control variables are total assets, ROA, NIM, capital to assets ratio, interbank loans, and demand deposits to total capital ratio. The empirical results from the estimated panel data regressions suggest that both bank competition and bank concentration have a significant impact upon bank's systemic risk and support the competition and concentration fragility views.

A paper by Zaghdoudi. et al. (2016) investigates if bank concentration has a positive or negative impact upon Tunisian banks' stability. Data from annual bank-level balance sheet and income statement are collected for 30 banks from the Tunisian professional association of banks covering the 1980-2009 years. Bank's market share to total banks' assets and HHI-assets index are measuring concentration whilst Z-score is the stability proxy used. Other bank-level variables used are total assets, loans to deposits ratio, loans to total assets ratio, deposits to liabilities ratio and interest expenses to interest income ratio. GDP per capita and inflation are also included. Random effects panel regression models are estimated and results confirm a positive relationship between concentration (HHI-assets) and risk-taking in other words concentration fragility view.

The impact of changing bank competition and the presence of Islamic banks on bank risk, profitability and capitalisation is explored by Sukmana and Ibrahim (2021) using a sample of 16 Islamic and 21 conventional Malaysian banks over the period 1997-2015. Competition proxy used is the LERNER index and bank performance is represented by ROA and equity to assets ratio. Bank risk is proxy by NPL ratio. The Islamic presence in banking industry is measured with the share of Islamic banks' financing to total banks financing. To assess the impact of competition they employ a Panel data Vector Autoregression(PVAR) model considered as "most appropriate since it treats all variables to be potentially endogenous and, at the same time, allows for unobserved individual heterogeneity (Love, Zicchino 2006)"(p. 231). Results based on all banks and only conventional banks sample is in line with competition stability view. When sample is restricted to Islamic banks competition has no effect on bank risk but only reduces profitability. Finally, the changing presence of Islamic banks improves the risk profile for conventional banks.

The relationship between bank concentration and bank risk-taking is examined for the South African banking industry in a paper by Mishi et al. (2016). Their sample consists of monthly data for seven big banks out of total nineteen covering a period of three years and a half 2008-2011. They then run panel data pooled regressions where the NPL ratio is the dependent bank risk variable and the explanatory variables apart from HHI-assets bank concentration index also include the total assets, repos rate, capital market investment and total factor productivity efficiency scores. Results strongly support the concentration-fragility view. Authors however notice that the study suffers from data unavailability.

An attempt to investigate the effect of the structure of bank's ownership and bank concentration on their risk-taking behaviour is taken by Al-Tamimi and Jellali (2013). To this end they collect bank level data for 15 national banks (excluding foreign banks) operating in UAE for the period 1998-2010. Banks' sample is split to 11 conventional and 4 Islamic. Competition is measured by the HHI-assets concentration index while risk is the ratio of risk-weighted assets to total assets. The ownership structure of banks is measured by three proxies such as the percentage of shares owned by government, institutions and private sectors for conventional and Islamic banks sample. Estimation technique is panel data OLS and results give significant results for ownership variables but not for the concentration variable. Authors admit however that their study suffers from the foreign banks' exclusion and overall data quality.

A paper by Kebangsaan et al. (2012) empirically explores the factors that influence financial stability and assess whether it differs between conventional and Islamic banks. The country chosen is Malaysia and the data sample includes 38 banks (21 conventional and 17 Islamic) for the time period 2005-2010. Z-score and NPL are the stability indices used and the explanatory factors are HHI-assets concentration index, bank's market share in terms of assets, total assets, loan to assets and cost to income ratios, GDP growth and inflation rate. Results from the Panel OLS model with either Z-score or NPL stability dependent variables overall agree that Islamic banks are more stable compared to conventional ones. With regard to bank concentration empirical estimates find a positive effect on stability no matter how is a measured but only significant for Islamic bank. Authors admit data limitations and short coverage period.

Within the context of empirically investigating the determinants of bank stability in Bangladesh bank market a paper by Hossain and Imam (2018) uses a sample of 29 listed banks of which 23 are conventional and 6 Islamic and covers the period 2005-2016. The innovation is that when measuring stability, apart from the standards Z-score index with ROA or CAR indices they construct a Z-score variation named Z-score Infection Rate Z-(IR) in order to account the fact that assets of Bangladeshi banks consist of loans and hence the risk of the loan portfolio is almost identical to banks' financial stability. The IR is the net NPL to total loans ratio multiplied by the loans written off and the ROA or CAP is substituted by the ratio of regulatory capital to total loans plus the loans written off. Competition is measured by the HHI concentration index. The control variables are the total assets, loans to assets ratio, cost to income ratio, share of Islamic banks, GDP and inflation. Results from a set of static (random effects) and dynamic (GMM) panel regressions indicate that Islamic banks are more financially stable and their presence promotes stability of the whole banking system. Higher bank concentration appears to reduce stability supporting the concentration-fragility view. However, this result is significant only when the Z(IR) version of stability index is used , a fact that confirms the importance of loan portfolio behaviour.

The effects of monetary policy and bank competition on banking defaults in bank market of Indonesia are explored in a paper by Sri-Ayomi et al. (2021). They collect data for 119 banks covering the period 2009-2019. The Z-score and NPL are measuring the probability of default or bank stability. Repo and credit interest rate changes capture monetary authority's policy while competition and concentration are proxy by PR-H and HHI-a indices, respectively. Control variables include total assets, loans to deposits ratio, net interest margin, equity to assets ratio, GDP growth, inflation rate and exchange rate. Using a panel-OLS –fixed effect and 2step GMM techniques, go on estimating a set of regression with dependent variable either Z-score or NPL and with competition and concentration measures separately. Results indicate that monetary policy (REPO and credit interest rates) enhances bank stability. Competition has a negative and significant impact on bank default risk i.e., promotes bank stability and hence supports the competition-stability view. However, results from concentration effect on Z-score and NPL support the concentration-stability view. Overall results agree with those reported in Kasman and Kasman (2015) and Noman (2017) where both utilised similar variables and estimation techniques.

3.4 Summary and key findings

- This review includes studies exploring the bank competition relationship with stability within a specific country sampling framework. We have reviewed 95 studies. Reviewed studies select countries from all world regions and grouping them in regions we record 45 studies for Asian countries, 21 for European countries, 15 for African countries, 7 for Latin American countries, 4 for Middle East countries and 3 for CEE/CIS countries. The majority of the studies (67) were published in the period 2016-2021 while a quarter of all the studies were published in the year 2020.
- The Z-score stability measure once again is the "winner" with 70 studies employing it. The NPL risk-taking measure is also alternatively used in 38 studies. Four studies use binary crisis variable.
- Non-structural measures of competition (LERNER, Boone and PR-H) are used 68 times with the LERNER and Boone used together in 11 studies. An interesting fact is that the concentration measures of HHI-a, HHI-l, HHI-d and/or CR (3,5,5,7,10) are used in 26 studies alone obviously exploring the concentration stability issue and not the competition-stability issue.
- With regard to the estimation method employed, system GMM and Panel-OLS are mostly applied. Simple OLS is also applied in 22 studies. The Logit model is applied in four studies where a binary crisis variable is present.
- Results, of course, support all views. So, in order to make sense of the findings we proceed by grouping countries by region and then compare the findings of the region already analyzed them with country results. So, for Asian countries the findings show that the competition-stability has a weak lead which is in line with the view when studies for the Asian region are reviewed. For the Latin American

countries studies the overall result favors the competition-fragility view in line with the initial study by Yeyati and Micco (2007) for the Latin America region. For African countries, the findings from individual countries strongly support competition-stability, a result in contradiction with the overall result when 10 African region studies are reviewed. The results from the three Middle East countries studies agree that in highly concentrated bank markets such as those of Middle East region stability is not supported by high banking concentration. A result that although not compatible with the MENA region findings agrees with the view that highly concentrated bank markets with TBTF banks can turn into instability.

3.5 Discussion on the Literature review findings on the Competition stability vs Competition fragility debate

Banks are the corner stone of any financial system performing essential functions necessary for economic growth and development. Therefore banks' 'healthy' functioning as financial services providers to households, entrepreneurs and government is vital to economic stability, development, and growth. Financial institutions' soundness and stability is most desirable since a collapse of banks causes the whole economy to experience economic turmoil with severe long lasting economic depression and undesirable social costs. The world economy has experienced such crises at the country (Argentina 2001-2002), regional (Asian 1997-98) and global level (2007-2009) in the last century (Kose et al., 2020). Therefore, great academic interest has been expended to analyze and investigate the causes of those financial crises and to provide advice to banking authorities for future crisis management. There are many bank-specific, institutional-specific, country and regional-specific and macroeconomic variables which have been empirically tested as explaining bank stability and crises. However, the market structure or the level/degree of competition in the banking sector has a prominent position. Although microeconomic theory considers a competitive (in contrast to a monopolistic) market structure desirable to ensure efficient allocation of limited resources, the question of whether competition is the ideal form of market structure in the banking industry is still open and debatable. In other words, the level and change of competition or market power in the banking industry is accepted as a factor that has a significant impact upon the stability of banks but the question remains as to whether it jeopardizes or enhances bank stability. The conclusion depends on how market structure or competition changes alter banks' charter value, moral hazard and assets-liabilities risk-taking strategies. The results and their strength is also influenced by the economic environment, the regulatory framework and sociopolitical developments. Academic research both on theoretical as well as on empirical grounds has continued in the last three decades to provide opposing answers about whether competition in the banking market produces a stable, sound and solvent banking system or makes it more fragile and insolvent. The question is still open since elements of the empirical studies conducted so far favors both views. However. this is not an unusual phenomenon when exploring relationships between two financial/economic concepts since we know that in the real economy the ceteris paribus condition does not hold and there are many bank-specific, macro-economic and non-economic factors that some extent influence the relationships under examination.

Both theories of competition-stability and competition-fragility are based on alternative hypotheses about how banks' risk-taking policy reacts to an increase of market power or competition: Does an increase in market power increase charter value? If the answer is yes, will banks then decide to keep safe this higher charter value and increase capital buffers and follow prudent and low-risk policies and hence enhance their stability? Or will the high charter value "pillow," causing moral hazard issues encouraging high risk choices which endanger bank solvency? Will a bank market dominated by few large banks induce them to undertake high portfolio risks since in the case of an insolvency event they believe in rescue by the authorities? In a more competitive market will the expected lower loan rates make new investments projects profitable and loans repayments safer and hence reduce credit risk and finally improve bank stability? Or will the low loan rates squeeze bank lending revenue streams and profits and induce banks to extend excessive credit without considering the risk-profile of borrowers which in turn increases credit risk and bank fragility? Do the large numbers of banks in a competitive market limit the available information about borrowers' credibility and hence increase credit risk and bank's insolvency? Or in a highly concentrated banking market will the borrowers be better scrutinized with respect to their credibility and additionally will the long established bank-customer bonds bring a low level of non-performing loans and enhance soundness and stability?

All these hypotheses need empirical testing and indeed very extensive academic research has been advanced to provide a verdict on the open case of the completion-stability issue. In this chapter we have undertaken the task of collecting all empirical research work related to the competition-stability issue from the last thirty years. Our survey is focused equally on theoretical and empirical research, and we include a) studies that directly investigate the effect of bank market power or competition or concentration on bank risk-taking or bank stability b) studies that explore how the competition-stability relationship is affected when other banking characteristics such efficiency, profitability, liquidity are taken into account and c) studies that although not directly exploring issues relating to competition-stability as such, have risk/stability and competition/concentration variables present in their estimated models and provide some indication/evidence on our issue of concern. I have grouped the papers based on the geographical area covered by the sample of the empirical studies. Moreover, we have a group of papers named GLOBAL where includes studies with a substantial number of countries from world regions, a group titled Islamic vs. Conventional which includes studies comparing Islamic and conventional banks and a group with the title "developed and/or vs. developing" that includes studies comparing the competition-stability issue in advanced-developed and developing-emerging countries. In the "single countries" countries group there are studies that tackle the competition-stability issue for only one country and although a few of them go on with an Islamic/Conventional comparison we still follow the single country criterion grouping. In addition, although the countries of GCC groups are geographically included in studies covering the MENA region we opted to have a separate group for GCC since these countries have the characteristic of being highly dependent on oil products.

The total number of studies that were finally selected and considered providing direct or indirect empirical evidence on the relationship between bank concentration or competition and bank risk-taking and/or stability is 279. Note that the studies included are only those published in the English language and therefore the total relevant studies may be underestimated.

Regarding the analytics of the geographical grouping of studies (see table 3-1) there are three distinct characteristics. First, that the "single countries" group includes 93 studies or 124 when USA and China are included and is the largest group covering 34% or 45% of total studies, respectively. Second, that the "single countries" and "global" groups sum up to 110 studies almost half (45%) of the total studies while when added to the "single countries" group the USA and UK separate groups the number of studies of those groups amount to 142 which cover 54.% of total studies. The "Europe" group with 22 studies comprises 7.9% of total studies. The "Latin America" and "BRICS" groups both with 4 studies respectively are the least explored geographical areas. Third, a considerable number of studies have been recorded exploring empirically the competition-stability issue related to the Islamic banking market as such or comparing it with conventional banks. Indeed, the groups of MENA, GCC, ISLAMIC vs Conventional and many Islamic countries studies from the "Single countries" group sum up to 70 studies or 28% of the total. This development is not unrelated to the cautious relaxation in the 80's and further acceleration in the 90's of banking restrictions in many Islamic countries that allowed the entrance and coexistence of conventional with Islamic banks, the presence of Islamic banks in non-Islamic countries such as UK, USA, Luxembourg, Germany and the provisions to allow Islamic banks to provide banking products resembling conventional ones. All these changes have increased the role of Islamic banking in the world financial system and its importance for banking industry stability and in parallel has caused the academic interest in Islamic finance and banking to soar.

Table 3-1 Literature review assessment of empirical studies for competition-stability relationship. 1990-2022

Region	**No. of studies**	**% of total studies**
MENA	12	4.3%
G.C.C	8	2.8%
ISL. -CONV.	14	5.0%
DEV/ED- DEV/ING	13	4.7%
EUROPE	21	7.5%
CEE	14	5.0%
ASIA	17	6,1%
CHINA	13	4.7%
AFRICA	13	4,7%
USA	18	6.5%
LATIN AMERICA	4	1.4%
GLOBAL	33	11.8%
BRICS	4	1.4%
SINGLE COUNTRIES	95	34,0%
Total Studies	**279**	**100%**

The chronological distribution of studies in the period covered of 1990-2022 (up to the point that this literature review is submitted) is of great interest and gives insight into a dynamic period in terms of methods and approaches in an ongoing debate. The number of studies is constantly increasing year by year. Single digit number of studies is recorded up to 2012 while as from 2013 and after double digit numbers of studies are recorded every year reaching a maximum of 50 studies in 2020. Therefore, as was expected, most of the total studies are recorded in the period 2013-2021 comprising 240 studies or 86% of the total. Furthermore, breaking this period into two equal sub-periods of 2013-2016 and 2017-2021 we find that the latter period records 167 studies or 59,4% of the total. The above developments fit with the increasing academic interest in Islamic countries (MENA, GCC, ISL vs. CONV) as mentioned before. This academic research trend in Islamic banking is also supported in a recent relevant survey by Abdullah et al., (2020). In their survey of general research on Islamic finance they find that 242 studies out of a total of 315 published in the period 1982- 2014 were published within the 2015-Jan. 2020 period.

Moreover, the high number of studies recorded in the last five years is the result of the growing interest in the competition-stability issue from all over the world as shown in table 3-1. In the period we observe an increasing number of relevant studies for Asia, Africa and Central Eastern Europe (CEE) groups. We consider that this positive development could be attributed firstly to the recent financial global crisis and banks' failures that attracted academic interest in exploring the causes and roots of such banking failures and secondly to the reforms and the adoption of information technology into banking accounting and management systems that made available more timely, detailed and long-term bank-level data for these countries.

Having reviewed 279 studies through the long period of thirty years from 1990-2022 we still cannot give a clear and robust answer to the question "Does bank competition enhance or hinder bank stability?" The outcome of the review process favoured neither the competition-stability nor the competition-fragility views. Clearly it is not a matter of listing the number of studies which support the competition-stability against the number of studies supporting the competition-fragility view. Every single study bears its own characteristics. Apart from bank market structure and stability measurement issues there are different banking principles, bank and country specific characteristics, various banking institutional and regulation frameworks and political and cultural idiosyncrasy that might influence the final verdict. In addition, the variety of estimation techniques available and models utilised for the empirical estimates is another factor influencing the significance and sometimes the "sign" of the results.

in the reviewed studies there is a consensus over the bank stability measures to be employed. The Z-score index is used in all studies except those using binary variables to indicate bank crises. The NPL ratio is also widely used as a direct measure of risk-taking and indirectly as a bank stability measure. The components of Z-score such as Equity to assets ratio, return on assets and standard deviation of Return on Assets are also used as bank stability components.

Regarding the bank competition measures used in the 279 reviewed studies the LERNER index is the “winner”. The BOONE competition index is also used but less frequently and, in most cases, appears together with the LERNER index. The PR-H statistics is rarely used. Bank concentration is used in many studies as an alternative to bank competition although many studies have stressed the non-direct association of lower or higher concentration with higher or lower degree of competition. However, many studies investigate the concentration effect on stability using either the top three or five banks’ share of total bank assets (CR3, CR5) or the HHI index based on bank assets and less frequently on banks loans and deposits. A considerable number of studies make use of both competition and concentration measures.

The econometric models employed for estimating the competition-stability nexus do not differ substantially. Since panel data makes it possible to have large data set with a few years of observations it is widely employed by many single country and cross-country studies. The seminal work by Arellano and Bond and the development of Generalized Method of Moments (GMM) with first - or second-degree differences is mostly used for panel data, but the panel pooled OLS method is also frequently used.

3.6 Motivation and hypothesis for the empirical relationship between banking stability and competition in the MENA region

As discussed extensively in the literature review, the MENA region is an interesting case for providing further evidence on the debate of the relationship between competition and banking stability as there are few papers that directly tackle the competition stability/fragility issue. The competition measures used are the LERNER and HHI indices while the Boone indicator has not been used sufficiently in the MENA region. I aim to contribute to this area by providing additional evidence with the use of Boone indicator which have not been used extensively so far due to data issues. In parallel, using the distinction between Islamic and Conventional banks distinction can further assist to decompose the above relationship.

The empirical analysis is further motivated by El and Mansour (2022) large sample analysis of MENA banks finding that competition positively affects both the cost efficiency and stability of the banks, where competition is measured by the Panzar-Rosse H-statistic and alternatively by the LERNER index. An additional motivation stems by Akins et al., (2016), as an interest in examining post- global financial crisis regulatory reform strategies in the form of worldwide deregulation and consolidation efforts. Specifically to investigate whether competition adversely or positively affects bank stability in the MENA countries where Islamic banks and conventional banks co-exist while addressing potential other external factors that may play a role. At the same time there are multiple factors in aiming to investigate the relationship between banking stability and competition in the MENA region. Firstly, the MENA countries "liberated" their banking market in the 1980s and 1990s but after almost three decades aimed to promote foreign penetration, consolidation, privatisation, there is a lack empirical evidence pertinent to whether competition influences positively or negatively risk-taking behaviour in banks in MENA countries. Second, as Bitar et al. (2016) argued and as discussed in Albaity et al., (2019) the credit growth rate in the MENA countries has been increasing rapidly, which may give rise to concerns about banking system stability, because credit growth may result in financial crisis. Third, the MENA region connects developing and developed countries in Asia, Africa and Europe, which, in turn, attracts bankers and investors worldwide. This locational advantage makes MENA countries more sensitive to political instability and, thus, financial and economic vulnerability. Fourth, within MENA, the Gulf Cooperation Council (GCC) countries with their minimum requirements setting for regional bank branches, may motivate banks to increase their market power in order to operate freely within the GCC countries. However, this consolidation as Boyd and De Nicolo, (2005) mention, can give rise to monopoly power wherein banks may set higher interest rates, weakening easy access to credit and financial inclusion, and making the banking system vulnerable due to greater risk-taking tendencies among banks. It can potentially increase the number of large banks, leading to "too-big-to-fail" effects, proving too costly for regulators to save them if they begin to face substantial damages (Tabak et al., 2012). Finally, another interesting issue within the MENA countries is the existence of Islamic banks, which are divergent from conventional banks in terms of the source and use of funds as discussed extensively in chapter 2 and section 3.1 above.

Overall, the key questions that remains and form the main hypothesis of the empirical analysis at this stage is as follows:

H1: Conventional and Islamic banks in the MENA region have a different relationship between bank stability and competition dependent on the type of bank.

H2: The competition measures of LERNER Index and BOONE indicator can provide a thorough assessment on the support of either the competition stability or the competition fragility relationship for the MENA region for all types of banks.

H3: Does the interaction of competition with distress mitigate the negative impact of the latter on stability?

Based on the evidence and studies conducted so far we have no clear expectation on the expected sign of competition either via the LERNER index or the Boone indicator, although based on previous studies done on developing economies we expect the relationship between bank stability and competition to be nonlinear (Fu *et al*., 2014; Albaity *et al*., (2019). Looking at older studies such as Keeley (1990), low competition leads banks to take fewer insolvency, credit risks, and enjoy more profitability supporting the competition-fragility view in the MENA countries. In addition, the results further suggested that the competition-fragility effect was more prominent for Islamic banks than conventional ones in the MENA countries.

3.7 Country and bank level information

As part of my analysis, I make use of the same dataset and process for banks in the MENA region as in chapter 2. Specifically, Bank-level data was collected from ORBIS Bankscope and the websites of individual banks. The Bankscope classification for Islamic banks has been crosschecked with available data to ensure maximum accuracy. The initial sample covers observations for 390 banks, across 21 countries in the MENA region over the period 2004–2015. The selection criteria for the final sample of the number of banks, countries and the covering period are the following: First, we consider banks with at least three years of available data. Second, we consider only countries with available data regarding the macroeconomic environment and the regulation framework with at least four banks and third, we drop Syria due to the ongoing crisis in the country from 2009. The application of the above filter restrictions on our initial sample leaves us with a final sample that consists of 19 MENA countries with 84

Islamic banks and 238 conventional (commercial) banks summing up to 322 banks. For Iran, observations are only available for Islamic banks as its banking system is 100% Riba-free. In other countries, both Islamic and conventional banking are authorized operating and practiced. 26% of the total observations are for Islamic banks. A complete overview of the banks and countries included in the chapter is given in Table 3-2 below.

Table 3-2 number of Islamic and conventional banks with observations for MENA countries. 2004-2015

	Islamic banks		**Conventional banks**		**Total**	
Country	Banks	Observations	Banks	Observations	Banks	Observations
Algeria	4	22	13	80	17	102
Bahrain	3	15	5	30	8	45
Djibouti	1	8	5	20	6	28
Egypt	5	31	28	158	33	189
Iran	15	110	1	7	16	117
Iraq	7	28	7	42	14	70
Israel	0	0	16	111	16	111
Jordan	3	17	14	102	17	119
Kuwait	11	88	6	47	17	135
Lebanon	3	21	52	332	55	353
Libya	1	10	11	120	12	130
Mauritania	2	20	8	123	8	123
Morocco	0	0	14	123	14	123
Oman	4	26	7	69	11	95
Palestine	3	21	3	28	6	49
Qatar	6	52	7	60	13	112
Saudi Arabia	5	38	9	88	14	126
Tunisia	2	19	16	132	18	151
UAE	11	134	14	168	27	302
Total	**86**	**660**	**238**	**1,840**	**322**	**2500**
%Mena	**26.7%**	**26.4%**	**73.3%**	**73.6%**	**100%**	**100%**

Source: Bankscope, Orbis Bank Focus and Central Bank's Reports. Conventional and Islamic banks are distinguished based on Bankscope and Orbis Bank Focus definitions on annual basis. Central bank reports show different operations business models.

3.8 Empirical approaches

The key objective is to assess the competitive environment of the MENA region banking industry against consolidation initiatives and to analyse the competition stability relationship under the moderating effect of conventional and Islamic banks.

By combining the approaches of Ibrahim et al., (2019) and Albaity et al., (2019), I contribute by examining both the LERNER index and the Boone indicator respectively and assess the risk implications at the sector level for MENA region banks.

3.8.1 Bank stability measurements

For our dependent variable, I use two different risk-exposure indicators as proxies for bank stability: The Z-score as an inverse measure of the probability pf a banks insolvency and the ratio pf Nonperforming loans to total loans (NPLs) to capture loan portfolio risk (Toader et al., 2018)

3.8.2 Z-score

As discussed extensively in chapter 2, the popularity of the Z-score stems from the fact that it has a clear (negative) relationship to the probability of a financial institution's insolvency, that is, the probability that the value of its assets becomes lower than the value of its debt. An advantage of the Z-score is that it can be also used for institutions for which more sophisticated, market-based data are not available as is the case for some banks in our sample. Also, the Z-scores allow comparison of the risk of default in different groups of institutions, which may differ in their ownership, objectives or business models but still face the risk of insolvency.

This measure is formally expressed as $Z - score_{i,j,t} = \frac{RoA_{i,j,t}+EA_{i,j,t}}{\sigma(RoA)_{i,j,t}}$, where $RoA_{i,j,t}$ denotes the return on assets of bank i in country j for year t, EAi,j,t represents the ratio of equity over total assets, and $\sigma(RoA)_{i,j,t}$ is the standard deviation of return on assets. We follow Beck et al. (2013) by using the full sample and a three-consecutive-year rolling window to calculate $\sigma(RoA)_{i,j,t}$ to ensure that results are unaffected by the variation of bank profitability and bank capital. In addition, the natural logarithm of the Z-score can replace the original Z-score values as they tend to be highly skewed, so we can avoid the truncation of the Z-score (Jeon et al. 2017) and become LnZ-score.

3.8.3 NPLs

As an alternative measure of banking stability, we consider the non-performing loans (NPLs) ratio that identifies problems with the quality of banks' assets. It is calculated as a ratio where loans of which the debtor has not made their scheduled payments for at least 90 days (non-performing loans) is the numerator and the total loans (including NPLs) of the bank is the denominator. A larger NPLs ratio is traditionally associated with a higher probability of banks bankruptcy and vice versa (Fiordelisi and Mare, 2014).

3.9 Measures of Competition

For the observed degree of competition, I make use of two country-level indicators: the LERNER Index and the Boone indicator.

3.9.1 The LERNER Index

The LERNER index is a common and widely used measure in the empirical literature at the individual bank level in banking research. It essentially captures the ability of a bank to set the price of output above its marginal cost as:

$$Lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}}$$

(1)

where P_{it} is the price of bank *i*'s output at time *t* measured as the ratio of total revenues to total assets, MC_{it} is the marginal cost of bank *i* at time *t*. If P_{it} - MC_{it} = 0 and hence $LERNER_{it}$ = 0, the bank faces perfectly competitive conditions and as such has no market power. A higher value of the LERNER index suggests less competition/more market power.

Following the convention in the literature (Turk-Ariss, 2010; Kasman and Kasman, 2015) and recent approaches (Ibrahim *et al.*,(2019)), I compute the marginal cost from a translog cost function with one output and three inputs written as :

$$lnTC_{it} = \alpha_0 + \alpha lnQ_{it} + \frac{\alpha_2}{2}(lnQ)^2_{it} + \sum_{j=1}^{3} \delta_i lnw_{jit} + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} \delta_{jk} lnw_{jit} lnw_{kit} + \sum_{j=1}^{3} \gamma_{jit} lnQ_{it} lnw_{jit} + \tau_1 Trend + \frac{\tau_2}{2} Trend^2$$
$$+ \tau_3 Trend \times lnQ_{it} + \sum_{j=1}^{3} \theta_j Trend \times lnw_{jit} + \varepsilon_{it}$$

(2)

where *TC* is the bank's total cost, *Q* is output measured by total assets, w_j (j = 1, 2, 3) is the price of input *j*, and *Trend* is the trend term included to capture technical changes in the cost function. The three inputs in the production are labor, funds and physical capital. The price of labor is measured by the ratio of personnel expenses to total assets. Meanwhile, the prices of funds and physical capital are measured by the ratio of interest expenses to total funds and the ratio of non-interest expenses to total assets, respectively.

Commonly applied in the literature, there is impose homogeneity and symmetry conditions in the estimation of the cost function. From (2), we may derive the marginal cost as:

$$MC_{TA_{i,t}} = \frac{\partial TC_{i,t}}{\partial TA_{i,t}} = \left(\beta_1 + \beta_2 \ln TA_{i,t} + \sum_{j=1}^{2} \beta_{2j} \ln W_{i,t}^{j} + \gamma_{4t} T\right) \frac{TC_{i,t}}{TA_{i,t}}$$

(3)

I estimate the total cost function using a combined sample of conventional and Islamic banks. Our argument is that the conventional banks and their Islamic bank subsidiaries, can share the same technology. My approach is closer to Clerides et al., 2015 where first the bank level estimates of the LERNER Index were calculated after calculating the marginal cost and the output price on the bank level and then the average of the bank estimates was used to calculate the country level index.

3.9.2 Boone indicator

The Boone indicator is used as a measure of the degree of competition calculated as the elasticity of profits to marginal costs (Boone, 2008). In our approach I follow one of the few MENA studies to empirically include Boone in their competition related estimations, that of Albaity *et al*., 2019. The Boone indicator is calculated as follows:

$\ln(\pi_{i,t}) = \alpha_0 + \beta t \ln MC_{i,t}$

(4)

where ln ($\pi_{i,t}$) and ln ($MC_{i,t}$) denote the log of profits (measured by return on assets) and marginal costs for the i^{th} bank at time *t*t, respectively. The coefficient, β indicates the Boone indicator which may take a negative or positive sign. A large negative β indicates high competition, because a bank may earn more profit by lowering its marginal cost at the expense of inefficient banks in a more competitive environment.

Both the LERNER and Boone indices require an estimation of marginal costs in their calculation. Marginal costs ($MC_{i,t}$) are cal- culated from the translog cost formula used above in (3) where $TC_{i,t}$ is the bank's total costs, $TA_{i,t}$ is the output (the total assets), W_i

is the price of the factors of production, defined as follows: W_1 is the first output (the price of purchased funds) using the proxy interest expenses divided by total deposits and short-term funding, W_2 is the second output (the price of labour and physical capital), proxied by non-interest expenses divided by fixed assets, T is the time trend that counts for the influence of technological shifts that lead to changes in the cost function over time, and ε_i is the error term.

3.10 Bank related variables

At the bank-level variables used we use was leverage and the proxy used for it is the ratio of the total equity to total assets (Lev). Berger and Bouwman (2009) demonstrated that the crisis of 2007–2008 was the result of the creation of excess liquidity by the U.S.A. banks. An analysis of leverage and liquidity was conducted by who discovered that banks with low liquidity levels and high leverage were involved in bankruptcy. In this study, leverage was measured by the ratio of total equity to total assets following Albaity et al., 2019. Hence, a higher leverage ratio means higher instability. In this study I also control for bank size, as it was expected to influence the stability of banking institutions (Fang et al., 2014). It is calculated in the bank literature as a natural logarithm of total assets (lnsize). Similarly, Tabak et al. (2012) found that large banks benefited more from competition because they enjoyed market power and diversification opportunities of their assets compared to smaller banks. Thus, large banks could ensure more stable earnings without having an incentive to take excess risk taking them financially stable. Furthermore, Schaeck and Cihák (2014) suggested that bank size enhanced bank stability through efficiency channels, arguing that, due to their significant market power, larger banks enjoy lower production costs. When large banks are systematically important banks (especially in the MENA region) in a concentrated market, their potential failure may spillover into the entire financial sector, and even the economy in general. Often, public policy bails out the large banks in difficulty. Thus, in concentrated markets, larger banks might make the banking system more fragile. Furthermore I consider capitalization, and income diversification, which are normally included in studies on bank risk and stability. The effect of capitalization on bank stability is expected to be positive since capital can serve as a buffer against adverse shocks. Finally, income diversification has a risk- mitigating effect, but, at the same time, may expose banks to volatile revenues. Following Stiroh (2004), the index of income diversification used in this study is as follows:

$$1-(IIR_{it}^{2}+NIIR_{it}^{2}),\ \text{where } IIR_{i,t}=\frac{NII}{NII+NNII};\ NIIR=\frac{NNII}{NII+NNII}$$

where IIR and NIIR represent, respectively, the interest income ratio and the non-interest income ratio. IIR is the ratio of net interest income divided by the sum of net interest income and the net non-interest income. NIIR is the ratio of net non-interest income divided by the sum of net interest income and net non-interest income.

3.11 Macroeconomic and control variables

Regarding macroeconomic variables I follow the mainstream of literature including, as in chapter 2, the GDP growth rate for capturing the business cycle effect on stability Given that investment opportunities are better during the up cycles, we expect GDP growth to have a positive (negative) influence on bank stability (bank risk).Hwever there are ,as mentioned in chapter 2 arguments that inconsistent macro policies might enhance instability. and I also include the inflation rate which is well documented in the literature that bank behaviour is influenced by the phases of the business cycle. To capture this, we incorporate GDP growth into the regression. Inflation is generally included to capture macroeconomic uncertainty or macroeconomic mismanagement. Thus, I expect its impact on stability to be negative. Apart from these macro- economic variables, we also control for the crisis episodes such as the global financial crisis by incorporating a dummy taking the value of 1 for the period 2008 – 2010 and zero otherwise in the regression.

3.12 Competition – Banking stability relationship

To start, we investigate the competition-stability relationship in MENAs dual banking system using the following dynamic panel specification with a system GMM approach. System GMM was chosen due to its robustness as a regression estimator. The GMM system's reliability is due to the assumption that the error term is not auto correlated, as well as the fact that there is consistency in the instruments considered. Hence, System GMM is built on two main specifications. To begin with, the Hansen test of over-identifying restrictions was applied to check the validity of the instruments. Then, a second test was used to verify the non-autocorrelation hypothesis. The existence of the first-order autocorrelation did not indicate inconsistencies in the estimates. This was confirmed by its second-order autocorrelation. More precisely, the two-step system GMM estimator was useful in resolving potential endogeneity problems. Regarding the stationarity of the variables, all of them passed the unit root test and were proven to be stationary. In addition, the system GMM overcomes the problem of stationarity by estimating the model at both levels and using first differences (Antoniou et al., 2008). Our general GMM regression was built on a cross-section of banks, and had the following general form:

$$FS_{i,j,t} = \alpha_0 + \gamma_0 FS_{i,j,t-1} + \gamma_1 LERNER_{j,t} + \gamma_2 Boone_{j,t} + \gamma_3 \ln size_{i,j,t} + \gamma_4 CAR_{i,j,t} + \gamma_5 LEV_{i,j,t} + \gamma_6 DIV_{i,j,t} + \gamma_7 DGDP_{j,t} + \gamma_8 \mathrm{Infl}_{j,t} + \gamma_9 \mathrm{Crisis}_{j,t} + \gamma 10 * Islamic_{i,t} + \varepsilon i,j,t$$

The financial stability measures FSi,j,t included in this study are the non-performing loan ratio (hereafter NPLs), the natural logarithm of the Z-score (LZ-score). The lag coefficient corresponds to the rate at which bank financial stability converges towards a long-run level. Two indicators of bank competition were applied: the LERNER index and the Boone indicator. In addition, lnsize, CAR, LEV, DIV, are bank level size, capitalization, leverage, diversification respectively. Our focal explanatory variables are the LERNER index and Boone Indicators. A negative and significant coefficient of the LERNER index would lend support to the competition-fragility view. Conversely, the competition-stability view is supported if the LERNER coefficient is positive and significant. Regarding macroeconomic variables, it is well documented in the literature that bank behavior is influenced by the phases of the business cycle. To capture this, we incorporate GDP growth into the regression. Given that investment opportunities are better during the up cycles, inflation is included to capture macroeconomic uncertainty or macroeconomic mismanagement.

3.13 Empirical Analysis and Discussion

The present study uses an unbalanced panel dataset of MENA commercial and Islamic banks. The sample comprises 21 conventional and 16 Islamic banks and covers the period 2004 - 2015. We draw the data on bank-specific variables from Bankscope. As we have noted above, we use the Z-score and the NPL as a measure of bank risk/stability (LNPL), the LERNER index and the Boone indicator to measure competition/market power at the bank level. The measurements of other bank-specific variables are as follows: the natural logarithm of total assets for bank size (Size); the equity to asset ratio for bank leverage (LEV); the ratio of non-interest income to total income for income diversification (DIV); the capitalization measure (CAR) is the bank's Tier 1 and Tier 2 capital over its Total assets ; Our macroeconomic variables are real GDP growth (GDPG) and inflation (Inf), which are sourced from the World Development Indicators (WDI) provided by the World Bank. Finally we use two dummies one for the global financial crisis (Crisis) which takes the value of 1 for the years 2008–2010 and 0 otherwise and the other is for the separation of Islamic banks (take value 1) from other non-Islamic banks and hence to capture the effect of Islamic Banks presence on stability.

Table 3-3 and Table 3-4 below provide the descriptive statistics for bank level and country level variables, respectively. Tables 2 shows the descriptive statistics of the variables for all of the banks as well as the Islamic banks and the conventional banks separately with their corresponding t-value. The LZ-score for the Islamic bank's sample is significantly lower than that of conventional banks, and there was a higher and significant mean of NPLs for Islamic banks compared to conventional banks which is a first indication that Islamic banks have high financial instability in MENA countries. In addition, the two proxies of competition showed low mean scores for the ROA for the full sample and closer values in the subsamples. However, the ROE is 11.08% for the full sample, which was significantly higher for conventional banks when compared to Islamic banks. The average growth rate in bank size was 8.30% for the full sample, while it was significantly higher for conventional banks compared to Islamic ones. Given that Islamic banks are relatively new compared to conventional ones, this difference was somehow reasonable. In addition, there is a clear difference in the capital structure as overall Islamic banks appear better capitalised but with higher variability compared to conventional banks. In terms of diversification, conventional banks scored higher than Islamic banks and the difference was significant. The level of leverage is significantly higher in Islamic banks, suggesting that they are highly leveraged which is partially expected due to the structure of their contracts resolving in more equity. Moving to the macroeconomic variables presented in Table 3-4, looking at the main measures of competition, the Boone indicator suggested a reasonably low level of competition compared with a low level of competition as also suggested by the LERNER index which provides some initial evidence on the level of competition in the MENA region, namely the lack of it.

Table 3-3 descriptive statistics for conventional and Islamic banks for MENA region. 2004-2015

		All banks			**Conventional banks**			**Islamic banks**			
Variables	**Definition**	N	Mean	Std. Dev	N	Mean	Std. Dev	N	Mean	Std. Dev	t-value
LZ-score	Measure of the distance of a bank from insolvency. Computed the natural logarithm of Z-score.	1856	3.35	1.09	1354	3.48	1.01	502	2.9	1.14	−9.13***
NPLs	Non-performing loans as a ratio of total loans	1977	7.48	7.32	1501	7.39	7.35	476	7.83	8.49	0.41***
CAR	Total capital ratio measured as a ratio of (Tier 1 + Tier 2) over total assets	2006	10.43	5.4	1489	11.44	1.14	517	12.4	8.7	2.55**
LEV	ratio of the total equity to total assets	2102	0.17	0.10	1678	1535	0.13	567	0.22	517	0.06**
DIV	1 - the interest income ratio and the non-interest income ratio squared	2076	0.37	0.14	1562	0.4	0.1	514	0.29	0.18	−9.74***
lnsize	Natural logarithm of total assets	2135	8.31	1.69	1535	8.21	1.58	600	7.11	1.95	−3.63***

The number of observation (N), average (Mean), standard deviation (Std. Dev), minimum (Min.) and Maximum (Max.) of the variables for all the banks, and then the conventional and Islamic banks separately. The t-value tests the significance of the differences between Islamic and conven- tional banks. Note: *, ** and ***denote statistical significance at the 10, 5 and 1% levels, respectively.

Table 3-4 descriptive statistics at the country level for MENA region. 2004-2015

Variables	Definition	N	Mean	Std. Dev	Min.	Max.
BOONE	The elasticity of profits to marginal costs	1830	−0.027	0.039	−0.10	0.04
LERNER		2139	0.28	0.19	0.10	0.62

Variables	Definition	N	Mean	Std. Dev	Min.	Max.
	The mark-up of price over marginal cost					
Inflation	CPI inflation rate	1950	3.78	4.09	−10.54	21.1

The number of observation (N), average (Mean), standard deviation (Std. Dev), minimum (Min.) and Maximum (Max.) of the country level variables. Note: *, ** and ***denote statistical significance at the 10, 5 and 1% levels, respectively.

We use the system GMM for estimating our model an approach proposed by Arellano and Bover (1995) and Blundell and Bond (1998). This approach is dynamic which allows to address potential dynamic endogeneity, unobserved heterogeneity and the simultaneity between banking stability and competition variables and other bank characteristics to attain perfect estimators. We report the result of the AR (2) second-order serial correlation tests, the Hansen J test of overidentifying restrictions and the difference in the Hansen J test of exogeneity. R

I consider both Boone and LERNER index under both Z-score and NPL banking stability measures and results are presented in table 3-5. The first lag of each of the dependent variables is positive and significant, indicating that the previous information about bank stability influenced the current level of bank stability.

Table 3-5 system GMM results for the competition-stability relationship for MENA banks. 2004-2015

Variables	LZ-score (1)	LZ-score (2)	LZ-score (3)	NPLs (4)	NPLs (5)	NPLs (6)
			Bank measures			
LZ-score t-1	0.111***	0.222***	0.201***			
	(3.205)	(3.315)	(3.315)			
NPLs (t-1)				-0.225***	-0.235***	-0.224***
				(-4.405)	(-3.315)	(-4.207)
CAR	0.115***	0.119***	0.099***	-0.129***	-0.121***	-0.157***
	(3.451)	(3.201)	(3.138)	(-3.112)	(-3.212)	(-2.902)
LEV	1.642***	1.853***	1.752***	-2.081**	-2.133*	-2.021*
	(2.315)	(2.439)	(2.137)	(-1.998)	(-1.798)	(-1.799)
DIV	0.109**	0.088**	0.091***	-0.119*	-0.126*	-0.111*
	(2.001)	(2.022)	(3.131)	(-1.934)	(-1.942)	(-1.289)
lsize	0.031*	0.022*	0.017*	-0.042*	-0.039*	-0.037*
	(1.99)	(1.98)	(1.97)	(-1.99)	(-1.992)	(-1.989)
Islamic	0.110**	0.146***	0.054**	0.012**	-0.045**	-0.385**
	(2.342)	(3.272)	(2.175)	(-2.267)	(-2.249)	(-2.369)
			Competition measures			

Boone	11.229**		14.223***	-13.223***		-13.111**
	(2.319)		(2.979)	(-2.279)		(-2.122)
LERNER	5.226***	5.360***		-1.437**	-1.211**	
	(3.012)	(3.111)		(-2.227)	(-2.125)	
Macroeconomic measures						
GDPG	-0.21***	-0.030***	-0.025***	0.019***	0.011**	0.013**
	(-3.323)	(-3.355)	(-3.126)	(3.119)	(2.265)	(2.225)
Inflation	-0.037**	-0.016**	-0.016**	0.013**	0.018**	-0.011**
	(-2.180)	(-2.123)	(-2.079)	(2.028)	(2.665)	(2.115)
Crisis Dummy	- 0.023***	-0.022***	-0.018***	0.037***	0.014**	0.021**
	(-3.112)	(-2.908)	(-2.551)	(3.001)	(2.765)	(2.665)
Constant	5.230***	5.320***	4.370***	-3.42***	-4.111***	-4.245**
	(3.122)	(3.318)	(2.601)	(-3.541)	(-2.665)	(-2.665)
Diagnostics						
Wald Chi2	103.43	102.33	98.198	97.982	92.248	93.118
# of obs.	1290	1290	1290	1290	1290	1290
AR(1) p value	0.012	0.027	0.021	0.019	0.019	0.032
AR(2) p value	0.433	0.387	0.372	0.318	0.321	0.289
Hansen p-value	0.422	0.323	0.356	0.38	0.301	0.331
Number of instruments	156	156	156	156 156	156 156	156

System GMM panel 2004-2015.The dependent variables of each regression are noted in the first line of the table. For variable definitions and sources, see Table 3 and Tables 4. Estimation method is system GMM model with t statistics reported under robust standard errors. We have treated lagged dependent variable as the endogenous variable in the GMM style instruments. For the case of transformed equation *,** and *** denote significance at 10%, 5% and 1% respectively.

Bank size appeared to have significant effect both both on LZ-score and NPLCubillas and González, 2014; Fang et al., 2014). It is found to be positive with LZ-score and negative with NPLs confirming that the larger the bank in terms of its assets the lower (higher) its instability (stability). This result is in line with other studies findings which justifies this positive relationship either that large banks could ensure more stable earnings without having an incentive to take excess risk Tabak et al. (2012) or that bank size enhanced bank stability through efficiency channels Schaeck and Cihák (2014)..

This GMM approach allows to address potential dynamic endogeneity, unobserved heterogeneity and the simultaneity between banking stability and competition variables and other bank characteristics to attain perfect estimators. This research employs the dynamic panel GMM approach proposed by Arellano and Bover (1995) and Blundell and Bond (1998). We report the result of the AR (2) second-order serial correlation tests, the Hansen J test of overidentifying restrictions and the difference in the Hansen

J test of exogeneity. For all three tests, we find that the value is statistically insignificant and as such we cannot reject the null hypotheses that no second-order serial correlation; our instruments are valid and the instruments we use in the system GMM estimation is exogenous, respectively. Results coincide and support the competition-stability view when considering both competition measures of LERNER and Boone (regression results in columns (1) and (4) from Table 3- 5). In regressions (2) to (3) for Z-score and (5) to (6) for NPLs we examine each competition measure separately and our key results are valid with statistical significance. Specifically, the Boone indicator which measures the level of competition was positive and significant using the LZ-score, but negative and significant with the ratio of non-performing loans. This outcome suggested that the higher (lower) the competition, the higher (lower) the bank's stability. This result means that competition is linked to stability. Based on the competition-stability nexus, it is observed that banks are able to earn abnormal returns results in higher profits. The findings are opposite to existing studies such as (Keeley, 1990; Fu et al., 2014) and recent studies which have also used the Boone indicator for the MENA region (to the extent of the authors knowledge the most recent is by Albaity et al., 2019. The second proxy of competition used was the LERNER index. The results showed that the coefficient of the LERNER index in the linear form was positive and significant with LZ-score negative and significant with NPLs. This confirmed the previous results of the Boone indicator of a competition-stability nexus. This indicated that higher competition could lead to less bank failures opposing several studies discussed in section 3.1 (Zoghlami and Bouchemia (2020) Albaity et al., (2019); Haque (2019) and Almarzoqi et al., (2015)) while being is in line with the argument that supports the competition-stability nexus proposed by Boyd and De Nicolo (2005), Labidi and Mensi (2015), Haque (2018) and Elfeituri (2020).

With regard to the effects of bank control variables on stability findings of positive and significant coefficients for CAR, LEV and DIV suggest that all promotes stability. The higher are, the bank's Tier 1 and Tier 2 capital over its Total assets, the equity to asset ratio and the ratio of non-interest income to total income the stability improves. The positive effect of capital to assets ratio on stability suggests that the higher is the amount of capital a bank maintains the easier can absorb losses to continue functioning during time of financial distress and ensure solvency and stability. The leverage ratio (LEV) was found to be positive with LZ-score and suggests that a strong leverage ratio requirement leads to a significant decline in the distress probability of highly leveraged banks and leads to increased bank solvency. This relationship was also supported by the negative and significant leverage coefficient with the NPLs. In other words, the higher equity in the leverage ratio leads to a lower leverage ratio which translates to lower NPLs indicating higher stability. Conversely, for the LZ-score, the higher the equity in the leverage ratio, the lower the leverage ratio leading to a high LZ-score implying high stability (Clark et al., 2018, Acosta-Smith et. al.(2020)).. Finally, the crisis dummy, as expected, present a negative sign which is the overall effect of the Global financial crisis on the MENA region, mostly through the foreign bank branches and foreign investments which were adversely affected.

The Islamic bank variable comes once again, as in our empirical study in chapter 2, as positively contributing to bank stability, once again indicating that the presence of Islamic banks promotes stability in the MENA region.

We further expand our initial model to estimate the interaction of market power with distress, already explored in chapter 2, and exploit a channel whether banks with different market power affect(mitigate or enhance) distress' impact on stability.

$$FS_{i,j,t} = \alpha_0 + \gamma 0\, FS_{i,j,t-1} + \gamma 1\, LERNER_{j,t} + \gamma 2\, Boone_{j,t} + \gamma 3 \ \ln size_{i,j,t} + \gamma 4\, CAR_{i,j,t}$$
$$+ \gamma 5\, LEV_{i,j,t} + \gamma 6\, DIV_{i,j,t} + \gamma 7\, DGDP_{j,t} + \gamma 8 \ \mathrm{Infl}_{j,t} + \gamma 9 \ \mathrm{Crisis}_{j,t} + \gamma 10 * Islamic_{i,t}$$
$$+ * \gamma\ 11\left(Lerner * Distress_{i,t}\right) + \gamma 12\left(Boone * Distress_{i,t}\right) + \ \varepsilon i,j,t$$

In order to mitigate unobserved heterogeneity for MENA banks, the Arellano and Bond (1991) GMM estimation is employed using lagged of dependent variable to deal with the endogeneity issue. Table 3-6 provide the estimation results. This latter approach is dynamic which allows to address potential dynamic endogeneity, unobserved heterogeneity and the simultaneity between banking stability and distress variables and other bank characteristics to attain perfect estimators. This research employs the dynamic panel GMM approach proposed by Arellano and Bover (1995) and Blundell and Bond (1998). We report the result of the AR (2) second-order serial correlation tests, the Hansen J test of overidentifying restrictions and the difference in the Hansen J test of exogeneity. For all three tests, we find that the value is statistically insignificant and as such we cannot reject the null hypotheses that no second-order serial correlation; our instruments are valid and the instruments we use in the system GMM estimation is exogenous, respectively.

We firstly observe that the size and sign of the control variables is not significantly changed. Looking at the interactions effects we notice that distress either interacts with LERNER or with Boone market power indices give the same direction of effects. That is, when distress is present competition positive effect on stability is not enough to mitigate the negative effect of distress. The coefficient remains negative and significant. Furthermore, we notice that in terms of magnitude the negative effect of medium and high distress on stability is higher when interacts with market power as presented by LERNER and Boone indicators. Overall, our results reaffirm results in chapter 2 that the degree of distress is detrimental to bank stability over counter balance any positive effect coming from regulatory or competition factors.

Table 3-6 System GMM results for the competition-stability relationship with interaction of bank distress with competition for MENA banks. 2004-2015

	Ln Z-score				NPLs			
Variables	1	2	3	4	1	2	3	4
				Bank measures				
LZ-score t-1	0.111***	0.222***	0.201***	0.201***				
	(3.205)	(3.315)	(3.315)	(3.315)				
NPLs (t-1)					-0.202***	-0.215***	-0.215***	-0.229***
					(-4.405)	(-3.325)	(-3.365)	(-4.009)
CAR	0.150***	0.123***	0.099***	0.087***	-0.119***	-0.131***	-0.111***	-0.117***
	(3.351)	(3.221)	(3.138)	(3.221)	(-3.112)	(-3.212)	(-3.212)	(-2.902)
LEV	1.342***	1.883***	1.752***	1.854***	-2.081**	-2.133*	-2.133*	-2.021*
	(2.215)	(2.439)	(2.137)	(2.117)	(-1.998)	(-1.798)	(-1.798)	(-1.799)
DIV	0.099**	0.088**	0.091***	0.084***	-0.119*	-0.126*	-0.126*	-0.111*
	(2.001)	(2.022)	(-3.131)	(2.431)	(-1.934)	(-1.942)	(-1.942)	(-1.289)
lsize	0.034*	0.032*	0.017*	0.021*	-0.042*	-0.039*	-0.043*	-0.047*
	(1.99)	(1.98)	(1.89)	(1.91)	(-1.99)	(-1.992)	(-1.992)	(-1.989)
Low distress	0.014**				-0.018**			
	(2.206)				(-1.999)			
Medium Distress		-0.012***				0.011***		
		(-3.021)				(3.071)		
High Distress			-0.017***				0.013***	
			(-3.183)				(3.183)	
Distress Dummy				-0.034***				0.066***
				(-3.171)				(3.211)
Islamic	0.112**	0.116***	0.094**	0.087**	-0.122**	-0.116***	-0.094**	-0.087**
	(2.342)	(2.679)	(1.975)	(2.267)	(-2.012)	(-2.559)	(-1.975)	(-2.267)
Inter Rate	-0.038	-0.065	-0.056	-0.078	-0.038	-0.065	-0.056	-0.078
	(-1.204)	(-1.041)	(-1.019)	(-0.904)	(-1.204)	(-1.041)	(-1.019)	(-0.904)
				Macroeconomic Variables				

GDP growth rate	-0.020**	-0.041***	-0.028**	-0.044**	0.022**	0.049***	0.042**	0.040**
	(-2.353)	(-2.455)	(-2.186)	(-2.266)	(2.353)	(2.455)	(2.186)	(2.266)
GDP per capita	0.035**	0.028**	0.023*	0.021**	-0.035**	-0.024**	-0.021*	-0.023**
	(2.212)	(2.221)	(1.922)	(2.073)	(-2.312)	(-2.261)	(-1.922)	(-2.073)
Inflation	-0.037**	-0.026**	-0.036**	-0.023*	0.027**	0.022**	0.032**	0.022*
	(-1.990)	(-2.223)	(-2.079)	(-1.928)	(1.987)	(2.123)	(2.019)	(1.928)
Crisis Dummy	-0.008	-0.006*	-0.022*	-0.122*	0.008	0.006*	0.022*	0.112*
	(-1.414)	(-1.842)	(-1.913)	(-1.942)	(1.814)	(1.862)	(1.917)	(1.942)
Competition								
LERNER	0.095***	0.098***	0.092*	0.091**	-0.091***	-0.111***	-0.192*	-0.191**
	(3.212)	(3.0161)	(1.522)	(2.073)	(-3.312)	(-3.061)	(-1.522)	(-2.073)
Boone	0.016***	0.015***	0.013***	0.033**	-0.016***	-0.015***	-0.013***	-0.033**
	(3.019)	(3.065)	(2.326)	(2.229)	(-3.019)	(-3.065)	(-2.636)	(-2.229)
Competition Distress Interaction								
LERNER	0.095***	0.098***	0.092*	0.091**	-0.091***	-0.111***	-0.192*	-0.191**
	(3.212)	(3.0161)	(1.522)	(2.073)	(-3.312)	(-3.061)	(-1.522)	(-2.073)
Low Distress * LERNER	0.033**				0.031**			
	(2.093)				(2.093)			
Medium Distress * LERNER		-0.048**				0.058**		
		(-2.162)				(2.222)		
High Distress * LERNER			-0.022**				0.018**	
			(-2.212)				(2.212)	
Distress Dummy * LERNER				0.028**				0.028**
				(2.162)				(-2.162)
Low Distress * Bone	0.020**				0.020**			
	(2.096)				(-2.096)			
Medium Distress * Boone		-0.061***				0.041***		
		(-2.219)				(2.543)		
High Distress * Boone			-0.010**				0.018**	
			(-2.285)				(2.333)	
Distress Dummy * Boone				-0.120**				0.090**
				(-2.212)				(2.234)
Constant	4.013***	5.022***	5.008***	5.017***	4.013***	5.022***	5.008***	5.017***
	(-3.422)	(-3.818)	(-3.685)	(-3.791)	(-3.422)	(-3.818)	(-3.685)	(-3.791)

Diagnostics								
Wald Chi2	108.43	101.33	101.54	98.92	97.982	94.67	93.22	93.99
# of obs.	1200	1200	1200	1200	1200	1200	1200	1200
AR(1) p value	0.009	0.011	0.021	0.019	0.022	0.021	0.027	0.0329
AR(2) p value	0.333	0.337	0.372	0.318	0.328	0.321	0.319	0.289
Hansen p-value	0.399	0.323	0.356	0.345	0.321	0.301	0.322	0.331
Number of instruments	138	138	138	138	138	138	138	138

System GMM panel 2004-2015.The dependent variables of each regression are noted in the first line of the table. For variable definitions and sources, see Table 3 and Tables 4. Estimation method is system GMM model with t statistics reported under robust standard errors. We have treated lagged dependent variable as the endogenous variable in the GMM style instruments. For the case of transformed equation *,** and *** denote significance at 10%, 5% and 1% respectively.

3.14 Conclusions

In this chapter, I expand on the banking stability notion with a twofold aim. The first part involves looking at both theoretical and empirical literature on a key debate which remains up to date: what is the relationship between banking stability and competition across the globe? By combining studies that cover different regions, countries time horizons and types of banks I provide an in-depth assessment on the two prevailing answers: The competition stability view versus the competition fragility view, with ample mixed evidence provided. From the analysis it becomes immediately clear that although microeconomic theory considers a competitive (in contrast to a monopolistic) market structure desirable to ensure efficient allocation of limited resources, the question of whether competition is the ideal form of market structure in the banking industry is still open and debatable. The conclusion depends on how market structure or competition changes alter banks' charter value, moral hazard and assets-liabilities risk-taking strategies. My analysis ,although basic theoretical issues are covered, is focused, , mainly on empirical research, and we include a) studies that directly investigate the effect of bank market power or competition or concentration on bank risk-taking or bank stability b) studies that explore how the competition-stability relationship is affected when other banking characteristics such efficiency, profitability, liquidity are taken into account and c) studies that although not directly exploring issues relating to competition-stability as such, have risk/stability and competition/concentration variables present in their estimated models and provide some indication/evidence on our issue of concern.

Among other results, I notice the increased usage of the LERNER Index with alternative measures being developed both in the case of single country studies and across multiple regions. More recently, the Boone indicator as a measure for banks competition level has been used extensively but is still lacking in applications in the context of emerging markets, with alternative measures and econometric specifications trying to capture the linear and nonlinear relationship between stability and competition. It became apparent that the simplest version of - score as a measure of bank stability with over 75 studies employing it while the NPL risk-taking measure is also alternatively used in 38 studies.

A striking result from the analysis, is that the groups of MENA, GCC, ISLAMIC vs Conventional and many Islamic countries studies from the "Single countries" group sum up to 70 studies or 28% of the total. This development is related to the cautious relaxation in the 80's and further acceleration in the 90's of banking restrictions in many Islamic countries that allowed the entrance and coexistence of conventional with Islamic banks, the presence of Islamic banks in non-Islamic countries such as UK, USA, Luxembourg, Germany, and the provisions to allow Islamic banks to provide banking products resembling conventional ones. All these changes have increased the role of Islamic banking in the world financial system and its importance for banking industry stability and in parallel has caused the academic interest in Islamic finance and banking to soar.

This led me to the second part of the twofold aim: empirically test the relationship between banking stability and competition using a large sample with both Islamic and conventional banks for 19 MENA countries from 2004 to 2015. To do so we consider the most prominent measures of competition, the LERNER index and the Boone indicator. Our key contribution is by using an extensive sample over a less investigated region such as the MENA, to uncover new evidence finding a positive relationship between competition and stability under different specification models, while considering a range of bank, macroeconomic and other control variables.

The two-step system GMM results demonstrated that both the Boone indicator and the LERNER index had a negative and significant effect on the LZ-score, ROE and ROA, and a positive and significant effect on the NPLs ratio, demonstrating that increased competition was associated with low bank stability and profitability, and high insolvency risk. This result suggests that banks' market power from high profitability is eroded in a highly competitive market, which exacerbates the risk-taking tendency of the banks to offset the lost profitability that tends to make them fragile. This finding implies that the most stable banks in MENA countries come from less- competitive markets. In addition, the results of the non-linear models using the quadratic terms from both the Boone indicator and the LERNER index, confirm the existence of a non-linear relationship between competition and bank stability in MENA countries. Competition among local banks must be controlled while increasing the government's grip on banks. In addition, stricter supervision of large banks is necessary to avoid destabilizing the whole economy. Moreover, governments and central banks in the MENA region should always review the licensing process of new banks to enhance both the quality of new banks as well as controlling the level of competition. In the analysis, the system GMM estimates further demonstrated that the competition-stability relationship was strengthened. This result in further reinforced by additional analysis which points that Islamic banks are less competitive, and increased competition exacerbated their risk-taking behavior compared to conventional banks. Future analysis can benefit from this approach and potentially decompose further the effect of Islamic banks by considering their relevant size in the banking market as is the case for Islamic banks which are concentrated in the six countries of the Gulf Cooperation Council. According to the findings, central bank and supervisory authorities should moderate and lower barriers to entry to increase the competition from new banks. In summary, the main results suggested that banks facing more competition accept less insolvency risk and credit risk. Therefore, the results support the competition-stability theory of Boyd and De Nicolo (2005) while clashing with many of the studies for MENA countries which find evidence in favor of the Competition fragility. The results further suggest that the Islamic banks presence enhance stability and competition-stability relationship is stronger for Islamic banks compared to conventional banks in the MENA region. Finally the interaction of distress with market power suggested that as long distress is present its negative effect on bank stability remains significant despite the positive effect of competition.

The findings suggest policy implications for promoting bank stability in MENA countries and future research with the use of different competition measures. Specifically, prudent liberalization to promote competition may make the banks more stable in MENA countries. To promote bank stability in MENA countries, the regulators might consider the channels among the policies are “passed on” to existing banks through merger and acquisition initiatives. This by no means suggests that measures which promote clear rules on the competitive structure of the banking industry should not be imposed. What is suggested through the analysis is to potentially allow over time for some competitive pressure on existing banks while considering the increase of the possibility of failure in concentrated markets, especially for small and medium banks. In these cases, activity restrictions may be imposed on the banking market. In this regard, regulators could continue to reinforce a capital adequacy framework by paying greater attention to efficiency as it has been consistently proven to improve bank stability by allowing sufficient buffers during both period of distress and periods of growth for banks.

Chapter 4 Interrelationships between bank competition, stability and efficiency: a single stage estimation model.

4.1 Introduction

The empirical investigation of the bank competition-stability nexus, as we have explained in previous chapters, is a non-conclusive issue. The two principal and contrasting theoretical views are the competition-stability(C-S) and the competition-fragility (C-F) as introduced by Kelly (1990) and Boyd and De Nicolo (2005) respectively. Academic research on empirical grounds in the last three decades continues to provide opposing answers on whether competition in the banking market produces a stable, sound, and solvent banking system or makes it more fragile and insolvent. However, during the decades of relevant research, we have witnessed two major developments. First, the measurement formulas of bank concentration or competition and bank stability or fragility concepts have embodied major changes so to bring them closer to their theoretical background. The measurement of competition is widely based on the structural indicators of LERNER and Boone while the Z-score indicator is the favourable bank overall stability measure along with the NPL ratio for bank's risk-taking/credit risk. Second, the fast-growing literature on econometric estimation techniques with all its variations make their employment in estimation reduce to a great extent the ambiguity about the results' robustness.

Furthermore, the empirical examination of the impact of competition on stability was carried out with stability being the dependent and competition being the major explanatory variables along with some control bank-specific and/or country-specific variables. However, such an approach could not provide any indication for the channels through which such positive or negative relationships exists within the banking industry. Therefore, academic research, turn its focus to other bank market variables as candidates for the intermediation role in the competition-stability issue. Bank efficiency was the immediate choice as the conduit variable. This choice was influenced by the fact that the banks' efficiency measurement, its comparison among banks and countries and its relationships with other bank market variables had already been a research theme of interest for both academia and decision makers (Berger *et al*. (1993), Berger and Mester (1997), Berger and Humpery (1997), Webb (2003), Fiordelisi *et al.* (2011)). A special stream of academic research has focused its interest on exploring the relationship of efficiency with market structure/competition and with risk-taking/stability. The findings with respect to efficiency-competition and efficiency-stability relationships help explaining the chain of reactions from competition to stability. However, the estimations so far do not provide a unanimous answer to these relationships.

Bank efficiency refers to the level of performance of the bank with respect to maximum output or maximum profits or minimum cost. Overall efficiency is a broad concept and consists of a range of efficiency sub-categories such output, profit, cost, technical and scale efficiency. Every such sub-category refers to a situation that bank managers' practices attain the maximum output that brings maximum profit by using the best technologically combination of the minimum amount of inputs that minimizes cost. The attainment of such an idealistic maximising situation for a bank's performance is dependent and influenced by many endogenous and exogenous factors of the banking industry organization. Special attention has been given, however, to cost efficiency since is closely interrelated with and plays a major role for overall bank efficiency or economic efficiency or x-efficiency. Cost efficiency measures how best a bank uses its available inputs to produce the targeted amount of products/services and if there is still room for increasing output without increasing inputs(cost) then the bank is cost-inefficient, non-profit maximising and there is 'waste' of scarce resources. In other words, cost efficiency gives a measure of how close a firm's cost is to what a best practice firm's cost would be for producing the same output bundle under the same conditions.

In the literature on efficiency and especially on cost efficiency there are studies that examine the relationship of efficiency with market power/competition and studies that explore the relationship of efficiency with risk/stability and a third group that examines the simultaneous relationship among efficiency, competition, and stability.

There are two methods so far employed to measure cost efficiency. First is the 'accounting ratios' method where efficiency is measured by bank's operational ratios computed from bank's balance-sheet data (Vittas, 1991). The other widely used method is the frontier function analysis either using the non-parametric linear programming DEA (Data Envelopment analysis) or with parametric SFA (Stochastic Frontier Analysis) model where both originated from the pioneer theoretical work of Farrel (1957).

The present paper within the context of estimating the relationship between bank market power/completion on bank stability takes a sample of countries that comprise the MENA region covering the time span 2004-2015 for over 280 banks in 21 countries providing new evidence in the ongoing debate regarding the relationship between bank and cost (in)efficiency.

The choice of MENA region is justified by the fact that this region is very important since it includes the GCC oil rich countries and is a bridge connecting developed and developing countries in Europe Asia and Africa and that makes its financial sector vulnerable to economic and financial crisis. Its growing banking industry up to the 90s was dominated by Islamic state banks and characterized by low freedom in bank activities. However, in the last decades in line with worldwide globalisation and banking deregulation, MENA and more widely Arab countries have experienced bank mergers, limited but continuous relaxation of banking restrictions, facilitation of foreign banks entry and banking regulation reforms. Furthermore. as Prasad et al. (2016) mention, MENA, GCC and non-GCC countries have proceeded to the progressive implementation of Basel III accord since 2014. The bank market structure in this region has been explored in many papers and results from early studies **(**Al Muharami et al. (2006), Ariss-Turk (2009) and more recently Prasad et al. (2016) tend to conclude that the MENA banking industry operates close to a monopolistic competitive environment. In other words, the lack of competition in the MENA region overall and specifically its banking sector is far from describing it as a clear monopoly. Last, but not least, up to now the number of studies reported for banking-stability issue for MENA region is limited and so this study should be very welcome.

The innovation of our completion-stability model is fourfold. First, for the first time it combines and investigates the interrelationships between competition, stability, and efficiency for the MENA region. Second, we use Boone indicator which has not so far been employed under the current format in the MENA region (to the extent of the authors knowledge). Third we estimate and use the stability-efficiency measure which has never been used in MENA studies and has rarely been used in general. Fourth, but most important, we built up a novel internally consistent econometric model which allows the interdependence of cost and stability inefficiencies both determined by the same set of predetermined variables and finally their joint estimation with the Boone indicator. All the variables of interest involved –cost efficiency, stability efficiency and competition - are estimated jointly within a unified model that allows the interpretation of their relationship using a common base. At the same time, we avoid the problems associated with the widely used practice of two stage modelling where first one estimates the cost function to obtain cost inefficiency estimates and then use the latter to have the competition index measure which is the explanatory variable of the stability dependent variable. Our model avoids the two-stage analysis problems since they "suffer from multiple econometric problems as well as lack internal consistency/validity" abstract (Tsionas, et al. (2018)). Finally, an overall contribution is the assessment of bank and cost inefficiency from multiple outputs that give a "range" of results with normal distribution assumptions allowing for internal comparison but also comparison of results across the literature shedding new light in a continuously evolving topic of bank and cost efficiency.

More analytically we build up a model based first on the stochastic frontier estimation of cost inefficiency which has never been used so far in the context of the competition-stability issue. Secondly, we do not use the conventional Z-score indicator but instead we use a trans log specification of it to estimate the stability-inefficiency also estimated by Fang et al. (2011) and Tabak et al. (2012). This measure estimates how close a bank's Z-score is to the maximum Z-score which is modelled as a stochastic frontier and hence is supposed to provide more robustness results.

As mentioned above we also employ the Boone competition indicator (Boone (2004, 2008) which has so far been used only once and this for the GCC region (Saif-Alyousfi, et al. 2020). The Boone competition variable is born out of the efficiency, profitability, and cost variables. Its main idea is that competition rewards efficiency and therefore in a competitive environment a bank with high-cost efficiency gain profits/market share in contrast to less efficient banks whose profits shrink. In other words, as competition intensifies, there is a reallocation of profits and market shares from less efficient to more efficient banks. The coefficient that is estimated from regressing marginal cost on profit/market share is the Boone index and it is the elasticity of profits/market with respect to marginal cost. As in the LERNER competition index, the problem of estimation of the unobservable marginal cost (MC) remains. The widely method used for MC estimation, apart from using average variable cost instead, is the usage of a translog cost function. In our model such a translog approach is used and we assume a composite error term which is disentangled into a standard random error term and the inefficiency term which accounts for bank's cost inefficiency. This allows for a connection with cost-efficiency/inefficiency that determines the competition intensity in the Boone indicator.

The remainder of the study is organised as follows. Section 2 reviews the relative literature on the relationship of efficiency with competition and stability. Section 3 and 4 describes the research model, the data structure and its econometrics specifications, respectively. The results are presented in section 5 and section 6 concludes.

4.2 Literature review

Financial institutions' soundness and stability is most desirable since a collapse of banks causes the whole economy to experience economic turmoil with severe long lasting economic depression and undesirable social costs. The world economy has experienced such crises at the country (Argentina 1997-98 and 2001-2002), regional (Asian 1997-98) and global level (2007-2009) in the last century Kose et al. (2020). Therefore, great academic interest has been expended to analyse and investigate the causes of banks insolvency and to provide advice to banking authorities for forecasting and future crisis management. Among a plethora of bank specific, institutional, country and regional-specific variables, the bank market structure and the level of competition in the banking market has a prominent position. The question of whether competition is the ideal form of market structure in the banking industry is still open and debatable. In other words, the level and change of competition or market power in the banking industry is accepted as a factor that has a significant impact upon the stability of the banks, but the question remains if it jeopardizes or enhances bank stability. There are two main opposing theories that answer this question, and both have a strong empirical background. The two seminal papers that initiated the academic debate on the competition and stability relationship are the Keely (1990) competition-fragility view arguing that bank competition enhances bank fragility (also called the charter value hypothesis) and the Boyd, De Nicolo (2005) competition–stability view which argues that bank competition promotes bank stability.

4.3 Analytical background reasoning

In particular Keely (1990), analyzing the behavior of the US banking system (the 150 largest banks) in the pre and post deregulation periods of the 70s and 80s, documents that the decline of charter value (the difference between the market value of a bank and its book value) of banks in 70s was followed by banks failure in 80s. He then rationalized this phenomenon on the grounds that deregulation (relaxation of entry restrictions) opened up competition (measured by Tobin q index) which in turn pressurized profits, monopoly rents and reduced bank's charter value. The banks' reaction in order to reverse such a situation is to choose more risky portfolio strategies which finally make banks less sound and more fragile. This is the well known as charter value hypothesis. Two studies by Elijah and Staidenberg (1996) and Demsetz. et al. (1996) following Keely's paper rational and extending Keely's empirical research to saving and loans institutions argue that results strongly support the competition-fragility hypothesis. Following the same theoretical path Matutes and Vives (2000) and Vives (2010) find that competition increases bank risks although they stress the role of regulation for controlling the competition- stability trade-off. Furthermore Allen and Gale (2000, 2004) in their theoretical model argue in favour of large banks and less competition since a) competition decreases banks' buffers and their reaction to keep or increase buffers is to take more risk b) in competitive markets with many small banks there will be no ability or willingness to support them through the interbank lending and put them in danger of failure and c) the lack of large banks that can earn high profits through profitable innovative financial products limits available buffers against distress situations. An additional argument against more competition in the banking industry is the inherent information asymmetry pertaining in a competitive market since the collection of information about borrowers' status is too costly. In other words, a small number of banks but of large size are able to undertake stringent monitoring of borrowers leading to safer lending which enhance bank stability, a view supported by Petersen and Rajan, (1995) and Hauswald and Marquez (2006).

As mentioned above the prelude to the competition-stability view is a paper by Boyd and De Nicolo (2005) and Boyd et al. (2006) where they look upon the issue from the asset side of the bank, the borrower. Their theoretical model allows for competition in both deposits and loans markets and considers the borrower's reactions to loan rates and other lending terms changes. Under competition conditions borrowers enjoy low loan rates and their investments' rate of success, ceteris paribus, increases in parallel with their profits. This, from the bank's point of view, makes the repayments of the loans safe and reduces the likelihood for banks to default. The same rational is expressed in a study by Boyd et al. (2010) investigating the crisis' determinant channels. Their results deny the trade-off between competition and stability and declare that that "Results in the current paper suggest that this (competition-fragility) finding is incorrect, and that the relationship is actually of opposite sign'' (p.30). Furthermore, they argue that when bank market power increases the result of higher interest loan induce borrowers to undertake risky projects and hence bank's portfolio becomes riskier and banks stability is jeopardized. Another argument supporting the competition-stability is the 'too-big-to-fail' concept which became well known in the aftermath of the recent financial crisis. These large banks created in a non-competitive market become so crucial to the economy's stability that they know ex-ante that in the case of distress the supervisory and government will not let them default. Knowing this in advance, bank managers are prone to risky projects with a result of increasing bank fragility Mishkin (2006), Uhde and Heimeshoff. (2009) and Barth et al. (2012).

Although, both the above two opposing views have theoretical and empirical support a reconciling view is documented in a paper by Martinez-Miera, Repullo. (2010). It is argued that the different and opposing views so far are the result of assuming a linear relationship between competition and stability. However, the model proposed assuming a non-linear relationship (usually a quadratic form with a U shape) can accommodate both opposing views. Depending on the level (high or low) of competition the degree of stability can be increasing or decreasing. The U shape is the outcome of opposing effects that competition causes when is increasing: the risk-shifting stability effect and the margin fragility effect. The lower loan rates as a result of competition either make borrowers investment projects profitable and easy to pay back and hence reduce credit-risk and increase stability of banks or makes banks' revenue (returns) fall and squeeze profits and buffers which in turn induce banks to invest in risky assets resulting in higher degrees of fragility. A number of empirical studies support the concavity of the relationship.

4.4 Related empirical evidence.

The theoretical opposing views have produced extensive empirical studies with results supporting each view. The variety of empirical studies exploring the stability and fragility relationship with competition cover many dimensions such as geographical (single country or cross-countries), time span and control variables (bank specific and country specific) in their sample data. Of course, there are various econometric techniques applied in the estimation procedure although the panel GMM is mostly used due to the nature of the data.

For example, Beck et al. (2006) in their study of 69 countries for 1980-1997 found that countries with concentrated bank markets are less prone to crisis. On the opposite, Berger et al. (2009) based on an international sample of 8235 banks from 23 developed countries argue in favour of the competition-fragility view since higher market power is associated with an increase in bank solvency. Yeyati and Micco (2007) using a sample of 8 Latin America countries examine how foreign market penetration affected competition and stability. Their finding argue that foreign market penetration lowers competition but since competition is negatively correlated with risk, hence stability increases. In a different direction of analysis, Schaeck et al. (2009) explore the link between competition and bank crisis events that occurred in 45 countries from 1980 to 2005. They find that bank failure likelihood decreases under competition. Anginer et al. (2014) use a sample of 1872 banks from 63 developed countries employ the LERNER competition index and Distance to Default (DD) bank failure measure to find out that competition is positively related to bank's solvency. Turk-Ariss (2010) takes a sample of 821 banks in 60 developing countries and using LERNER and Z-score finds that as market power increases profit efficiency also increases and overall stability is boosted.

In more recent analysis such as Davis et al. (2020) for the period 1999-2015, takes a sample of 112 advanced and emerging countries and through a GMM model estimates the relationship between LERNER and Z-score. Findings support the competition-fragility view for both the complete sample and for sub-samples of advanced and emerging countries. Li (2019b) explores influence of bank capital and competition (LERNER and PR-H indicators) on bank-risk taking (Z-score) behaviour for a sample of 118 developed and developing countries covering the 2001-2016 period. The finding indicate that competition measured both with LERNER and PR-H show that greater market power makes banks to reduce their risk-taking and induce their stability.

Two recent studies by De-Ramon et al. (2018, 2020) consider a sample of 250 banks for the years 1994 to 2014 and using OLS and quantile regressions explore the competition stability relationship for the U.K. Competition is proxied by LERNER, LERNER-adjusted and Boone while for stability the authors use Z-score and its components. The results from OLS regressions on average support the competition-fragility view. The results from quantile regressions indicate that the effect of competition on stability is dependent on the bank's risk level. Increase in competition in low-risk banks lowers stability in contrast to the case of high risk banks.

Jiménez et al. (2013) collect data for 107 banks in Spain for the period 1998-2003. Using a first difference GMM estimation model, concentration indices and LERNER indicator measure of competition are regressed upon loan risk NPL ratio and they find clear support of the Martinez-Repullo non-linear relationship between concentration and stability. Also, the results support the competition-stability view and this view is more "intense" when using the competition index (LERNER).

A group of papers explores the competition-stability within the context of dual banking systems where Islamic and conventional banks coexist. The first attempt is the paper by Cihak and Hesse, (2008) where they collect data for 77 Islamic and 397 conventional banks operating in 18 Islamic countries. They use only the HHI concentration measure and Z-score for bank stability. OLS estimates find that small Islamic banks are sounder than small commercial and large Islamic banks and those large commercial banks are safer than large Islamic banks. The results also find that for the all-banks sample and for the large-banks sample, as concentration is increasing, stability is decreasing supporting the concentration-fragility view. In the last decade, a number of studies have compared the competition effect on stability for dual banking systems. Two papers by Louati et al. (2016) and Louhichi et al. (2019) utilize the same sample of 34 Islamic and 139 conventional banks operating in 10 Islamic countries. Both use LERNER and Z-score but the former study has estimations based on the SUR model and the latter uses GMM. The results from the whole sample support evidence that market power and stability are positively related and hence support the competition-fragility view which also holds for both types of banks.

In the context of our analysis, the existing literature for the MENA region is rather limited. Some of the first studies that indirectly provide some evidence on competition-stability issues (to the extent of the authors knowledge) for MENA region are those by Rajhi and Hassairi (2013) where they investigate the stability of conventional and Islamic banks and their determinants, along with Srairi (2013) within the context of examining the role of ownership and stability in MENA banks. Both studies use only concentration indices the former HHI and the latter CR3 while both use Z-score as a stability measure and panel OLS estimation models. Srairi (2013) covers a short period of 2005 to 2009 and the sample includes 10 MENA countries with 143 banks. Rajhi and Hassairi (2013) covers a longer period of 9 years 2000-2008 and a very large number of banks (557) from 10 MENA and 6 non-MENA Asian countries. Their findings agree that concentration is positively related to stability. In other words, the

MENA banking system which is concentrated and dominated by state controlled banks enjoys stability.

Gonzalez et al. (2017) try to test the relationship between competition and bank stability uses a sample for 356 banks operating in 19 MENA countries during the period 2005–2012. The PR-H indicator for competition along with the HHI concentration index is the main explanatory variables of the Z-score and NPL ratio stability measures. Panel OLS with fixed and random errors are estimated and findings show a significant non-linear U-shaped relationship. However, when the linear relationship is estimated findings for Gulf countries support the competition-fragility view and for non-Gulf countries group competition is positively associated with stability. A recent paper by Albaity et al. (2019) explores the effect of competition on bank stability using data from 160 conventional and 57 Islamic banks across eighteen MENA countries between 2006–2015. The Boone and LERNER indicators are employed with NPL credit risk variable and Z-score for overall stability. The two-step GMM model is estimated, and the findings document a negative and positive effect of the LERNER and Boone indicators upon Z-score and NPL respectively supporting the competition-fragility hypothesis. This competition-fragility effect is also found to be stronger for Islamic compared to conventional banks. The same result is found in the paper by Zoghlami and Bouchemia (2020) which examines the effect of concentration (HHI) competition(LERNER) and profitability(ROA,ROE) upon stability (NPL ratio). The sample used consists of 197 banks operating in the MENA region during the period 2011–2018 and both Panel OLS and GMM models are estimated.

The only study that finds support of the competition-stability view comes from Haque (2019) within the context of investigating how ownership structure and bank regulations individually and interactively influence the risk-taking behaviour of a bank measured with Z-score and NPL ratio. The competition (LERNER index) appears as a control variable and findings from the estimated GMM model show a negative relationship only with Z-score (default risk) that support the competition-stability view. This view is supported only with portfolio risk when the sample split into pre and post global financial crisis period.

Overall, given the fact that banking systems of MENA countries are characterised by higher concentration of ownership, a strict regulatory structure and monopolistic competitive conditions (Prasad et al. 2016) distributes to competition a negative role with respect to stability. The studies performed so far are not only limited in number but also in the measures and estimation models used. Therefore, the issue of stability and competition indeed needs further exploration for the MENA region with new measures and models to the stability of the banking system.

4.4.1 Efficiency and Market Power

The in-between role of bank efficiency in the competition stability relationship has raised relevant literature to explore the two sides of the relationship of efficiency with market power/competition and risk/stability.

The two theoretical frameworks that justify the negative or positive sign of the relationship between cost efficiency and market power are the Quiet Life Hypothesis (QLH) also known as competition – efficiency and the efficiency structure hypothesis (ESH) also mentioned as the competition-inefficiency model respectively.

The QLH argues for a negative relation between market power and efficiency. Hicks (1935) argued that managers of monopolistic enterprises that are insulated from competition are enjoying extra rents, and this may be motivate them to avoid effectively enacting their managerial duties to reduce cost and enhance cost efficiency. Hicks (1935) names this practice the "quiet life. Therefore, if QLH holds we expect a negative sign since higher market power (low competition) causes a deterioration of cost efficiency. The opposite view of ESH as presented by Demsetz (1973) postulates that more efficient firms will better compete with less efficient firms so will gain higher market share resulting in higher bank concentration and market power. Therefore, a positive relationship is established between efficiency and market power.

Empirical work on the nexus between bank cost efficiency and market power has provided studies with mixed results. Studies by Berger and Hannan, (1998) for US and Delis and Tsionas (2009) applying the local maximum likelihood methodological approach to a sample of European Monetary Union over the years 1999-2006 agree that greater market power is accompanied by efficiency losses as suggested by the QLH. The QLH is rejected and a positive relationship between cost efficiency and market power is found in the studies by Weill (2004) for the banking markets of 12 European Union countries during the period 1994-1999 and in the study by Andries and Capraru (2014) for EU27 for the period 2004-2010. Furthermore, two studies by Koetter *et al*. (2012) for the US and Koeter and Vins (2008) for German saving banks find clear evidence that support the QLH. A number of studies however support the contrary view of ESH. A study by Casu and Girardone (2006) uses a sample of European union banks from five countries over the period 2000-2005. Employing Granger causality tests, they find that market power increase does not reduce cost efficiency but rather increase it. Maudos and Fernadez-de Guevara (2007) provide empirical results in support for ESH. The positive relationship between efficiency and market power i.e., competition-inefficiency view is also found in Pruteanu-Podpiera *et al*. (2008) for Czech and Fare *et al*. (2010) for Spain and Dong *et al*. (2016) for China.

Although many studies analyse and compare the efficiency of Islamic and conventional banks (for a review see Reepu and Arora; 2020), the research for competition and cost efficiency relationship in Islamic banks and MENA region is indeed scarce A study by Al-Muharrami and Matthews (2009) is concerned with the GCC region. The paper uses panel estimation with fixed and random and non-parametric measure of the technical efficiency effect examines the bank performance and competition relationship for the period 1993-2002. Empirical results do not find any support for QLH and the banking industry in the GCC region is better explained by the competition-inefficiency view. Turk-Aris (2009) perform a comparative analysis between Islamic and conventional banks in market structures, competition and profitability taking a sample of 13 countries for the period 2000-2006. The findings argue for a less competitive Islamic compared to conventional banking system and that significant market power is associated with high profits. Another study by Bakour, Gallali (2016) examines and compares the competition and cost efficiency relationship of Islamic and conventional banks in the MENA region. The sample consists of 157 conventional banks and 66 Islamic banks covering the 2004-2013 period. Efficiency is estimated with the SFA method and competition is the PR-H index. Findings from a two-stage model estimation supports, first, that Islamic banks in MENA are more efficient than conventional and second, the existence of a positive link between competition and efficiency. A recent study by Apergis and Polemis (2016) asses for the MENA region the relationship between competition, as measured with the PR-H index, and efficiency estimated with the DEA method. The sample covers the period 1997-2011 for ten MENA countries. Results from Granger-causality tests and the GMM model find a significant negative impact of cost efficiency on competition.

4.4.2 Efficiency and stability

Efficiency is central to the effective running of the banking system and maintaining its stability. The issue of the relationship between efficiency and stability has been examined first within the context of examining the effect of capital changes on risk-taking behaviour and second when comparing efficiency and stability between conventional and Islamic banks.

The empirical studies of the capital and risk relationship come to the agreement that bank efficiency should also be considered for a complete analysis. Hughes and Mester (1998, 2009) argue that a complete analysis of the relationship between capital and risk needs the presence of efficiency. They argue that a less efficient bank with low capital may be tempted to take on higher risk to compensate for lost profits. In line with this argument Berger and Young (1997) and Kwan and Eisenbeis (1997) have documented such a relationship and agree that apart from capitalisation, efficiency is a factor which determines risk-taking. Berger and Young (1997) employing a granger causality test find that a reduction in efficiency precedes to an increase in nonperforming loans. Kwan and Eisenbeis (1997) employs a simultaneous equation system and find that well capitalized banks are more efficient and less vulnerable to risk taking. The literature provides evidence on this relationship. One argument is that efficient banks manage their assets better in terms of evaluation, monitoring and therefore minimizing loans default and improving bank's stability. Such an argument is put forward by Berger and Mester (1995) and Williams (2004).

The European banking market was the choice of a paper by Altunbas et *al* (2007) for analysing the relationship between capital, risk and efficiency. They use bank data for Banks operating in 15 European countries over the period 1992-2000. Cost inefficiency is derived from a SFA model while risk is measured with loan loss reserves and capital by the ratio of capital to assets. They model three equations for each dependent variable and use the SUR estimation method. They argue that they find no positive relationship between inefficiency and risk-taking but find that European inefficient banks hold more capital and take less risk. This result however contradicts the findings by Fiordelisi *et al* (2011) when they examined the same relationship for European banks.

The study also by Apriadi et al. (2016) taking quarterly data for Indonesian commercial banks for the period 2005-2013 estimates efficiency through SFA and uses Z-score for stability and HHI for competition. The results from a granger causality test indicates a positive effect of efficiency on stability on both directions.

In a paper by Beck et al. (2013) the authors compare business models, efficiency and stability between Islamic and conventional banks using a sample 21 Islamic countries and the UK over the period 1995-2009. Their comparison is based on accounting ratio and regressions analysis. The results show that Islamic banks are less cost inefficient with higher asset quality and are better capitalized. These characteristic makes them less insolvent and more stable.

In the paper by Saeed and Izzeldin (2014) the authors examine the relationship between default risk and efficiency and compare it between conventional and Islamic banks for the GCC region. The sample includes data for 106 banks covering the period 2002-2010. They use SFA to estimate cost and profit efficiency and default is measured by the DD indicator. The results from the panel VAR model show that for the GCC region a decrease in default risk is associated with lower efficiency. However, for conventional banks there is a clear trade-off between efficiency and default which is absent in the case of Islamic banks.

As regards the MENA region there are two papers one by Said (2013) and one and Lemonakis et al (2015). The simplistic analysis made in Said 2013, employs DEA to estimate efficiency and accounting ratios to proxy risk (credit, operational and liquidity). They then estimate their Pearson correlation indices and find that efficiency and risk are negatively correlated which means an efficiency – stability relationship. Their data covers banks from the MENA region over the period 2006-2009. The study by Lemonakis et al (2015) analyses the efficiency and examines its effect upon capital and risk. The sample includes 100 banks from 6 MENA countries over the period 2003-2012.They use the DEA model to compute the efficiency scores which is then used as an explanatory variable in stability (Z-score) and capital (equity to assets ratio) equations. The results argue in favour of a negative relationship between efficiency and risk and a positive relationship between capital and efficiency. In summary, the strong capitalisation increases efficiency which in turn reduces risk and increases stability. Another study is by Alam (2012) although not related directly to the MENA region, his sample of 11 emerging countries includes 6 countries from the MENA region and a large percentage of the 235 banks (165 CB and 70 IB) used in the sample belongs to these countries. For the period 2000-2010 cost and profit efficiency are measured using

SFA and bank risk is proxied by Loan Loss Reserves (LLR). The positive and significant coefficient found from SURE regressions with cost inefficiency regressed on LLR and vice versa suggest a positive relationship between cost efficiency and bank stability.

4.4.3 Efficiency, Competition and stability.

The above two-fold relationship between efficiency with competition and stability has been examined as a single relationship. There are however very few papers testing this interrelationship. In an early study by Schaeck and Cihak (2008) they use two sets of data, one with 8,900 US banks and one with 3,600 European banks from 11 countries covering the same period 1995-2005. Profit and cost efficiency is estimated using the SFA, LERNER and Boone indicators measuring competition and Z-score stability. They employ the Granger causality test and the results show that competition measured with Boone influence positively efficiency which in turn increases stability.

Kasman and Carvallo (2014) takes a sample of 272 banks operating in 11 Latin America countries in order to examine inter-linkages between stability, competition and efficiency over the 2001-2008 period. They use a dynamic Granger causality test and find apart from support for QLH also that competition leads to greater stability and higher efficiency increase stability.

Recent studies by Hou et al. (2014) and Tan and Floros (2018) refer to the Chinese banking market and examine the interrelationship among efficiency, risk-taking and competition. The first study collects data for 44 major banks and covers the 2007-2011 period. Employing a two-stage DEA model they estimate technical efficiency. Competition is measured with the concentration HHI index and NPL ratio and equity to assets ratio are the stability measures. After obtaining the technical efficiency estimates they run a truncated regression. The results argue that competition compels banks to higher efficiency, but higher efficiency is positively associated with risk taking and less stability.

The second paper by Tan and Floros (2018) use bank data for 100 banks for the period 2003-2013. The authors estimate efficiency using DEA analysis and competition is proxied by a LERNER-efficiency adjusted indicator. Credit risk is the NPL ratio and insolvency risk is the stability-efficiency measure resulting from a translog specification of Z-score. The results show that higher efficiency is associated with greater credit and insolvency risk.

The literature with respect to Islamic countries is indeed scarce and there are few studies explicitly investigating the MENA region. Two recent studies by Phan *et al*. (2019) and Saeed *et al*. (2020) explore the relationship between risk capital and efficiency and then the competition, efficiency, and stability relationship. Phan *et al*. (2019) examines bank data from four Asian countries over the period 2004 to 2014. Both DEA and SFA models are used for measuring cost efficiency and competition is measured with the conventional LERNER and the efficiency adjusted LERNER indicators. The Z-score measures stability. Although the results from the GMM model clearly show that competition has a negative impact on stability the effect of cost inefficiency on bank efficiency for the MENA region remains unclear and is ambiguous from both theoretical and methodological point of view.. Saeed *et al*. (2020) examines and compares the interrelationship among risk, capital and efficiency between conventional and Islamic banks and collects data for 180 conventional and 65 Islamic banks in 14 Asian countries over the 2002-2012 period. The authors estimate cost efficiency using SFA, stability is proxied by Z-score and capitalization by the capital to assets ratio. They built up three equations for the three dependent variables of capital efficiency and risk and estimate them with a seemingly unrelated regression model. They find that for conventional banks cost efficiency is associated with lower risk and more stability while for Islamic banks the opposite is observed.

Taking into consideration the literature so far reviewed about how competition, efficiency and stability are related asserts the important role of bank efficiency and especially cost efficiency. Therefore, the specification of our model allows a role for cost efficiency within the context of examining the competition stability relationship. As we have observed, the accurate estimation of efficiency has been a challenge and in most cases where no “accounting ratios” are used the choice is between the DEA and SFA methods. Although both methods have been widely used when estimating efficiency, in our model we use the SFA method instead of DEA. The SFA model is considered superior to DEA since the latter is a non-parametric mathematical programming technique and its analysis is based on an input/output multiple situations and measures the relative situation of each bank against the envelope of surface as expressed by the best banks. In contrast SFA is an econometric method and uses a parametric technique to estimate the characteristics of a best-practice bank from the production or cost function. Moreover, it has two principal advantages. First that as a parametric approach it separates the error term into a random error and an inefficiency term. This random error can capture exogenous shocks. Second estimates are less sensitive to outliers. SFA is implemented by making an econometric estimate of the best practice frontier. A production or cost unit efficiency score is given by the ratio of the observed output(cost) to the maximum of feasible output(cost), where the maximum is the frontier of best practice. SFA leads to estimation of the objective frontier function (cost or production function), by its specification in a Cobb-Douglas or trans logarithmic function. With the SFA it is easier to include control variables in the estimation process like country control variables that would allow country comparisons. Berger and Humphrey (1997) summarize that DEA ignores the measurement errors and inaccuracies related to accounting data and bad lack or good fortune that temporarily worsen or improve bank's efficiency. These errors may be measured as inefficiency and affect the inefficiency scores.

An additional characteristic of the studies exploring the role of efficiency in competition and stability is that the estimation procedure follows a two stage rational of. The first stage involves the estimation of cost inefficiency and the second stage uses the latter as an explanatory variable for stability or competition. The second stage mostly uses regressions to estimate the final relationship without taking a bounded domain of the cost inefficiency estimates. As Tsionas et al. (2018) argue the second stage does not recognize the fact that both generated estimates of cost efficiency and competition index are both subject to parameter uncertainty which in turn may make inference biased.

To avoid all these econometric problems our model follows an internally consistent approach and allows a mutually dependent relationship among competition, stability and efficiency. The use of the theoretically advantageous Boone indicator and its theoretical relationship with efficiency makes the modelling of variables' interdependence econometrically easier. Some attention has been recently devoted to estimating the Boone indicator via a cost function and multiple Boone simultaneously for a range of outputs. Furthermore, the use of a stability-efficiency measure as an outcome of a SFA analysis instead of the convenient Z-score "binds" the model better. To ensure coherence and internal consistency we jointly estimate stability (stability-efficiency score), competition (Boone indicator) and efficiency (translog cost function) allowing the dependence of stochastic noises and inefficiencies terms.

4.5 Model

Suppose $x \in \Re_{+}^{K}$ is a vector of inputs whose prices are $w \in \Re_{+}^{K}$, $y \in \Re_{+}^{M}$ is a vector of outputs and $z \in \Re^{d_z}$ denotes a vector of other variables in the cost function, for example non-performing loans (NPL), log equity, time dummies, and possibly other so-called environmental variables. Define the cost function.

$$C(w, y, z) = \min_{x \in \Re_{+}^{K}} \left\{ \sum_{k=1}^{K} w_k\, x_k;\ f(x, y, z) \le 1 \right\}, \tag{1}$$

for some transformation function, $f(x, y, z) \le 1$ which describes production possibilities. Here we use the translog functional form for the cost function:

$$\begin{aligned} \ln\ C_{it} = \alpha_{i0} + \sum_{k=1}^{K} \alpha_k \ln\ w_{itk} + \frac{1}{2} \sum\nolimits_{k=1}^{K} \sum\nolimits_{k'=1}^{K} \alpha_{kk'} \ln\ w_{itk} \ln\ w_{itk'} + \\ \sum_{k=1}^{K} \gamma_m \ln\ y_{itm} + \frac{1}{2} \sum\nolimits_{m=1}^{M} \sum\nolimits_{m'=1}^{M} \gamma_{mm'} \ln\ y_{itm} \ln\ y_{itm'} + \\ \sum_{k=1}^{K} \sum_{m=1}^{M} \delta_{km} \ln\ w_{itk} \ln\ y_{itm} + z'_{it}\eta + v_{it,1} + u_{it,1}, \end{aligned} \tag{2}$$

where the indices $i \in \{1, \ldots, n\}$ and $t \in \{1, \ldots, T\}$ denote bank and time, respectively. For each bank i the banks in the same country are known. The presence of fixed effects is denoted by α_{i0}. Standard properties that should be imposed are homogeneity of degree one in input prices and symmetry of $\alpha_{kk'}$s. Moreover, $z_{it} \in \Re^{d_z}$ denotes a vector of other variables in the cost function, for example non-performing loans (NPL), log equity, time dummies, etc. The two-sided error component, $v_{it,1}$ stands for measurement errors and $u_{it,1}$ is a non-negative error component representing cost inefficiency (in Tabak et al. 2012 the second error component is missing).

Our main concern is to derive Boone's (2008) indicator which is often estimated as

$$\ln\ S_{itm} = \beta_o + \beta \ln\ M\,C_{itm} + e_{itm},\ m = 1, \ldots, M, \tag{3}$$

where S_{itm} is market share of output[2] m for bank i (where the share is derived for the same country), MC_{itm} denotes the marginal cost[3] of output m for bank i and period t, and e_{itm} is an error term. Typically, one estimates (2), derives marginal cost for output m, defined as

$$MC_{itm} = \frac{\partial \ln\ C\,(w_{it}, y_{it})}{\partial \ln\ y_{itm}} \cdot \frac{C(w_{it}, y_{it})}{y_{itm}},\ m = 1, \ldots, M. \qquad (4)$$

The first terms of this expression, $\frac{\partial \ln\ C(w_{it}, y_{it})}{\partial \ln\ y_{itm}}$, can be estimated easily from (2).

The most general form of Boone's indicator is provided by the following regression equation:

$$\ln\ S_{itm} = \beta_o + \beta_t \ln\ M\,C_{itm} + \lambda_t + e_{itm},\ m = 1, \ldots, M. \qquad (5)$$

In this equation λ_ts are time effects (i.e., time dummy variables) to enable control for time-specific effects and Boone's indicator is time-varying (by multiplying time dummy variables with $\ln\ M\,C_{itm}$), see Leuvensteijn et al. (2011), Schaeck and Cihák (2010), Schaeck et al. (2009), and Tabak et al. (2012). The code for Boone estimation is given in appendix ????

The Boone indicator (β) considers that competition improves the performance of efficient firms and weakens the performance of inefficient ones. This result enables the measurement of competition via the response of profits or market shares to changes in marginal costs. Thus, firms' gap in efficiency is mirrored into a gap in profits with more efficient firms gaining more profits and extra market share at the expense of inefficient firms. As the degree of competition increases the more intense is the allocation of profits and market shares from cost inefficient to cost efficient firms phenomenon of

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[2] The original Boone indicator uses profits instead of market share, since the efficiency gap of banks make more efficient (less costly) firms produce more output (market share) and gain more profits at the expense of market share and profits of less efficient firms.

[3] Since marginal cost cannot be extracted directly from banks accounts, some studies approximate marginal cost with average cost estimated as the ratio of average variable cost to total income (see Schaeck and Cihak 2014)

competition. The stronger this effect is, the more negative β will be. In other words, the market shares of banks with low marginal costs are expected to increase, so $\beta < 0$. Therefore, the larger, in absolute value, this (negative) value of β will be. However, "positive values for β are also possible, as Leuvensteijin *et al.* (2011) evidence, meaning that the higher a bank's marginal costs, the more market share it will earn. There are also two possible explanations to this phenomenon. Either (i) the market has an extreme level of collusion or (ii) the banks are competing on quality. This last explanation may reflect strong collusion, as well." (Tabak *et al.* 2012, p. 3370).

Some qualifications are in order. Following Boone *et al.* (2004), a linear relationship of the form (3) or (5) is possible only under certain assumptions, the most basic one being that demand functions are linear. Tabak *et al.* (2012) also mention the following: "As in Leuvensteijin *et al.* (2011) and Schaeck and Cihák (2010), we are also aware of possible endogeneity problem in the estimation of equations (4) and (5). Both papers highlight the possibility of joint determination of performance and cost. The present paper's approach is to test first whether endogeneity is indeed present in our specifications" (Tabak *et al.* 2012, p. 3370). In fact, since marginal cost can only be estimated, there is an errors-in-variables problem in specifications like (3) or (5) which is quite likely to yield severely biased estimates of Boone's indicator.

A third problem is that with multiple outputs, it makes little sense to estimate each equation in (5) alone. In fact, a more appropriate model is.

$$\begin{gathered} \ln\ S_{it1} = \beta_{io1} + \beta_{t1} \ln\ M\,C_{it1} + \lambda_{t1} + e_{it1} \\ \ln\ S_{it2} = \beta_{io2} + \beta_{t2} \ln\ M\,C_{it2} + \lambda_{t2} + e_{it2} \\ \cdots \\ \ln\ S_{itM} = \beta_{ioM} + \beta_{tM} \ln\ M\,C_{itM} + \lambda_{tM} + e_{itM,} \end{gathered} \tag{6}$$

where, for example, $e_{it} = [e_{it1}, \dots, e_{itM}] \sim (\mathbf{0}, \Sigma)$. To our knowledge estimating simultaneously more than one Boone indicator for a range of outputs is a novel feature in the relevant literature. The output related Boone indicators are simultaneously estimated, and this has the advantages of first avoiding estimating our model for each output and second each product's estimated competition is made interdependent with cost and stability inefficiency.

A third problem arises from the following consideration. Tabak *et al.* (2012) want to examine in addition a measure of the bank's ''stability inefficiency''. The degree of ‘‘stability efficiency’’, represents how close a bank is to the maximum possible Z-score, which is modelled along the lines of a stochastic frontier model:

$$\ln Z_{it} = g(\ln w_{it}, \ln y_{it}, z_{it}; \varphi) + v_{it2} - u_{it2}, \qquad (7)$$

where $g(w_{it}, y_{it}, z_{it}; \varphi)$ is a functional form similar to (2), whose parameters are φ, $v_{it,2}$ is a two-sided error term, and $u_{it,2}$ is a non-negative error component representing stability efficiency. The Z-score is $Z_{it} = \frac{ROA_{it}+cap_{it}}{\sigma_{it}}$ and it is inversely proportional to the bank’s probability of default. In this definition cap_{it} is capitalization and σ_{it} is a measure of variability of ROA. Among the z_{it}s Tabak *et al.* (2012) also include macroeconomic determinants.

For the one-sided error component in (7), Tabak *et al.* (2012) assume that it follows a truncated normal distribution:

$$u_{it2} \sim \mathcal{N}_{+}(\mu_{it2}, \sigma_{u2}^{2}), \qquad (8)$$

where $\mu_{it,2}$ includes an intercept and it is a linear function of minus Boone’s indicator (which directly proportional to competition), the equity to assets ratio (Capital Ratio), which is a measure of capitalization, the liquid assets to total assets ratio (Liquidity), which is a measure of liquidity, the natural logarithm of assets, and the loan loss reserves to gross loans (LLR, in %) to control for the bank’s loan portfolio risk. They also include bank ownership dummies (foreign and private) to assess the differences of stability inefficiency across different bank ownership types. In all of their estimations the reference group is the state-owned banks. This can be written as:

$$\mu_{it2} = z'_{it}\tau_2, \qquad (9)$$

where τ_2 is a vector of parameters. Likewise, we can parametrize cost inefficiency in (2) as follows:

$$u_{it1} \sim \mathcal{N}_{+}(\mu_{it1}, \sigma_{u1}^{2}),\ \mu_{it1} = W'_{it}\tau_1, \qquad (10)$$

where τ_1 is a vector of parameters. In this way we can disentangle cost inefficiency from Z-score inefficiency.

4.6 Econometrics of the model

One significant implication of the model is that outputs in the cost function (2), are no longer predetermined under the specification in (6). Clearly, $S_{itm} = \frac{y_{itm}}{\sum_{j(i)} y_{j(i)tm}}$, where $j(i)$ denotes all banks that are in the same country with bank i. In turn

$$\ln\, S_{itm} = \ln\, y_{itm} - \ln \sum_{j(i)} y_{j(i)tm}, \tag{11}$$

which implies that outputs are endogenous not only in both (6) and (2) but also in (7). To summarize, we have the following system of equations:

$$\ln\, C_{it} = f(\ln\, w_{it}, \ln\, y_{it}, z_{it}; \varphi_1) + v_{it1} + u_{it1}, \tag{12}$$

$$\ln\, Z_{it} = g(\ln\, w_{it}, \ln\, y_{it}, z_{it}; \varphi_2) + v_{it2} - u_{it2}, \tag{13}$$

$$\begin{gathered} \ln\, y_{it1} - \ln \sum_{j(i)} y_{j(i)t1} = \beta_{io1} + \beta_{t1} \ln\, M\,C_{it1} + \lambda_{t1} + e_{it1} \\ \ln\, y_{it2} - \ln \sum_{j(i)} y_{j(i)t2} = \beta_{io2} + \beta_{t2} \ln\, M\,C_{it2} + \lambda_{t2} + e_{it2} \\ \cdots \\ \ln\, y_{itM} - \ln \sum_{j(i)} y_{j(i)tM} = \beta_{ioM} + \beta_{tM} \ln\, M\,C_{itM} + \lambda_{tM} + e_{itM}, \end{gathered} \tag{14}$$

$$u_{it1} = \ln\, \Phi\,(z'_{it}\tau_1),\, u_{it2} = \ln\, \Phi\,(z'_{it}\tau_2), \tag{15}$$

where now φ_1 and φ_2 denote the parameters in (2) and (7), respectively, f denotes the translog functional form in (2). In this form it is clear that outputs are endogenous and, in fact, appear on both sides of (14). A novel element in (15) is that Φ can be any distribution function in standard from, and, therefore, we do not have to assume that inefficiency is random and follows a specific distribution. This specification has been used successfully by Paul and Shankar (2018) and Tsionas and Mamatzakis (2019). In this work we assume a logistic distribution of the form$\Phi(x) = \frac{1}{1+e^{-x}}$.

Within this context of analysis an important question arises. What is the relationship between cost inefficiency and Z-score inefficiency?

It is reasonably accepted that risk-taking activities that affect stability are endogenous and are normally a Decision Management Unit (DMU) choice. If banks' DMU response to an efficient (lower cost) risk is taking on more risk in return for higher profits (and market share), then we would observe another risk-taking effect which can raise costs, all else equal, if banks have to spend more in technology and special human resources to manage increased risk and dealing with the possible appearance of nonperforming assets. As we have included the competition and cost relationship in our model we must for the sake of the model's integration include in it the cost-inefficiency and stability-inefficiency interdependence. Therefore, unless risk (stability) is incorporated into the analysis, the increase in costs due to increased risk-taking may mask scale economies due to diversification. Therefore, it is important to explore such relationship because its positive or negative sign will determine the acceptance of the competition –stability or competition-fragility hypotheses. Our strategy is to replace (15) with a novel equation:

$$u_{it1} = \ln\ \Phi\,(W'_{it}\tau_1),\ u_{it2} = \ln\ \Phi\,(W'_{it}\tau_2 + \zeta u_{it1}), \tag{16}$$

viz. Z-score inefficiency is explained[4] not only by the predetermined variables in W_{it} but also the level of cost inefficiency (ζ being a coefficient) which allows for dependence between the two types of inefficiency.

In addition, we assume the error terms in (12) - (14) are correlated in the following sense:

$$\boldsymbol{v}_{it} = [v_{it1}, v_{it2}, e_{it1}, \dots e_{itM}]' \sim (\mathbf{0}, \Sigma). \tag{17}$$

The Jacobian of transformation from $\boldsymbol{v}_t$ to the endogenous variables (log outputs, Z-score and cost), which accounts for statistical endogeneity in (12)-(14) and (16) is

[4]The marginal effect of u_{it1} on the expected value of u_{it2} is nonlinear so the coefficient ζ does not have an easy interpretation. The same is true for the marginal effect of any variable in W_{it}.

complicated. To provide statistical inferences we use the Generalized Method of Moments (GMM) in its continuously updated estimation (CUE) version. Our instruments are lagged values of input and output prices and lagged values of Z_{it} plus the level and lagged values of W_{it}. In the list of instruments, we also include squares and interactions of all variables in the basic list.. In appendix 2 we provide details on variables used in our estimation and in appendix 3 we provide a pseudo code with basic steps in calculation process and in a way to be transparent if used in other software calculation programme. Finally, our data set was adjusted so that filling up inputs and outputs in countries that were not available in our initial excel data set.

4.7 Empirical results

In Figure 4-1 we present sample distributions of posterior mean estimations for cost efficiency (u_{it1}) and Z-score inefficiency. Cost inefficiency averages close to 15% and Z-score inefficiency close to 20%. Cost inefficiency ranges from 5% to 20% and Z-score inefficiency from 5% to almost 40%. The cost-inefficiency scores are an indication of how much banking costs increase due to misuse of inputs. An average cost-inefficiency of 20% can be interpreted as the bank being able to produce the same output but with 20% less cost. The cost efficiency scores (meaning the difference of 100% from the cost-inefficiency score) found in our model are much higher than those reported in a study by Apergis and Polemis (2016) where the sample includes 217 banks from 10 MENA countries over the period 1997-2011. Cost efficiency is estimated using DEA modelling and his competition index is PR-H index. Their estimation follows the two-stage procedure. The mean cost efficiency score across all sample countries is 77.6% which implies a cost inefficiency of 22.4% and for the individual countries the mean score ranges from 78.2%(Morrocco) to 92.1% (Egypt). Results near our cost efficiency estimates are reported by Kassem *et al* (2014) and Bader *et al* (2008). The former study uses a sample that includes 187 banks from 11 MENA countries and Turkey over the period 2005-2011. Cost efficiency is estimated by SFA with Maximum Likelihood method and the mean value reported is 0.81 (inefficiency of 19%) but we notice that depending on the country under examination there are cases with a much higher variation in our results within the years under examination, such as 1.00 (100%) for Oman across all the years of our sample).

Bader (2008) reports, for 80 banks from 21 Islamic countries from the Middle East, Africa and Asia, an estimated by DEA average cost inefficiency of 10%. For Middle East countries the average cost inefficiency reported is 9% for Islamic banks and 7% for commercial banks.

However much higher cost inefficiency is reported by Alam (2012) and Moudud-Ul-Huq et al (2014). The study by Alam uses SFA to estimate inefficiency and reports an average cost inefficiency of 55% for 70 Islamic banks and 35% for 160 conventional banks. All banks come from 11 emerging countries (6 are MENA region countries) and the period coverage is 2000-2010. Moudud-Ul-Huq et al (2014) take a sample of 634 conventional, 298 Islamic and 37 special government banks in the MENA region over the period 2011-2017. They use two-step estimation method and in the first stage they compute cost efficiency using the SFA model. They find that the wastage of their cost frontier amounts to 47.07%, 42.35% and only 10.6% for Islamic banks, conventional banks and special government institutions, respectively. A recent study by Chaffai and Coccorese (2019) within the context of comparing MENA banking efficiency with that in Europe, US, Asia and Latin America for the period 2000-2012 they report a mean cost efficiency of 0.87 (inefficiency 13%) for the MENA region. The observed variation of cost-(in)efficiency results so far reported for the MENA region is reflecting, apart from the different business models of Islamic and conventional banks, mainly the heterogeneity of the region in terms of technical and allocative inefficiencies in countries banking system.

The recorded 20% average score of Z-score inefficiency and the wide range of its variation from 5% to 40% means first that Z-scores are found to be 20% lower compared to what they could be according to their determinant's calculations and second there is a significant variation reflected across all types of banks in terms of Z-efficiency and on the averages, Z-scores. Indeed, it makes quite a difference for a bank or a banking system to record a stability-inefficiency of just 5% which means optimum stability level is almost attained or to record a 40% stability-inefficiency which read as that actual bank stability is 40% lower than its optimum attainable stability level. . Unfortunately, we have no other studies that report Stability-(in)efficiency scores for the MENA region for comparison. There is a study by Louati and Boujelbene (2015) investigating the bank stability causal factors for Islamic and Conventional banks in 12 MENA countries for the period 2005-2012. Within this context they use, instead of the conventional Z-score, the stability-efficiency variable the latter derived from the SFA model using the Z-score as dependent variable instead of total cost in the cost function already used for computing MC needed for the LERNER competition index estimation. The stability efficiency variable is then used as the dependent variable in the GMM model employed for estimating the competition (LERNER) and other control variables effects on stability-efficiency. The authors report no stability-(in)efficiency scores but only that their findings support the competition-stability hypothesis.

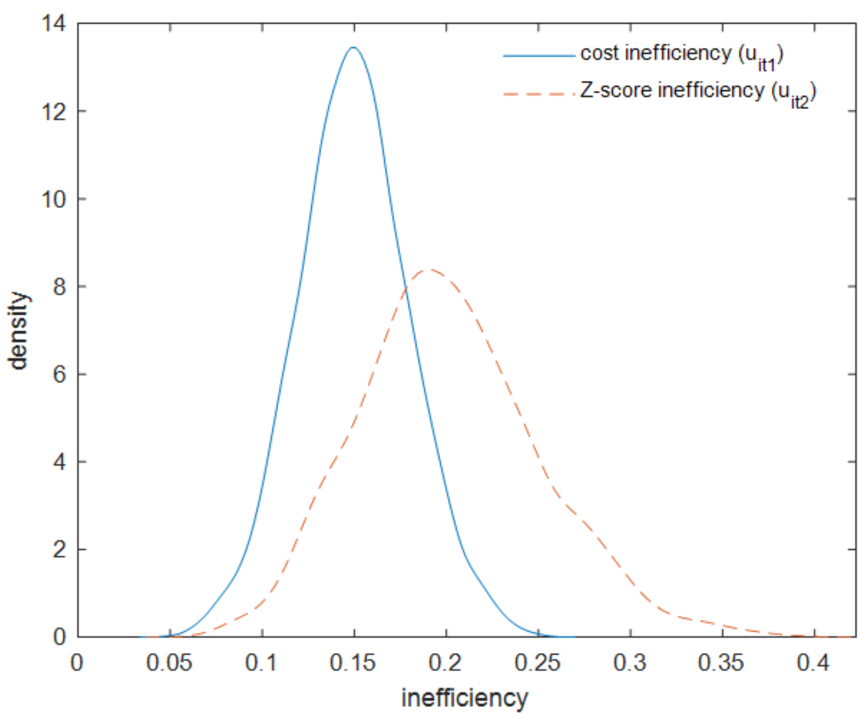
There are however three studies that report stability-efficiency scores one for transition countries and two for China. The former study by Fang *et al* (2011) examined the effect of competition and institutional changes upon the stability of 14 economies in transition for the period 1997-2008. Apart from conventional Z-score index they employ SFA to estimate the stability-efficiency index as derived from a nonstandard profit function. The reported mean value of stability-efficiency for all countries is 0.475 (47,5 %) while the minimum and maximum values recorded are 4.1% and 84.1% respectively.

The second and third studies by Tan (2016) and Tan and Floros (2018) investigate the impact of risk and competition on profitability for 41 Chinese banks over the 2003-2011 period and the competition, stability and efficiency interrelationship for 100 Chinese banks over the period 2003-2013 respectively. They proxy stability by a stability inefficiency variable derived from a translog specification with Z-score as the dependent variable. The mean stability-inefficiency variable for all banks records for both studies a value of 0.33 in other words an average value of 0.67 stability-efficiency. Compared to our MENA estimate of 20% stability -inefficiency is much higher although not comparable since Chinese and Islamic banks operate with different business models and other environmental characteristics.

The large variations of cost-efficiency and especially stability efficiency is not surprising since first in the MENA region countries, after the 90s continuous financial reform changes such as the abolishment of interest rate controls and the relaxation of strict entrance controls, we find a large number of conventional banks together with the traditional Islamic banks which differ in efficiency as most relevant studies report and second MENA includes all countries of the GCC region and also North African countries. However, the GCC region includes rich oil exporting countries with strong and large Islamic banks while the North African sub-region includes countries with relatively small banks. The MENA countries present a banking industry that is known for regulatory and cultural heterogeneity and diversity of ownership and type of banks.

Therefore, large efficiency and stability variations reflect the variety of banking systems within the MENA region, where managerial decisions affect the Z-score indicator in terms of capital, profitability and technological measures, considering the different contracts formed in commercial and Islamic banks and the technology adopted. In addition, the range of Z-score inefficiency indicates considerable heterogeneity in the different business models and managerial practices may be at work. The business model of Islamic and conventional banks differs primarily due to the interest rates that conventional banks use in their banking activities but which are not allowed in Islamic banking where instead they have a framework of profit and losses sharing. The literature on the differences between the two financial systems is rich especially from Islamic forums and organization but for thorough discussions and comparisons of Islamic and conventional financial systems see Beck *et al* (2013) and Selman and Nawaz (2018).There is a large literature that has focused on the comparison of performance of Islamic and conventional banks. The results reported provide support, although not always at a statistically robust level, for the diverse views that Islamic banks are more or less efficient or no different from conventional banks.

Figure 4-1 Z-score and cost inefficiency for the MENA region 2004-2015



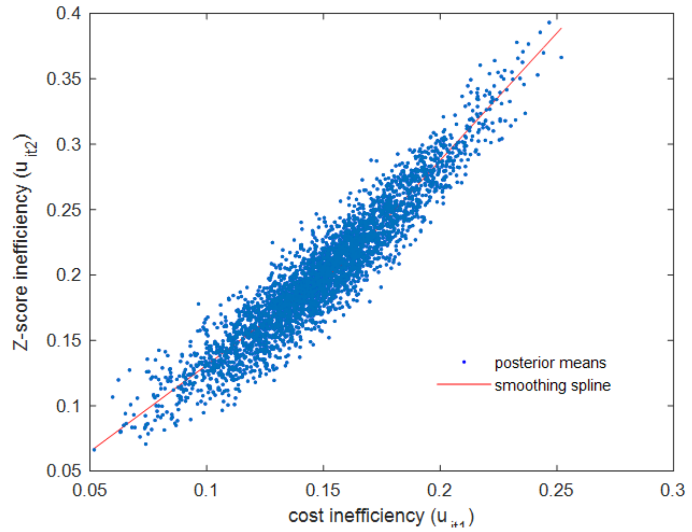
In Figure 4-2 we examine the relationship between Z-score and cost inefficiency. Clearly, there is a positive and slightly nonlinear relationship between the two. One interpretation is that cost inefficiency, through the multiple Boone indicators outputs (among which are net loans, securities and off-balance sheet items), causes higher Z-score inefficiency. In other words, we find no trade-off between cost efficiency and stability. This positive relationship between cost efficiency and stability, the latter measured mostly with conventional Z-score index, has being argued by a number of studies including Berger and Mester (1995), Williams (2004), Saeed and Izzeldin (2014).

Our findings coupled with the positive relationship between cost efficiency and competition are verified by a number of studies including for MENA by Polemis and Apergis (2016) and Bakour and Gallali (2020) which points to the direction of competition-stability hypothesis. A reduction in cost inefficiency increases competition (Boone indicator) which in turn makes banks choose less risky portfolios the latter improving overall banks' solvency. Also, the findings in Figures 4-1 and 4-2 support the competition-stability view as a reduction in cost inefficiency (lower cost and marginal cost) is often reflected in lower interest rates charged, better structure and higher performance of loans. It is important to note that the results at this stage are based upon the whole sample of banks, provided that three out of the total five outputs are based on the loan structure of banks, regardless of being commercial or Islamic. Furthermore, a decrease of cost-inefficiency is accompanied by a decrease of the marginal costs of products. This in turn create more efficient banks to share the market (in different outputs but especially its terms of loans) and leads to an overall bank market power decrease and an increase of level of competition. This effect combined with the verified positive relationship between cost-inefficiency with stability-inefficiency makes the competition increase related to lower stability-inefficiency or higher stability. Therefore, we end up with positive relationship between competition and stability.

However, this finding is in contrast to the results reported from studies investigating the competition stability nexus in the MENA region where the majority support the competition-fragility hypothesis. As we have already mentioned in the review of empirical studies exploring the competition-stability issue for the MENA region most studies either use concentration indices or LERNER indicator. In a study with a sample period (2006-20015) similar to ours Albaity *et al*. (2019) employ both the LERNER and Boone indicators, the latter used for first time in the MENA region. They also use, along many other control variables, efficiency as an explanatory variable of stability. However, efficiency is estimated from accounting data as a ratio of cost to income. The results from a single equation estimated with 1-step GMM confirm the stability-fragility view.

In Figure 4-2 the smooth and nonlinear curve suggests the steep rise of banking instability, as well as all the betas being cantered in close proximity to the main estimation, suggesting no significant outliers. As the relationship progresses, for the lowest and highest levels of Z-score inefficiency, we observe the lack of values which also correspond to the finding of Figure 4-1, on the range banking instability inefficiency between 5% to 40% The observed relationships in Figure 4-1 and 4-2 of lowest and highest values of stability-inefficiency with higher or lower cost inefficiency is rather related to technical efficiency variation in these cases. Technical efficiency is under the control of managerial decision units since they decide technologically the combination of existing inputs. A number of studies (Rosman *et al* 2014, Mualhi 2015, Mohd Noor *et al* 2020) for the MENA region, covering different periods but always within the 2001 to 2012 time span, using stochastic frontier methods estimated the technical efficiency and its components of pure technical and scale efficiency. If one summarizes their results technical inefficiency varies between a high of 0.55 and a low of 0,35. The breakdown into pure and scale efficiency indicates that the source of technological inefficiency is both pure and scale inefficiency although in different degrees. That implies that MENA banks are not only managerially inefficient in exploiting their resources to the fullest extent but also that their operations were at wrong scale. These results fit well within the range of values of stability and cost inefficiency in Figures 4-1 and 4-2 as Z-scores tend to be lower when associated with increased cost inefficiency, compared to the individual determinants of the Z-score.

Figure 4-2 Z-score and cost efficiency for MENA banks 2004-2015



In Figure 4-3 we report the sample distribution of posterior mean estimates of returns to scale (RTS) from the cost function. The RTS information derived from the cost function is useful since in our model structure output scale operations are connected with stability-inefficiency. The returns to scale estimates give the information about the optimal size of banks overall activity given the range of multiple Boone indicators outputs, cost efficiency and technology. Increasing or decreasing returns to scale inform managers that doubling the number of inputs will result in either more or less than double the output. The size of scale operations is under management choice and control and the amount and mix of products they decide might be over or under the optimal one.

The estimates range from slightly over 0.85 to 1.15 and they average close to 1 implying constant return to scale which implies that during the period under examination banks have been, on average, operating near to the optimum scale of operations for the mix and number of products produced. However, we also observe that the wide RTS variation indicates that there are banks which are operating at increasing and decreasing returns to scale probably due to "wrong" mix and size of activities' chosen through the multiple Boone indicators output. Therefore, upsizing or downsizing the scale of operations would be the right management action. Our findings of increasing and decreasing RTS values along the average constant RTS are reported also in studies for the MENA region by Moualhi (2015) for the period 2006-2012. However, Rosman *et al* (2014) when examining the efficiency of Middle East and Asian Islamic banks during the global crisis years of 2007-2010 report that the majority of Middle East Islamic banks operated in DRS and only a minority at CRS.

As we have already established RTS is defined as RTS = $\sum_{m=1}^{m} \frac{\theta lne}{\theta lny_m}$ where m=outputs and the individual components (known as output cost elasticitiy or cost scale elasticity) are reported in Figure 4-4. In terms of RTS and the five cost-output elasticities estimated we observe first that all elasticities are less than one (inelastic) and second they distinguishably differ. The most prominent output is y3 (Loans to other Banks) followed by y4 (Total securities), y2 (Other Loans), y5 (off balance sheet items) and lastly, y1 (Net loans). The output 'loans to other banks' is a type of interbank market for Islamic banks which contains a range of noninterest bearing loan instruments to avoid liquidity abnormalities. Many of the conventional instruments have been replicated into Shariah-compliant ones. Though structurally the same, the Islamic Interbank Money Market (IIMM) has had its own set of issues. The fact that non-Islamic financial institutions can have access to the IIMM has meant that funds can flow between the two money markets. This enables easy arbitrage, and the implication is that the yields prevailing in the IIMM have to be in line with those of the conventional money market.

The high value of 0.35 for y3 output-cost elasticity means that the responsiveness of cost to a 100-percentage change in output-scale, given its Boone indicator value, will be an increase of 35 percent. This means that, ceteris paribus, cost inefficiency will decline and increasing returns to scale are present. Second, a high elasticity of 0.3 is also observed for y4 (securities) while all other products show relatively much lower cost output elasticity. Another noticeable point is that the output-cost elasticity difference between the high and low elasticity range is 0.15 points for all outputs except Y5. The first result that is interesting is that the multiple Boone indicators that are simultaneously estimated (equations 6) in our model can assists us in breaking down and comparing different RTS for multiple Boone indicator outputs, which to the extent of our knowledge, has not been assessed yet, especially in the context of emerging markets and the MENA banking systems. The second result which is striking is how the Loans to other banks is the output with the highest elasticity (given the data availability restrictions in place and the different structure of commercial and Islamic banks), compared to the rest of the loan structure. In addition, total securities (y4) also offer significant information for the multiple Boone outputs and show that investment strategies in securities and their cost in terms of competition structure can impact banking stability significantly. The net loans and other loans with relatively low output-cost elasticity indicates that the expansion of the volume of loans should not be a priority since their cost change, taking into consideration competition level, does not affect the banks stability. This is in line with the conclusions of other studies that the managers' actions should be directed towards quality of services and better screening of loans to ensure lower credit-risk and not through scaling loan activities.

Figure 4-3 Returns to scale for MENA banks using the multiple Boone indicator outputs, 2004-2015

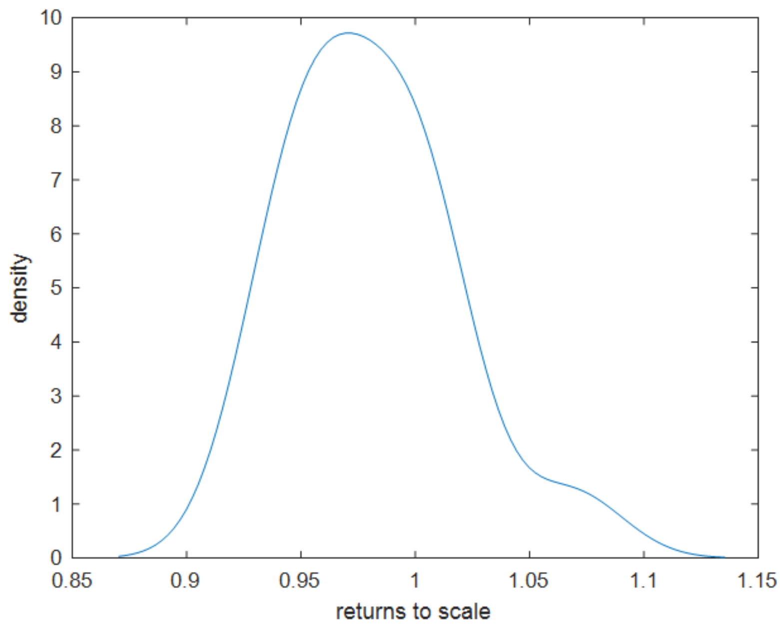
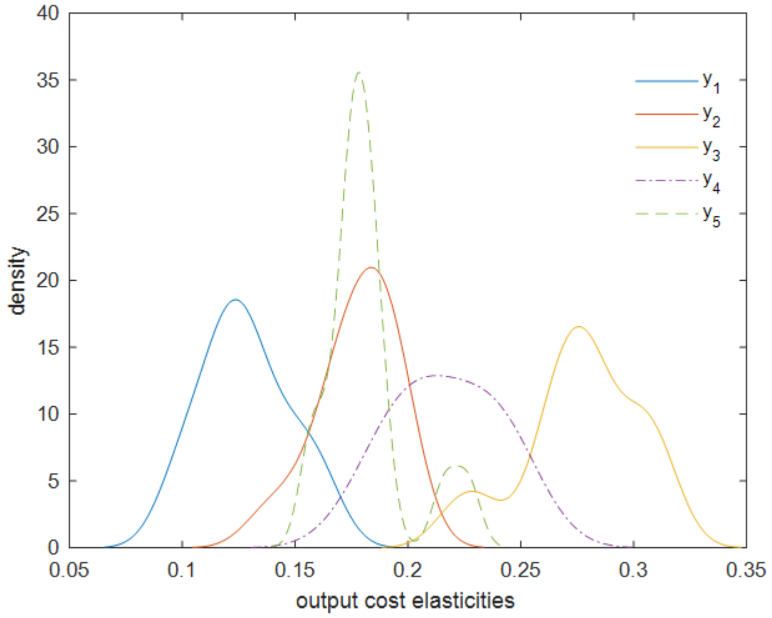


Figure 4-4 Output cost elasticities for all MENA banks 2004-2015



Using the multiple Boone outputs, we can assess the RTS effect on the bank stability (Z-score). In Figure 4-5, the Z-score RTS are reported in comparison to the RTS in Figure 4-3. Noticeably, the average Z- score-RTS is close to one as the average RTS derived from cost function in Figure 4-3. However, the range area of Z-score-RTS is 0.7 points (0.6- 1.3) and is two times wider compared to the RTS range of 0.35 (0.8 – 1.15) suggesting the larger degree of variation across the stability of banks in the MENA region and the combination of commercial and Islamic banks with different mix of products and business model. This is important information as it relates to the "production" of Z-scores based on their determinants (capital and profitability indicators). This different range of variation suggests that cost changes through RTS have a wider effect on banks stability (Z-score-RTS) than on RTS itself. This might be the result of different capitalization strength and profitability (ROA) between and within commercial and Islamic banks.

The information on Z-score-RTS decomposition into individual Z-score for each bank output is valuable and fortunately can be estimated due to the structure of our econometric model. The individual Z-score output elasticities are important to managers and supervisory authorities since they give them information on the stability variability for each output with respect to its change in scale operations. The components of RTS are reported in Figure 4-6, like the cost output elasticities in Figure 4-4. First from Figure 4-6 we observe the different average values and value ranges of

Z-score elasticities for all outputs. This variability in values suggest that different outputs contribute differently to the overall degree of stability as measured by Z-score. The prominent output in terms of Z-score values is output Y4 (securities) with a mean value of elasticity of 0.35 and outer values of 0.2 and 0.5. The output Y3 (loans to other banks) records a relatively low stability-output elasticity. This finding combined with its high output-cost elasticity found in Figure 4-4 means that although an increase in output Y3 will strongly affect cost, its effect on stability will be very mild. On the contrary the expansion of output Y4 (securities) will not greatly affect so its cost conditions but will have a big effect on its stability. The other outputs Y1, Y2 and Y5 record low mean and range of Z-score –output elasticities.

Figure 4-5 Z-score returns to scale for all MENA banks 2004-2015

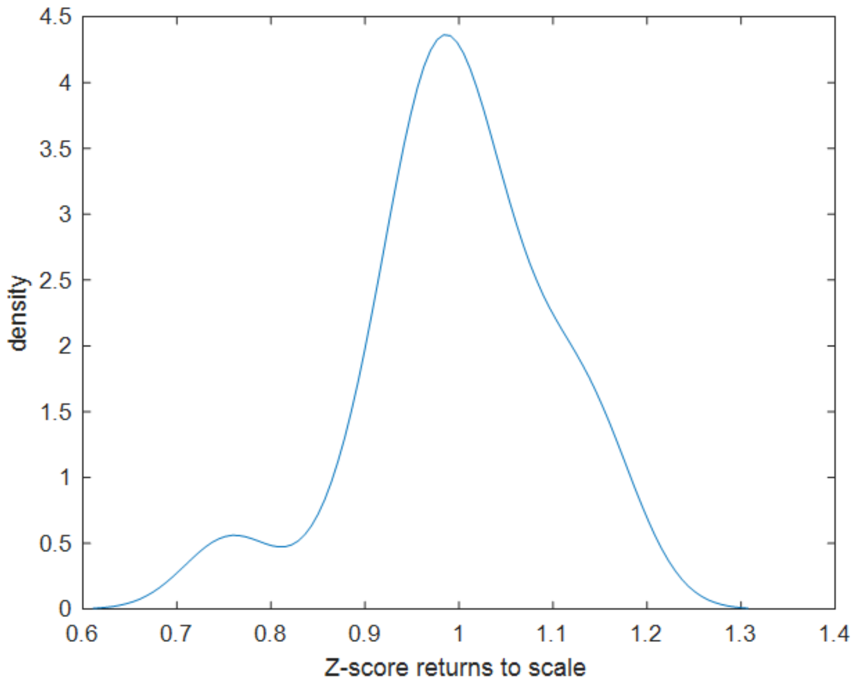
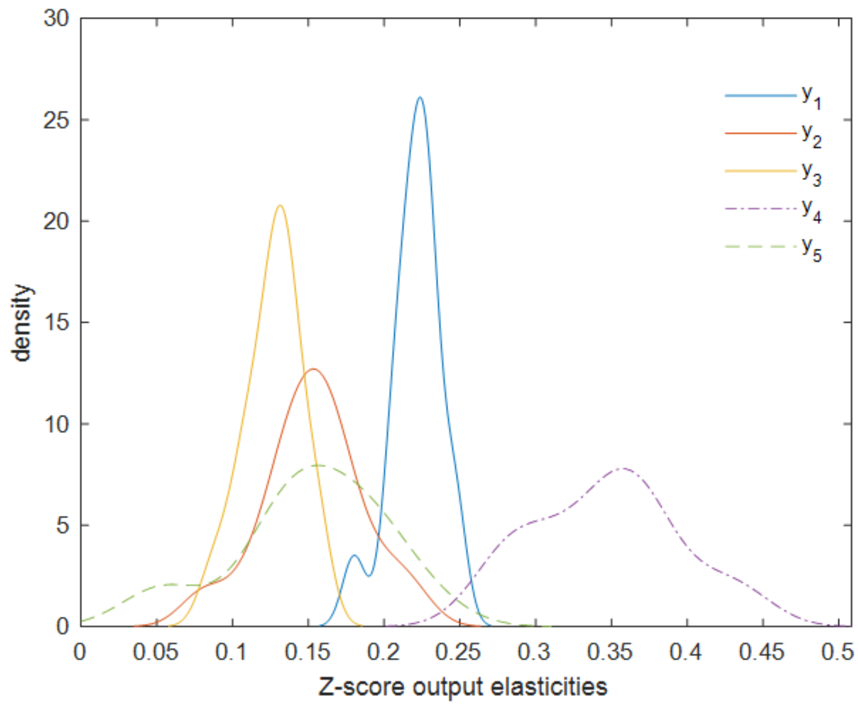


Figure 4-6 Z-score output elasticities for all MENA banks, 2004-2015



In our last analysis of our model's results, we explore the development of productivity growth and its components of efficiency and technical progress. Productivity is a measurement of the efficiency of a production process. It is calculated as the ratio of output to input. Productivity growth simply refers to an improvement or increase in the efficiency of work or production. Generally, productivity growth is shown by an increase in total output or production. Bank productivity growth can be attributed to two factors: Cost efficiency change and technological change. Efficiency is defined as r_{it} =(u_{it}-u_{it-1}) / (1/2 (ln_{it}+n_{it-1}) and efficiency change is EC= r_{ist}-r_{ist-1}. Technical change through time is TC= $\frac{\theta lnc}{\theta t}$. Productivity growth is defined as PG=TC+EC. Sample distributions posteria mean estimates are reported in Figure 4-7 for the cost function and Figure 4-8 for Z-scores. The distributions depicted in Figure 4-7 are derived from cost functions. Technical change is the distribution of cost changes through time while the efficiency change is the change in cost-efficiency between two years throughout the sampling period. Productivity growth over time is the combined outcome of efficiency and technical changes.

From Figure 4-7 we observe that EC lies between -0.5% to 1.5% and averages close to 0.6%. So, on the average there is a small cost decrease of efficiency over time. Also, the TC average value is 0.6% which translates into very slow technological progress within the sampling years although we have witnessed huge progress in banking technology. These technical and efficiency contributions from the cost side sum up to an average productivity growth of 1.2% considered rather mild progress. A recent study by Eleftuiri (2019) covers a long period of 1999-2012 for 11 MENA countries and finds an average productivity growth of 8.1% much higher than our estimate. This large productivity growth when decomposed to technical and efficiency changes is attributed only to technical change. The method used for estimation is DEA along with the Malmquist index.

A study by Karanlioglu and Musajeva (2017) focuses on explaining the productivity changes in 6 GCC countries for the period 2012-2016. The DEA based Malmquist index estimation gives a mean productivity growth of 27% for the period under analysis which is attributed 26% to technical change and 1% to efficiency change.

However, another very recent study by Jubilee *et al* (2021) assess the productivity difference between IB and CB for 385 banks in 18 dual banking countries over the period 2008-2015. The estimates are derived from the DEA-based Malmquist index. They report for all banks a high productivity percentage of -15.2% which is attributed mainly to technical change (-13.4%). We see the same picture when the sample is broken to IB and CB. For IB and CB productivity on average has a growth of -11.2% attributed to technical changes while for CB the estimates are 14.7% and also attributed mostly to technical change (-12.1).

A recent study by Nugrohowati *et al* (2020) employing the Malmquist productivity index examines productivity and technical change for 44 Islamic banks in 10 Islamic countries (6 MENA) for the period 2015-2018. They report a productivity change of 5.5% which originates from a technical change of 6.8% and a decline of efficiency of 1.3%.

Overall, the results provide a wide range of productivity, technical and efficiency changes for Islamic countries' banking sectors. The different short or long periods coverage, different sample of countries and different estimation techniques employed are the causal factors.

Exploring further the Z-score function with inefficiency term we can derive, for the first time, the distribution of the posterior means of PG, EC and TC as depicted in in Figure 4-8. The information we can further derive is how the (in)-stability (Z-score) has contributed to PG through the stability influence on efficiency and technical progress. Firstly, we observe that PG of the Z-scores ranges from zero to almost 7% which again displays the broad range of banking stability, as recorded in the Z-score- inefficiency variable in Figure 4-1 and the management decisions reflected on the capital structure and profitability indicators. PG averages around 4% showing that Z-scores and hence stability improve by almost 4 percentage points per year. This substantial growth is evidently, mostly driven by both TC and EC (with the latter averaging close to 2%). The above findings for productivity, technical and efficiency changes have of course policy implications for bank managers operating in dual-banking system countries The low productivity change is a matter of concern since it is closely associated with bank profitability. The results also point to the fact that both low efficiency and lack of technological advances are to blame for low productivity. Therefore, banks operate below their optimal efficiency and technological progress and managers must take actions to adopt productively new technology in new products and at the same time to improve efficiency and profitability.

Figure 4-7 Cost function Efficiency Change (EC), Technical change (TC) and Productivity Growth (PG) for all MENA banks, 2004-2015

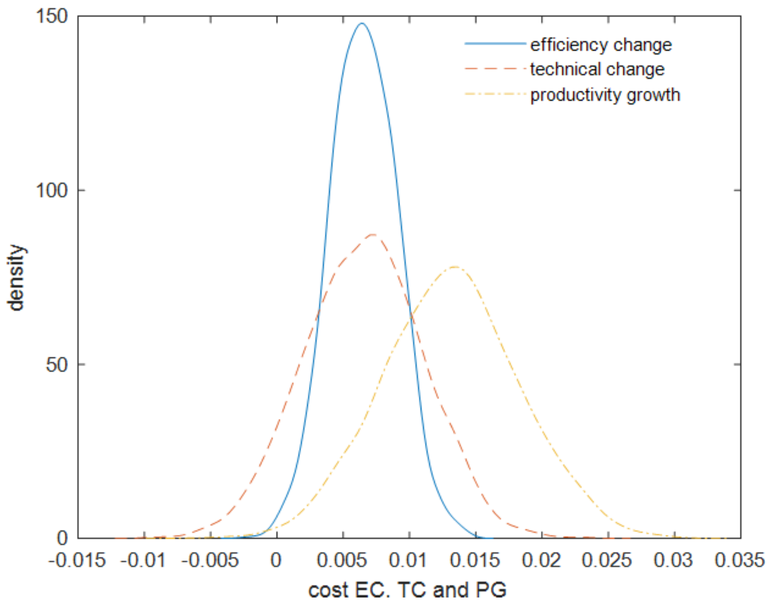
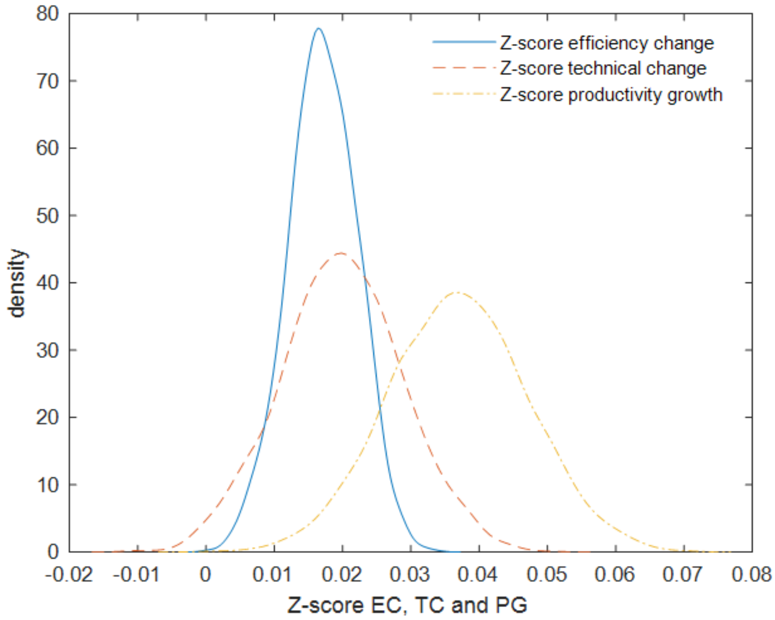


Figure 4-8 Z-score Efficiency Change (EC), Technical Change (TC), Productivity Growth (PG) for all MENA banks 2004-2015



4.8 Conclusion

The purpose of our study is to investigate the impact of bank competition on stability considering the relationship of efficiency with those two variables. To this purpose we have two alternatives: either to estimate the model into two stages or to estimate it in a single stage model. The two–stage approach, frequently found in the academic literature, computes as the first stage efficiency through accounting ratios or parametric (SFA) and non-parametric techniques and this estimate is used in the second stage as an explanatory variable in the stability or competition or both equations to derive the final strength of the relationship and the role of additional control variables.

However, this procedure leads to a bias because efficiency scores are first computed without taking into the analysis the competition regime and factors linked to bank technological process while in the second stage there is an endogeneity problem since the estimated efficiency scores possibly influence the production process and therefore the inefficiency equations. Therefore, we follow a novel approach for estimating these relationships. The novel model adopted is a single stage procedure and using the econometric stochastic frontier analysis for both efficiency and stability we allow for their dependence on each other. Further the multiple outputs in the cost function are not predetermined but are determined endogenously along the multiple Boone indicators. We applied our model to the MENA region for the period 2004-2015 using a sample of over 280 banks in over 20 countries. We consider the MENA region a suitable region for our research since MENA countries and especially GCC countries has undergone in the 90s significant changes in their economies and strict Islamic banking sector. It is crucial that the banking sector develops in a stable way, and this relies on efficient and stable banks. Banks, in the absence of a well-developed capital market play a prominent role in the economy. Their cost efficiency and high productivity enhances profitability which in turn leads to sustained stability.

There is a range of statistical inference that the model provided when it was estimated with GMM in its Continuously Updated Estimation (CUE) version.

The first important finding is that the cost efficiency and stability inefficiency are highly correlated in a positive relationship, and this indicates that no trade off exist between efficiency and stability. Manager's actions on cost efficiency improvement will also bring more stability.

The second result is that our findings support the competition-stability hypothesis. This result contrast with previous findings for the MENA region and has some different policy implications. Under this finding the regulatory authorities should promote competition through further relaxation of entry into the banking market and allow new products in IB competitive to CB. Moreover, given our finding that MENA countries are on average operating under constant returns to scale, a further increase of market power and bank size will not only bring banks into a situation of decreasing returns to scale but also will risk their solvency.

Furthermore, using the multiple Boone indicators output we found first that returns to scale averaged near to one implying constant return to scale and second when analysed using each output-cost elasticity surprisingly the output 'loans to other banks' showed a big elasticity. The similar elasticity was recorded for the output of 'securities. These findings are to be combined with the productivity, technical and efficiency change in terms of cost and stability (Z-score).

The average of productivity, efficiency and technical change give the picture of a slow progress in adopting technological progress and there is no optimum combination of resources.

Managers have to choose their investment strategies especially with respect to ‘loans to other banks’ and ‘securities’ since these two outputs affects cost efficiency and stability considerably compared to other outputs. The output of ‘loans to other banks’ is not clean of operational risk despite the loans being among banks. The usage of such funds affects cost efficiency and as such must be given extra attention and further analysis.

Bank regulators are concerned about the safety and soundness of the banking system and preserving public confidence in the banking systems. Therefore, they should not only take actions to enhance competition among banks but also closely watch managers' decisions about investment mix choices which have an impact on the efficiency. profitability and stability development of the bank. Further reforms may be desired in order to obtain the optimal utilization of capacities as well as making the greatest use of resources. Overall, a different mix of policies should be adopted depending on the characteristics of the MENA banking systems.

Chapter 5 Conclusions

The banking market stability and the avoidance of banks failures and closures is a necessary and sufficient condition for overall financial stability and progressing economy. There is a rich literature on empirical studies that investigate the factors affecting bank stability and their findings have traced bank-specific, economy-specific, regulatory, institutional and almost all refer to bank market structure that impinge upon bank stability. The present thesis focuses its interest on the banking market stability and the core of our research is to identify "new" factors that impact on stability, employ measures least used and utilize "new" estimation models .There are three chapters 2,3 and 4 in which our empirical work is contained.

The bank level data collected for our empirical studies covers 322 banks from 19 MENA countries and covers the period 2004-2015. As explained in the relevant chapters the choice of MENA region is based on the facts that there is limited research on factors affecting bank stability, that Islamic and conventional banks coexist in that region and that MENA banking market is a major player in the world financial system IN chapter 2 the dynamic evolution of distress and its effect on banking stability under two alternative specifications, the CAMEL methodology and a dummy variable approach.

Distress and degrees of Low, Medium, and high distress is compiled using CAMELS. Bank stability is measured with the overall stability Z-score index and with the bank risk-taking NPL ratio. The estimation of the basic model is done with the polled OLS method but also estimated with fixed effects panel technique. We also use the dynamic panel GMM where we assess the effect of distressed banks on stability and provide a direct link between research on distress and banking stability in emerging and developing markets which are in an important region of the world, but still not sufficiently explored. We augment the analysis by considering the macroeconomic and the regulatory environments as well as the global financial crisis and other structural events such as Arab spring crisis.

In chapter 2 we consider that banks instability is a gradual process where there are phases of different degrees of "distress" and banks either reach the final stage of failure or come back to solvent and stable situation. It is then crucial to examine if and how bank stability is influenced by the level of distress. Furthermore, within this context of different degrees of distress we examine the impact of other relevant variables to stability when interaction with varying degrees pf distress is present. We further examine if the presence of Islamic banks is promoting or mitigates stability within the context of increasing distress stages. To this end we estimate our model using various econometric techniques to check the robustness of our results. We use pooled OLS, fixed effects panel and 2-step GMM models.

The main objective is to examine if distressed banks and the regulatory environment influence the overall banking sector stability. Results from all estimated models verify first that distressed banks have an overall significant and negative effect on banking stability and second that regulation policies such as capital stringency, supervisory power and activity restrictions come out significantly impact upon stability but with mixed results. Specifically, supervisory power in all models comes out with a negative sign suggesting that the greater supervision power weakens stability while the results for capital regulation stringency indicate a positive effect on stability. Finally, activity restrictions show mixed results. Our modelling also explores whether the presence of Islamic banks and their interaction with all levels of bank distress affects financial stability. Our findings suggest that the Islamic banks presence does not differentiate the negative effect of bank distress on stability and therefore the presence of conventional and Islamic banks in the MENA does not alter the overall impact of distress.

Finally, we model and estimate in a robust way the interactions of the regulation measures with each level of bank distress and the results show that the effect on stability varies with the level of bank distress. However, when bank distress is severe (Medium to High Distress) the interaction effect is significantly negative for all regulatory measures. Although the results of separate regulatory measures provide mixed results for their effect on stability, we have an exact result that distress's negative effects on stability, especially when bank distress is medium or high, overrides the positive regulatory or enhance the negative regulatory effects on stability and overall weakens the stability of the banking system.

A final mode of our estimation models explores the effect of the global financial and Arab spring crisis on stability. The results from all models estimated have the expected negative effect which indicates that non-bank originated turmoil crisis weakened stability, no matter how the latter is measured.

The macroeconomic environment measured either with GDP growth or with GDP per capital, despite the variation in regulatory restrictions, is a significant driver of banking stability. However, an inflationary situation is found positively affecting stability but is non-significant. On the regulatory side and the macroprudential and micro prudential surveillance, the capital requirement index, the power of supervisory agencies index and the activity restrictions index contribute to banking stability in different ways. This behaviour is explained by the variation of the index presented for each country, as investment restrictions on banks' activities impose the largest penalty on banking stability.

Our findings have Four important policy implications. Primarily, the significant negative effect of distress on banking stability gives a warning to financial authorities that their available surveillance tools should be designed in such a way that distress situations can be quickly detected and hence to avoid when avoid creating domino effects for the financial stability.

Second the results show that although Islamic banks presence enhance overall bank stability the distress situation cancels out this effect. Therefore, in the presence of distress, regulation effects do not differ for Islamic and conventional banks. This suggests that when regulations are designed is important that these policy-measures and should benefit all types of banks instead of indirectly placing the burden of operation on one type of bank. In other words, regulators and policy makers should develop a mix of policies which can enhance banking stability, instead of imposing a "one size fits all" approach.

Third findings for the regulatory environment effects, with or without interacting with distress, on stability reinforce the arguments favouring first implementation of more stringent capital regulations to boost capital strength, less restrictions on activities of the banking sector to help for the most efficient allocation of resources and less stringent supervisory power but more targeting oriented for early distress identification. As regards the MENA region, the trend across most of its countries was toward increased capital stringency by adopting Basel's guidelines on capital requirements before the burst of global financial crisis and this combined with the stability profile of Islamic banks had a positive effect on banking stability. However, the combination of more capital requirements in a stricter regulation and activities environment leads, under the effect of distressed banks, to less stable banking market environment.

Our results for MENA region bank market once again warn the regulatory/supervision authorities that no matter how stringent capital requirements are, how powerful is the supervisory power, how strong are activity restrictions the presence of the distress phenomenon dominates, and authorities must have a regulatory/supervision toolkit that is able to identify and i tackle issues of distress for avoiding financial instability.

Finally, the overall results indicate that distressed banks hurt banking stability and that a clear way of successfully dealing with bank crisis in the MENA region is the decomposition of the regulation environment, as we have performed in our study. Our results can be used as a first pass at decomposing how bank distress evolves over time in this regard. Bank distress will always exist due to banks risk taking activities, but the correct mix of capital, activity and supervision rules should allow regulators to distinguish which cases require immediate treatment and which types of resolution are optimal. To this end, our approach and our empirical study is an additional monitoring tool in creating safety nets for the financial sector.

In chapter 3 we present our second empirical study that consists of two parts. The studies related to competition-stability nexus is very reach and growing over the last decade and to our knowledge there are no reviews studies so far solely dedicated to the empirical studies that only deal directly or indirectly with the debatable competition-stability issue . Therefore, we took the task to collect and critically review all studies published as from 1990 publication of seminal paper by Keely (1990) up to 2021. After filtering the 300 collected papers only 279 papers were considered relevant for our review experiment. We did not proceed to conventional categorization to studies supporting either competition-stability or competition-fragility views but instead we found the categorization more interesting and innovative to be based on the country or the region being investigated. This choice give you the advantage to compare for each region not only the results as such but also to compare the differences in time periods coverage, competition, and stability variables used , control variables and estimation method. Therefore the important contributions of the current in-depth literature review are firstly, that it reviews the empirical studies concerning the academic debate over whether the bank competition or concentration or market power has a positive or negative effect upon the bank risk or bank stability. We include papers that directly or indirectly present empirical estimates for such a relationship and assess their contributions accordingly. Secondly, we conducted a thorough research of all sources of academic articles and central banks/international organizations repositories to consider all aspects in our analysis. This was important for representing diverse finding and policy recommendations in an evolving and dynamic field of financial and banking stability where key challenges remain. Thirdly, our review covers one of the longest time periods presented in literature reviews in this area (to the best of our knowledge) starting from 1990 with the seminal paper of Keely (1990) and ending with papers published in 2021. Fourthly, the fact that the exceptionally large number of articles collected covers is not, as usually, divided into and presented within the two competition-stability and competition-fragility rival views. Rather, we found the categorization more interesting and innovative to be based on the country or the region being investigated. Every geographical region covered has its own banking sector developments and characteristics and makes each one a unique case when the competition-stability issue is investigated from both empirical and theoretical point of views.

The areas where the studies have been distributed are the continents Asia, Africa, Europe, and America with countries of special interest such as the USA and China being reported separately. Also, studies exploring the competition-stability issue only for Islamic countries or comparing the competition-stability validity between Islamic and conventional banking systems (ISL. Vs CONV., MENA and GCC) are also presented as separate groups. We also consider, as a separate group, studies concerning the Central Eastern Europe and Ex-soviet Countries (CEE), although these studies could be associated with the 'EUROPE' group. Finally, the Global studies group includes papers exploring the competition-stability issue using many countries from across the continents and the group Emerging includes relevant studies for a number of emerging/developing countries. Therefore, the final grouping of the studies boils down to 15 groups which are: MENA(Middle East North Africa), GCC(Gulf Cooperation Council), ISL. vs. CONV, DEV/ED vs. DEV/ING, EMERGING, EUROPE, CEE(Central Eastern Europe), ASIA, CHINA, AFRICA, USA, LATIN AMERICA, GLOBAL, SINGLE COUNTRIES and BRICS(Brazil-Russia-India-China-South Africa).

Findings from the detailed analysis of the studies, are presented after the review of the relevant studies for each region . However, overall findings worth mentioning: First, with regard to the chronological distribution it is clear that the majority of studies were published in the last five years and this is a result of the growing interest in the competition-stability issue from all over the regions covered. We consider that this growing interest could be attributed on the one hand to the recent financial global crisis and banks' failures that attracted academic interest in exploring the causes and roots of bank instability and on the other hand to the reforms and the adoption of information technology into banking accounting and management systems that made available more timely, detailed and long-term bank-level data for these countries. Second bank concentration is used in many studies as an alternative to bank competition although many studies have stressed the non-direct association of lower or higher concentration with higher or lower degree of competition. However, many studies investigate the concentration effect on stability using either the top three or five banks' share of total bank assets (CR3, CR5) or the HHI index based mainly on bank assets and less frequently on banks loans and deposits. A considerable number of studies make use of both competition and concentration measures. Third comparing the variables used for measuring competition the LERNER index is the "winner" but Boone indicator is also used but less frequently and, in most cases, appears together with the LERNER index. Fourth, stability measures cover a wide range of variables derived from bank-balance sheet data. The Z-score index is used in majority of studies except those using binary variables to indicate bank crises. The NPL ratio is also widely used as a direct measure of risk-taking and indirectly as a bank stability measure. The components of Z-score such as Equity to assets ratio, return on assets and standard deviation of Return on Assets are also used as bank stability components. Fifth, The econometric models employed for estimating the competition-stability nexus do not differ substantially. Since panel data makes it possible to have large data set with a few years of observations it is widely employed by many single country and cross-country studies. However, our findings record various statistical and econometric methods used such as simple OLS , 2SLS, Granger causality test, panel OLS with fixed or random effects and final the most recently used is the one or two step difference GMM with first or second degree differences. There are cases due to data format(e.g., bank crisis binary data) that logit models and semiparametric models are also rarely used. Finally, it is interesting to notice that apart from bank market structure being the major determinant of bank stability examined there are studies that examine the effect of bank efficiency and various banking institutional and regulation frameworks on the relationship between competition and stability. These regulation and institutional factors were examined in chapter while efficiency is the factor that is examined in chapter 4.

The second part of chapter three is empirical and examines the competition-stability issue for MENA region using the same sample data set as in chapter two. Building the model, we followed the major findings from our review study. We use the most favourable indices for competition and stability which are the LERNER and Boone indicators and Z-score and NPL ratio, respectively. Also, the estimation method employed is GMM being the most favourable used according to our review analysis. Results favour the competition-stability view. Furthermore, despite the positive effect of competition on stability, when we interact competition with the bank distress levels we find that distress outweighs this favourable effect of competition and stability still deteriorates.

In chapter four our review of empirical literature asserts the two-fold meaningful relationship of cost efficiency with stability and competition and hence efficiency influence of competition-stability relationship. It is crucial that the banking sector develops in a stable way, and this relies on efficient and stable banks. Banks, in the absence of a well-developed capital market play a prominent role in the economy. Their cost efficiency and high productivity enhances profitability which in turn leads to sustained stability. Therefore our third empirical study investigates the role of efficiency and its impact on bank competition-stability relationship considering the relationship of efficiency with those two variables.

The innovation of our econometric approach is that we do not follow the conventional and mostly used two-step approach when build up our model. That is, we do not estimate at step-one the cost-efficiency, normally done through SFA or DEA well-known approaches, and then in step two use these efficiency estimates as explanatory variables in competition, stability or competition and stability equations.

Instead we follow a novel approach for estimating these relationships. The novel model adopted is a single stage procedure that avoids estimation bias problems associated with two-step models (Tsionas et.al. 2018). To avoid all these econometric problems our model follows an internally consistent approach and allows a mutually dependent relationship among competition, stability, and efficiency. The use of the theoretically advantageous Boone indicator (used only once in studies concerning MENA region) and its theoretical relationship with efficiency makes the modelling of variables' interdependence econometrically easier. We estimate the Boone indicator via a cost function and multiple Boone simultaneously for a range of outputs. Furthermore, instead of the convenient Z-score we use SFA (stochastic frontier analysis) to estimate stability-inefficiency measure and cost-inefficiency that "binds" the model better. In other words, use of the econometric stochastic frontier analysis for both stability and efficiency and estimates for the Z-score stability inefficiency and cost-inefficiency allow for their dependence on each other and ensure coherence and internal consistency in our model. Further the multiple outputs in the cost function are not predetermined but are determined endogenously along the multiple Boone indicators.

We again apply our econometric model to MENA region with the same sample as in previous two empirical studies that is for the period 2004-20015, for nineteen countries and 322 banks. We consider the MENA region a suitable region for our research since MENA countries and especially GCC countries included in this region have undergone in the significant changes in their economies and gradual relaxation of strict Islamic banking sector rules.

There is a range of statistical inference that the model provided when it was estimated with GMM in its Continuously Updated Estimation (CUE) version.

The first important finding is that the cost inefficiency and stability inefficiency are highly correlated in a positive relationship, and this indicates that no trade off exist between efficiency and stability. Manager's actions on improving cost efficiency will also bring more stability.

The second result is supporting the competition-stability hypothesis. This result is in line with the findings from previous chapter where both LERNER and Boone competition indicators were employed along with conventional Z-score stability index. However contrast with previous findings for the MENA region and has different policy implications. The policy implication for the regulatory authorities is that they should promote competition through further relaxation of entry into the banking market and allow new products in IB competitive to CB. These findings reinforce the findings of the second chapter where higher activity restrictions have negative effects on stability. So, relaxing such restrictions through policies that enhance competition enhance bank stability. Moreover, given our finding that MENA countries are on average operating under constant returns to scale, a further increase of market power and bank size will not only bring banks into a situation of decreasing returns to scale but also will risk their solvency.

Furthermore using the multiple Boone indicators output we found first that returns to scale averaged near to one implying constant return to scale and second when analyzed using each output-cost elasticity surprisingly the output ‘loans to other banks’ showed a big elasticity. The similar elasticity was recorded for the output of ‘securities. These findings are to be combined with the productivity, technical and efficiency change in terms of cost and stability (Z-score).

The average of productivity, efficiency and technical change give the picture of a slow progress in adopting technological progress and there is no optimum combination of resources.

Managers have to choose their investment strategies especially with respect to ‘loans to other banks’ and ‘securities’ since these two outputs affects cost efficiency and stability compared to other outputs. The output of ‘loans to other banks’ is not clean of operational risk despite the loans being among banks. The usage of such funds affects cost efficiency and as such these funds must be given extra attention and further analysis.

Bank regulators are concerned about the safety and soundness of the banking system and preserving public confidence in the banking systems. Therefore they should not only take actions to enhance competition among banks but also closely watch managers' decisions about investment mix choices which have an impact on the efficiency. profitability and stability development of the bank. However finding from chapter 2 that higher supervising power is not promoting stability must be considered. That is the supervision of and control of risk associated with managers choices must be eclectically and not a strict supervision “one size fits all. Further reforms may be necessary in order to obtain the optimal utilization of capacities as well as making the greatest use of resources.

Overall combined results from our research topics urge regulatory and supervisory authorities to coordinate and drive their action to relaxation of banking business restrictions along with a selective supervision towards keeping banks distress at low level. These actions will give room for more competition in banking market which in turn enhance bank soundness. and both will Overall, a different mix of policies should be followed depending on the characteristics of the MENA banking systems.

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Appendix 1

Appendix 1 - Table 1 Bank related regulation measures for the MENA region 2003-2014

Country	Regulation	Range	2003-2007	2008-2010	2011-2014
	Overall Restrictions on Banking Activities	3-12	5	6	6
Algeria	Capital Regulatory Index	0-10	4	8	6
	Official Supervisory Power	0-14	6	6	8
	Overall Restrictions on Banking Activities	3-12	8	8	6
Bahrain	Capital Regulatory Index	0-10	4	5	8
	Official Supervisory Power	0-14	14.5	12.5	11
	Overall Restrictions on Banking Activities	3-12	2	12	6
Djibouti	Capital Regulatory Index	0-10	3	n.a.	10
	Official Supervisory Power	0-14	9	12	12
	Overall Restrictions on Banking Activities	3-12	7	7	8
Egypt	Capital Regulatory Index	0-10	5	5	10
	Official Supervisory Power	0-14	6	8	11
	Overall Restrictions on Banking Activities	3-12	5	11	7
Iran	Capital Regulatory Index	0-10	7	8	10
	Official Supervisory Power	0-14	4	12	12
	Overall Restrictions on Banking Activities	3-12	6	10	11
Iraq	Capital Regulatory Index	0-10	6	7	8
	Official Supervisory Power	0-14	8	8	11

Country	Regulation	Range	2003-2007	2008-2010	2011-2014
	Overall Restrictions on Banking Activities	3-12	10	9	10
Israel	Capital Regulatory Index	0-10	7	6	8
	Official Supervisory Power	0-14	8	8	9
	Overall Restrictions on Banking Activities	3-12	6	8	10
Jordan	Capital Regulatory Index	0-10	8	7	9
	Official Supervisory Power	0-14	12	12	12
	Overall Restrictions on Banking Activities	3-12	5	8	4
Kuwait	Capital Regulatory Index	0-10	9	9	9
	Official Supervisory Power	0-14	10	10	11
	Overall Restrictions on Banking Activities	3-12	5	6	5
Lebanon	Capital Regulatory Index	0-10	7	6	9
	Official Supervisory Power	0-14	12	10	12
	Overall Restrictions on Banking Activities	3-12	8	9	7
Libya	Capital Regulatory Index	0-10	8	8	9
	Official Supervisory Power	0-14	10	10	8
	Overall Restrictions on Banking Activities	3-12	7	9	8
Morocco	Capital Regulatory Index	0-10	7	7	8
	Official Supervisory Power	0-14	11	12	11
	Overall Restrictions on Banking Activities	3-12	9	8	8

Country	Regulation	Range	2003-2007	2008-2010	2011-2014
Oman	Capital Regulatory Index	0-10	6	6	8
	Official Supervisory Power	0-14	4	12	13
	Overall Restrictions on Banking Activities	3-12	3	2	5
Palestine	Capital Regulatory Index	0-10	8	5	10
	Official Supervisory Power	0-14	4	7	9
	Overall Restrictions on Banking Activities	3-12	3	3	8
Qatar	Capital Regulatory Index	0-10	4	7	9
	Official Supervisory Power	0-14	3	4	9
	Overall Restrictions on Banking Activities	3-12	8	9	11
Saudi Arabia	Capital Regulatory Index	0-10	3	7	10
	Official Supervisory Power	0-14	2	12	11
	Overall Restrictions on Banking Activities	3-12	8	7	9
Tunisia	Capital Regulatory Index	0-10	8	8	8
	Official Supervisory Power	0-14	9	9	9
	Overall Restrictions on Banking Activities	3-12	5	7	9
UAE	Capital Regulatory Index	0-10	2	2	2
	Official Supervisory Power	0-14	2	2	9

Source: Barth et al. 2013. Overall Restrictions on Banking Activities REFER TO Insurance, Securities and Real estate activities banks can engage with. Capital regulatory Index is the initial and overall capital stringency, whether the capital requirement reflects certain risk elements and deducts certain market value losses from capital before minimum capital adequacy is determined. Official Supervisory Power is whether the supervisory authorities have the authority to take specific actions to prevent and correct problems. CAPR(Capital Requirements: An index that takes values between 0 and 9, with higher values indicating greater stringency), SUPP (Supervisory Power: An index that takes values between 0 and 14 with higher values denoting greater supervisory power) ACTRS (Activity Restrictions: An index that takes values between 0 and 16 with higher values indicating more

Country	Regulation	Range	2003-2007	2008-2010	2011-2014

restrictive environment enforced by government) and REGQ(Annual index of the quality of regulatory quality in the country. The index ranges from −2.5 to 2.5 with higher values denoting better institutional development).

*,

Appendix 1 - Table 2 Institutional Development Index for 18 countries.

Country	Regulation	Range	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Algeria	Corruption Index	(-2.5) to (2.5)	-0.692	-0.679	-0.482	-0.521	-0.56	-0.595	-0.578	-0.525	-0.545	-0.503	-0.473	-0.6	-0.663	-0.691
Bahrain	Corruption Index	(-2.5) to (2.5)	0.412	0.451	0.319	0.194	0.181	0.189	0.185	0.183	0.217	0.374	0.433	0.279	0.139	-0.058
Djibouti	Corruption Index	(-2.5) to (2.5)	-0.825	-0.584	-0.71	-0.662	-0.544	-0.328	-0.368	-0.404	-0.41	-0.462	-0.542	-0.599	-0.658	-0.651
Egypt	Corruption Index	(-2.5) to (2.5)	-0.553	-0.647	-0.624	-0.747	-0.762	-0.779	-0.515	-0.631	-0.696	-0.598	-0.631	-0.625	-0.643	-0.629
Iran	Corruption Index	(-2.5) to (2.5)	-0.267	-0.389	-0.483	-0.484	-0.548	-0.775	-0.839	-0.947	-0.873	-0.791	-0.687	-0.619	-0.605	-0.716
Iraq	Corruption Index	(-2.5) to (2.5)	-1.214	-1.485	-1.374	-1.448	-1.46	-1.462	-1.327	-1.259	-1.171	-1.217	-1.278	-1.334	-1.369	-1.396
Israel	Corruption Index	(-2.5) to (2.5)	1.124	0.929	0.831	1.008	0.85	0.895	0.81	0.755	0.805	0.91	0.913	0.866	0.943	1.06
Jordan	Corruption Index	(-2.5) to (2.5)	0.315	0.256	0.257	0.259	0.264	0.356	0.159	0.041	0.101	0.072	0.068	0.136	0.26	0.269
Kuwait	Corruption Index	(-2.5) to (2.5)	0.799	0.786	0.507	0.433	0.371	0.42	0.309	0.302	0.086	-0.19	-0.188	-0.24	-0.225	-0.204
Lebanon	Corruption Index	(-2.5) to (2.5)	-0.665	-0.663	-0.531	-0.942	-0.888	-0.818	-0.834	-0.875	-0.903	-0.869	-0.924	-1.037	-0.884	-0.966
Libya	Corruption Index	(-2.5) to (2.5)	-0.885	-0.908	-0.962	-1.084	-1.046	-0.953	-1.208	-1.288	-1.302	-1.364	-1.482	-1.565	-1.617	-1.569
Morocco	Corruption Index	(-2.5) to (2.5)	-0.26	-0.143	-0.308	-0.408	-0.345	-0.382	-0.326	-0.205	-0.401	-0.437	-0.371	-0.266	-0.22	-0.15
Oman	Corruption Index	(-2.5) to (2.5)	0.59	0.673	0.395	0.352	0.351	0.515	0.332	0.324	0.14	0.182	0.159	0.31	0.269	0.372
Palestine	Corruption Index	(-2.5) to (2.5)	-1.245	-1.334	-1.309	-1.359	-1.401	-1.356	-1.355	-1.369	-1.402	-1.368	-1.405	-1.391	-1.304	-1.282
Qatar	Corruption Index	(-2.5) to (2.5)	0.536	0.519	0.713	0.931	0.677	0.943	1.567	1.407	1.008	1.061	1.111	0.989	0.891	0.918
Saudi Arabia	Corruption Index	(-2.5) to (2.5)	-0.152	-0.287	-0.097	-0.19	-0.165	-0.008	-0.017	0.041	-0.305	-0.039	-0.02	0.087	0.052	0.226
Tunisia	Corruption Index	(-2.5) to (2.5)	0.161	0.083	-0.258	-0.189	-0.25	-0.304	-0.221	-0.259	-0.057	-0.06	-0.067	-0.037	-0.072	-0.118
UAE	Corruption Index	(-2.5) to (2.5)	0.861	1.057	0.999	0.893	1.014	1.082	0.913	0.896	1.078	1.164	1.281	1.204	1.072	1.276

Source: Kauffman (2011) and Institutional

Appendix 1 - Table 3 Correlation Matrix of all r variables: banking stability, Banking level, bank Distress, Macroeconomic and Regulatory variables.

Variables	Ln Z-score	NPL	TC1	TCR	EQA	LAS	LLP	NPL	RoA	LGR	EGR	NIM	ROAE	ROAA	LATS	LTD	GDPG	INF	GDPp.c	InteRate	CAPR	SUPP	ACTRS	REGQ	Crisis	Arab Spring
Ln Z-score	1																									
NPL	0.175	1																								
TC1	0.294	0.405	1																							
TCR	−0.360	−0.391	−0.318	1																						
EQA	0.031	0.056	−0.007	0.415	1																					
LAS	0.073	0.084	0.061	0.407	0.849	1																				
LLP	−0.030	−0.047	−0.043	0.117	−0.023	−0.047	1																			
NPL	0.129	0.027	−0.035	0.342	−0.305	−0.283	0.209	1																		
RoA	0.045	−0.018	−0.053	0.192	−0.424	−0.393	0.08	0.195	1																	
LGR	0.172	0.121	0.164	0.046	−0.202	−0.208	0.194	0.175	0.57	1																
EGR	0.161	0.134	0.086	0.107	0.015	0.073	0.035	0.108	0.015	0.012	1															
NIM	0.201	0.401	0.191	0.504	−0.261	−0.192	0.063	0.47	0.061	0.1	0.177	1														
ROAE	−0.361	−0.461	−0.384	0.342	−0.326	−0.402	0.075	0.097	0.228	0.049	−0.217	0.029	1													
ROAA	0.137	−0.092	0.02	−0.170	0.025	0.006	0.223	−0.329	0.023	0.03	−0.125	−0.173	0.215	1												
LATS	−0.107	−0.076	−0.045	−0.075	0.059	0.091	−0.143	−0.200	−0.195	−0.269	−0.077	−0.190	−0.019	0.023	1											
LTD	0.19	0.142	0.015	−0.070	0.013	0.005	0.018	−0.065	−0.046	0.073	0.037	−0.039	−0.098	−0.011	−0.037	1										
GDPG	0.079	0.069	0.15	0.037	−0.157	−0.174	−0.063	0.012	0.099	0.166	0.153	0.082	0.067	−0.037	−0.082	0.281	1									
INF	−0.103	−0.043	−0.066	−0.198	0.226	0.251	−0.236	−0.326	−0.179	−0.190	−0.128	−0.274	−0.119	0.239	0.306	−0.071	−0.268	1								
GDPp.c	0.164	0.105	0.103	0.097	−0.149	−0.133	0.117	0.14	0.102	0.062	0.245	0.082	−0.032	−0.094	−0.182	0.065	0.168	−0.257	1							
InteRate	0.083	0.137	−0.026	−0.050	−0.043	−0.180	0.078	0.224	−0.024	−0.016	−0.038	−0.059	0.083	−0.305	−0.190	−0.035	−0.459	0.437	−0.680	1						
CAPR	−0.056	−0.046	0.054	0.316	−0.191	−0.219	0.131	0.356	0.105	0.101	0.11	0.281	0.048	−0.212	−0.221	−0.147	0.071	−0.680	-0.321	−0.169	1					
SUPP	0.034	−0.003	0.1	0.275	−0.254	−0.267	0.225	0.364	0.165	0.16	0.112	0.203	0.14	−0.233	−0.245	−0.123	0.277	−0.711	−0.182	0.099	0.577	1				
ACTRS	−0.199	−0.217	−0.130	0.238	−0.093	−0.094	−0.015	0.232	0.042	−0.043	−0.180	0.078	0.224	−0.083	−0.012	−0.305	−0.190	−0.035	−0.083	−0.149	0.437	0.19	1			
REGQ	−0.024	−0.016	−0.038	−0.059	0.083	0.137	−0.026	−0.050	−0.146	−0.232	0.061	−0.061	−0.103	0.002	0.086	−0.273	−0.369	0.061	0.073	−0.123	−0.182	−0.083	−0.169	1		
Crisis	−0.056	−0.046	0.054	0.316	−0.191	−0.219	0.232	0.042	−0.043	−0.180	0.078	0.073	0.037	−0.039	−0.284	−0.245	−0.123	0.277	−0.012	0.107	−0.190	0.073	0.099	0.166	1	
Arab Spring	−0.107	−0.076	−0.045	−0.179	−0.190	−0.128	−0.274	−0.119	−0.179	−0.190	−0.128	−0.274	−0.119	−0.284	−0.123	0.277	0.129	0.027	−0.035	−0.035	−0.230	−0.012	−0.305	−0.043	−0.180	1

Appendix 1 - Table 4 Fixed effects panel results on banking stability for MENA region without controlling for bank distress for 2004–2015.

Variables	Ln (Z-score)				Non-Performing Loans (NPL)			
	1	2	3	4	5	6	7	8
				Bank characteristics				
TCR (total capital ratio)	0.030**	0.040**	0.054**	0.058**	-0.072**	-0.071*	-0.087**	-0.069**
	(2.419)	(2.361)	(2.329)	(2.446)	(-2.237)	(-1.763)	(-2.378)	(2.189)
NIM (net interest margin)	0.025**	0.029**	0.030**	0.082**	-0.098**	-0.126**	-0.120**	-0.136**
	(2.161)	(2.166)	(2.168)	(2.362)	(-2.061)	(-2.165)	(-2.062)	(-2.166)
LTD (Loans to deposits)	0.151**	0.154**	0.157**	0.087	-0.092**	-0.096***	-0.090***	-0.194**
	(2.266)	(2.327)	(2.836)	(1.287)	(-2.802)	(-3.226)	(-2.518)	(-2.327)
Inter. Rate	-0.190**	-0.090**	-0.111**	-0.182**	-0.221	-0.255*	-0.197	-0.291
	(-2.311)	(-2.110)	(-2.229)	(-2.165)	(-1.411)	(-1.779)	(-0.999)	(-1.212)
Islamic	0.111**	0.156***	0.084**	0.092**	-0.180**	-0.145**	-0.184**	-0.285**
	(2.342)	(3.179)	(2.175)	(2.267)	(-2.306)	(-2.249)	(-2.432)	(-2.369)
				Macroeconomic Variables				
GDP growth rate	0.022**	0.022**	0.023**	0.023**	-0.039*	-0.033*	-0.032**	-0.042**
	(2.343)	(2.545)	(2.156)	(2.256)	(-1.859)	(-1.926)	(-2.024)	(-2.043)
GDP per capita	0.122**	0.112**	0.132**	0.013**	-0.012*	-0.023*	-0.021*	-0.022*
	(2.053)	(2.055)	(1.986)	(1.966)	(-1.829)	(-1.836)	(-1.849)	(-1.823)
Inflation	-0.059*	-0.066*	-0.076*	-0.023*	0.045*	0.079**	0.047**	0.039**
	(-1.890)	(-1.823)	(-1.879)	(-1.828)	(1.850)	(2.193)	(2.072)	(2.184)
Crisis Dummy	-0.018*	-0.026*	-0.022*	-0.072*	0.018**	0.0151**	0.0161**	0.0251**
	(-1.814)	(-1.849)	(-1.893)	(-1.842)	(2.071)	(2.099)	(2.080)	(2.100)
				Regulation Measures				
CAPR	0.035**	0.078**	0.062**	0.087**	-0.123**	-0.111**	-0.148**	-0.162**
	(2.330)	(2.331)	(2.322)	(2.033)	(-2.333)	(-2.133)	(-2.232)	(-2.138)
SUPP	-0.016**	-0.015***	-0.013**	-0.013***	0.037***	0.033***	0.035***	0.035***
	(-2.319)	(-2.865)	(-2.416)	(-2.799)	(3.163)	(3.057)	(3.049)	(3.019)
ACTRS	-0.015***	-0.012***	-0.014***	-0.017***	0.024*	0.026*	0.022**	0.012*
	(-3.128)	(-2.856)	(-3.054)	(-3.196)	(1.951)	(1.960)	(2.154)	(1.986)
REGQ	0.011	0.011	0.021	0.008	0.007	0.004	0.002	-0.004
	(0.275)	(0.322)	(0.017)	(1.445)	(1.222)	(0.762)	(0.115)	(0.265)
Arab Spring	-0.011	-0.021	-0.012	-0.014	0.024	0.012	0.012	0.021
	(-0.608)	(-0.159)	(-0.155)	(-1.508)	(1.322)	(0.191)	(0.592)	(0.527)
Constant	1.013***	1.022***	1.028***	1.017***	1.020***	1.010***	1.161***	1.120***
	(3.442)	(4.818)	(2.985)	(2.891)	(4.016)	(3.285)	(3.691)	(4.412)
				Diagnostics				
Num. of obs.	2569	2569	2569	2369	2201	2201	2201	2201
Bank and Year FE	Y	Y	Y	Y	Y	Y	Y	Y
R^2	14.12%	14.21%	14.12%	14.45%	12.01%	12.23%	12.46%	12.09%
F stat	166.9***	164.6***	167.6***	146.7***	149.6***	157.94***	151.9***	152.58***

Note: Unbalanced panel 2004-2015.The dependent variables of each regression are noted in the first line of the table. For variable definitions and sources, see Table 2. Country dummies are included in all regressions. Banking stability includes Z-score (Measure of the distance of a bank from insolvency. Computed as the sum of equity to asset ratio and the return on assets (RoA) divided by the standard deviation of the RoA), Ln (Z-score) (Measure of the distance of a bank from insolvency. Computed the natural logarithm of Z-score), NPL (The ratio between non-performing loans and the total gross loans of the bank).

Independent Variables include: Bank Specific Variables and CAMEL related variables: Capital (TC1=Tier 1 capital to total assets, TCR=Total capital ratio measured as a ratio of (Tier 1 + Tier 2) over total assets, EQA=The ratio between total equity and total assets of the bank, Asset quality (LAS=Ratio of net loans to total assets, LLP=Ratio of loan loss provisions to total loans, RoA=The ratio of bank net income to average value of assets) Management quality (LGR=Average of historical loan growth rate, EGR=Average of historical earning growth rate) Earnings (NIM=Net interest margin measured as a ratio of (interest received − interest paid) to total earning assets, ROAE=Return on average equity measured as a ratio of net income to average capital equity, ROAA=Return on average assets measured as a ratio of net income to average assets) Liquidity quality (LATS=The ratio between liquid assets and short term borrowing of the bank, LTD=The ratio of total loans to total deposits of the bank, LAT =The ratio of liquid assets over the total assets of the bank)

Bank Distress includes: Low Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 1-2.4), Medium Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 2.5-3.4) High Distress (Composite index for each bank of CAMEL from 1 to 5 where distress is classified for banks in categories 3.5-5), Distress Dummy (Dummy if the observed value of the binary is one under the state of distress following requirements in section 2.2, and zero otherwise).Bank Controls: Size (Natural logarithm of assets (in millions of constant US dollars), IntRate (Rate of interest charged on short-term loans made between banks), Islamic (dummy equal to 1 if a bank is Islamic and 0 otherwise). Macroeconomic Variables include: GDPG growth rate (The annual growth rate of each country's real GDP), GDP per capita (Gross domestic product divided by midyear population in constant 2010 U.S. dollars), INF (The inflation rate based on the consumer price index) UNEM (Percentage of unemployed to total labour force (%)) Regulatory variables: CAPR (Capital Requirements: An index that takes values between 0 and 9, with higher values indicating greater stringency), SUPP (Supervisory Power: An index that takes values between 0 and 14 with higher values denoting greater supervisory power) ACTRS (Activity Restrictions: An index that takes values between 0 and 16 with higher values indicating more restrictive environment enforced by government) and REGQ (Annual index of the quality of regulatory quality in the country. The index ranges from −2.5 to 2.5 with higher values denoting better institutional development). Control Variables include Crisis Dummy (dummy equal to 1 for the global financial crisis of 2008-2009, 0 for other periods), Arab Spring (dummy equal to 1 for the Arab spring of 2011-2012 for Algeria Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates and 0 for other periods) Estimation method is fixed effects method with statistics reported under robust standard errors clustered by bank in columns (1) – (4) and (4)–(8).

*,** and *** denote significance at 10%,5% and 1% respectively

Appendix 2 Z-score calculation in Excel

Date	Sales	year	ROA	3year Average ROA	E/A	standard deviation of ROA	ZSCORE
bank 1	country A	2004	0.05		0.12		
bank 1	country A	2005	0.09		0.13		
bank 1	country A	2006	0.05	0.06	0.10	0.027122059	6.02
bank 1	country A	2007	0.13	0.09	0.09		6.64
bank 1	country A	2008	0.08	0.09	0.12		7.62
bank 1	country A	2009	0.10	0.10	0.13		8.60
bank 1	country A	2010	0.09	0.09	0.14		8.48
bank 1	country A	2011	0.06	0.08	0.11		7.13
bank 1	country A	2012	0.09	0.08	0.12		7.37
bank 1	country A	2013	0.08	0.08	0.14		7.99
bank 1	country A	2014	0.06	0.08	0.15		8.36
bank 1	country A	2015	0.03	0.06	0.12		6.51

We can repeat this process for all the other banks in all the other countries and years to get the z-scores for each bank in each year. Once we have these values, we can also get the Zscore of the country as weighted average of individual banks Zscore with total assets being the weights.

Appendix 3 Data in Chapter 4

For the purposes of our analysis, we focus as stated above on the MENA region for both conventional and Islamic banks reaching a total of 3549 observations for 322 out of total 381 banks in 19 countries. As discussed above we combine information from x $\in \Re_{+}^{K}$ which is a vector of inputs whose prices are $w \in \Re_{+}^{K}$, $y \in \Re_{+}^{M}$ is a vector of outputs and $z \in \Re^{d_z}$ denotes a vector of other variables in the cost function and other so-called environmental variables. The data sources range from annual bank balance sheets including the variables needed for the cost and Marginal cost calculation, Macro variables, efficiency variables (authors calculations), ownership variables (with an addition of distress dummy at the bank level from hand collected data) and a set of regulation variables (from World Governance Indicators). Specifically, for the input x we use. Moving to the output system we use data inputs such as X1= Number of Employees, X2= Fixed Assets and X3= Total Deposits, Money Market and Short-Term Funding and their corresponding prices are w1= (Personnel Expenses / X1), w2 = (Expenses on Fixed assets /X2) and w3 = (Interest Expenses/X3) . The outputs are classified as y1=Net Loans, y2=Other Loans, y3=Loans to Banks, y4=Total Securities and y5 = off balance sheet items. Regarding the other variables, including both macroeconomic and regulatory level information we make use of the GDP growth rate, Bank capital to assets ratio (%), Bank liquid reserves to bank assets ratio (%), Bank nonperforming loans to total gross loans (%), Deposit interest rate (%) GDP growth (annual %) GDP per capita (constant 2010 US$) Real interest rate (%)Unemployment, total (% of total labour force) (modelled ILO estimate). In addition, I consider at the bank level per year the following measures: Equity / Total Assets (%), Liquid Assets/ Total Assets, Total assets USD (con2010), Size (logarithm of total assets), Loan Loss Reserves, Gross Loan. Finally, we distinguish between, Commercial and Islamic banks with a dummy variable approach.

Appendix 4 Basic steps of Boone estimation

INPUTS:

- w: vector of input prices of size K
- y: vector of outputs of size M
- z: vector of environmental variables in the cost function of size d_z
- f(x,y,z): transformation function that describes production possibilities
- n: number of banks
- T: number of time periods

OUTPUTS:

- boone_indicator: a scalar value that represents the Boone indicator for all banks and time periods

FUNCTIONS:

- translog_cost(w,y,z): calculates the translog cost function using inputs w, outputs y, and environmental variables z
- marginal_cost(translog_cost, w, y, m): calculates the marginal cost of output m using the translog cost function and inputs w and y
- market_share(i, m, y, country_i): calculates the market share of output m for bank i in its country
- time_dummy(t, T): returns a vector of time dummy variables of size T

1. Initialize variables:

   - boone_indicator = 0

2. Loop through all banks:

   - for i = 1 to n

     3. Loop through all time periods:

        - for t = 1 to T

          4. Calculate the translog cost function for bank i at time t:

             - cost_it = translog_cost(w_it, y_it, z_it)

          5. Calculate the marginal cost for all outputs of bank i at time t:

             - MC_it = []

             - for m = 1 to M

- MC_itm = (∂ ln(cost_it) / ∂ ln(y_itm)) * (cost_it / y_itm)
- append MC_itm to MC_it

6. Calculate the market share for all outputs of bank i in its country at time t:
   - S_it = []
   - for m = 1 to M
     - share_itm = market_share(i, m, y, country_i)
     - append share_itm to S_it
7. Calculate the time dummy variable for time t:
   - lambda_t = time_dummy(t, T)
8. Fit a linear regression of ln(S_itm) on ln(MC_itm) and lambda_t:
   - beta_o, beta_t, lambda_t, e_itm = linear_regression(ln(MC_itm), ln(S_itm), lambda_t)
9. Add beta_t to the Boone indicator:
   - boone_indicator = boone_indicator + beta_t

10. Divide the Boone indicator by the number of banks and time periods:
    - boone_indicator = boone_indicator / (n * T)

11. Return the Boone indicator