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How Does Bank Competition Affect Solvency, Liquidity and Credit Risk?

Evidence from the MENA Countries

by Raja Almarzoqi, Sami Ben Naceur, and Alessandro D. Scopelliti

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Authorized for distribution by Raja Almarzoqi

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Abstract

The paper analyzes the relationship between bank competition and stability, with a specific focus on the Middle East and North Africa. Price competition has a positive effect on bank liquidity, as it induces self-discipline incentives on banks for the choice of bank funding sources and for the holding of liquid assets. On the other hand, price competition may have a potentially negative impact on bank solvency and on the credit quality of the loan portfolio. More competitive banks may be less solvent if the potential increase in the equity base—due to capital adjustments—is not large enough to compensate for the reduction in bank profitability. Also, banks subject to stronger competitive pressures may have a higher rate of nonperforming loans, if the increase in the risk-taking incentives from the lender's side overcomes the decrease in the credit risk from the borrower's side. In both cases, country-specific policies for market entry conditions—and for bank regulation and supervision—may significantly affect the sign and the size of the relationship. The paper suggests policy reforms designed to improve market contestability and to increase the quality and independence of prudential supervision.

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I. INTRODUCTION[1]

How does bank competition affect financial stability? To what extent may policy reforms aimed at increasing competition among banks affect the stability of individual institutions and the whole system itself? And does this relationship work differently for distinct types of banking systems? The link between bank competition and financial stability has been widely debated in the theoretical and empirical literature, with varying results and conclusions for policy recommendations. In addition, the global financial crisis has prompted a broad discussion of the structural and regulatory policies that can improve the resilience of the banking sector, in both advanced economies and developing countries. In this perspective, the structure of the banking market and the intensity of competition among financial intermediaries are key aspects for the policy options of governments, central banks, and supervisory authorities. Understanding how competition may shape the incentives of credit institutions for risk-taking is essential to the design and organization of a stable and efficient banking system that is able to finance profitable investment opportunities and support sustainable economic growth.

The current debate on the desirable policies for the banking sector assumes particular relevance in the case of developing countries, especially after the fallout from the financial crisis in advanced economies. Indeed, the recent financial turmoil has raised concern that possible flaws in the process of liberalization and deregulation over the years may have contributed—together with other factors—to increase the financial risk-taking of credit institutions in various countries. For this reason, the policy agenda for financial sector reforms in developing countries requires, among other issues, an accurate analysis of the impact of bank competition on financial stability, in order to identify the proper policy measures to be implemented in the coming years.

Increasing competition among banks may yield large and significant benefits for consumer welfare, by favoring the provision of credit at better conditions for enterprises and households, and by improving the variety of financial contracts to better satisfy customer preferences. Policy authorities are also interested in ensuring that in a more competitive market, credit intermediaries are not incentivized to take on additional risks to financial stability and that proper policies should be arranged to address and contain such risks should they appear.

This paper focuses on a geographical area, the Middle East and North Africa (MENA), whose banking sector is still characterized by low levels of competition and high barriers to entry. In order to formulate appropriate policy recommendations for such country authorities, it is crucial to investigate whether eventual policy measures to liberalize banking markets and increase competition among credit intermediaries may also affect financial stability, given the specific peculiarities of the MENA region, which boasts both Islamic and conventional banking systems.

The paper explores this empirical question by considering multiple dimensions of financial stability in relation to the different sources of bank risk at the institution level, especially solvency risk, liquidity risk, and credit risk. Most empirical studies on this topic have analyzed the effects of bank

competition on one specific dimension of financial stability, mainly the solvency position of individual institutions or eventually the credit risk of their loan portfolios while — to the best of our knowledge — none of them has considered the possible implications for bank liquidity.[2] The financial crisis has shown the importance of assessing financial stability with regard to different sources of bank risk, by looking not only at the capital adequacy for loss absorption purposes—given the credit risk of bank assets—but also by considering the availability of sufficient liquidity buffers for stable funding, particularly in situations of market stress. As a consequence, the international standards for microprudential regulation were recently revised, with new liquidity ratios introduced in the Basel III accord, in addition to the existing capital requirements.

In this connection, the results of the empirical analysis show that bank competition may affect financial stability differently, depending on the type of risk; in particular, an increase in pricing competition shows a significant and positive impact on bank liquidity, while it may have some potentially negative effects on bank solvency and on asset quality. First, bank competition would exert a self-discipline mechanism on the choice of funding sources. If banks price their products on a competitive basis, they get lower profit margins and then cannot afford costly funding sources; for this reason, more competitive banks tend to keep larger liquidity buffers than banks with relevant market power. Second, price competition may have a potentially negative impact on bank solvency, if the decrease in bank profitability—due to the lower interest rate margins—is not compensated by a large enough increase in the bank capital position. In fact, credit institutions disposing of some market power may exploit the higher rents from their activities to build larger capital cushions for possible losses, while more competitive banks with fewer profits can improve their solvency only by achieving higher targets for their equity-asset ratios. Third, an increase in competition may raise the credit risk of the loan portfolio, if the increase in the risk-taking incentives for profitability purposes overcomes the decrease in the credit risk from the borrower's side. In addition, if financial intermediaries have larger market power, they are better able to exercise price discrimination among borrowers with respect to their credit risk and then they can more efficiently screen and monitor debtors, so as to improve the average quality of their asset portfolios.

This classification of multiple dimensions of financial stability, with respect to distinct sources of bank risk, may also be useful for disentangling the diverse effects as observed in the literature on bank competition and stability. Indeed, different effects may be explained in terms of different risks. In this paper, we focus on the microprudential analysis of individual institutions; that is, whether more competitive banks are also more stable in terms of capital adequacy, liquidity position, and asset quality. Then, in a separate work, we will consider the macroprudential implications of bank competition: whether more competitive banking systems are also more or less prone to systemic crises and whether credit institutions with large market power also present high systemic risk.

The outcomes of the empirical work also show that the degree of market contestability and the quality of banking regulation and supervision, if interacted with the indicator of price competition, may change the sign and the size of the observed relationship.[3] The interaction with the country-specific framework for banking regulation and supervision is particularly important in explaining

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[2] Few contributions on bank competition and liquidity are provided in the theoretical literature. In particular, Carletti and Leonello (2012) propose a model to study the impact of credit market competition on liquidity crises: they show that competition is beneficial for bank liquidity as it induces banks to behave more prudently and hold more reserves.

[3] In this respect, our results are consistent with the rationale discussed in Beck, De Jonghe, and Schepens (2013). Using a dataset for banks at the global level, they show that market, regulatory, and institutional features can explain the large cross-country variation observed in the relationship between bank competition and stability.

the results on solvency risk and credit risk, given that the existing microprudential policies in previous years focused precisely on such risks, while the liquidity risk was not subject to any regulation. For this reason, we can argue that the solvency position and the asset quality of a bank may also be affected also by the requirements of prudential regulation and supervision. Therefore, the effects of the pressures from market competition must be examined in conjunction with the regulatory and supervisory framework of the country.

When banks dispose of some market power, capital regulation and supervisory independence may provide an effective mechanism for them to safely manage their additional profit margins and increase their capital buffers. Also, when markets are not contestable because of heavy restrictions on banking activities—or because of frequent rejection of license applications—an increase in price competition may improve financial stability in terms of bank solvency and asset quality. The interaction between market entry conditions and banking regulation and supervision suggests some relevant policy implications. First, stringent capital regulation and independent supervision may ensure the proper incentives to improve bank solvency and reduce risk-taking in credit portfolios for banks with large market power. Second, in the presence of high barriers to entry, it is important to increase price competition among the incumbent banks to avoid a possibly negative impact of market power on bank stability. In particular, it is crucial to ensure that the incumbent banks do not exploit such market concentration to expand their market power and increase their risk-taking. Third, in some cases, activity restrictions or entry requirements may be useful to ensure that the institutions operating in the market are managed in a prudent way. Then, to the extent that they may limit the number of potential competitors and then increase concentration, authorities should keep to a minimum those regulations which—by imposing discipline over access to the market—may unduly reduce market contestability and restrict the possibility of competition.

Finally, the paper exploits the heterogeneity across different types of bank business model in the MENA region, by distinguishing between conventional and Islamic banks. We explore whether the presence of Islamic banking can affect financial stability either directly, through the effects on the bank business model, or indirectly, through the impact on the competition-stability nexus. Indeed, Islamic banks present, per se, larger liquidity buffers than conventional banks, because their liability structure is less reliant on short-term funding. Given this positive and direct effect of the Islamic banking model, the impact of competition on liquidity for Islamic banks may possibly reverse sign. Moreover, Islamic banks show - per se - lower credit risk; that is, they have lower rates of nonperforming loans and therefore need less loan loss provisions. For this reason, the presence of Islamic banks can — at the level of the system — reduce the risk-taking incentives that an increase in bank competition may induce for the credit risk of the bank portfolio. Finally, the study shows that an increase in bank competition may reduce the franchise value and then, potentially, the solvency of individual banks, but with no significant differences between conventional and Islamic banking.

II. THE BANKING SYSTEM IN THE MIDDLE EAST AND NORTH AFRICA

The banking system in the Middle East and North Africa presents some relevant features which provide a peculiar and interesting setting to conduct our empirical analysis on bank competition and financial stability.

First, the banking sector in the MENA region suffered only minor consequences from the global financial crisis, compared to the banking systems of other emerging and developing markets. This feature may vary across countries, depending on the openness to international capital flows, on the

business model for bank funding and on the exposures to the real estate sector. In general, the banking systems in the Gulf Cooperation Council (GCC) countries[4] are more integrated with the global financial markets, both for the presence of a few subsidiaries of U.S. or E.U. banking groups, and for the investments of some GCC banks in the financial markets of advanced economies. For this reason, banks in the GCC countries have—to some extent—been more exposed to the shocks affecting the international capital markets in times of crisis, but at the same time they have invested more resources in the domestic markets after that.

Second, the banking system in MENA is characterized by the coexistence of conventional and Islamic banking. In particular, the Islamic banking sector in the MENA countries has grown considerably over the past few years, also in terms of its world-wide role, and it now represents more than 50% of Islamic banking total assets at the global level (Syed Ali, 2010). The diffusion of Islamic banks may substantially vary across MENA countries. Their presence is particularly relevant in the GCC countries: in Saudi Arabia, Kuwait, and Bahrain their market share is 48.9%, 44.6%, and 27.7%, respectively (Ernst and Young, 2014). At the same time, their diffusion is constantly increasing in other countries of the region.

The presence of Islamic banking in MENA may have relevant implications not only in terms of the business model, but also for the stability of the banking sector in the region. Indeed, the crisis (Hasan and Dridi, 2010) showed that that certain features of the Islamic banking business model may explain the financial resilience of such institutions: their activities are more tied to the real economy, also thanks to the profit and loss sharing; they cannot have exposures to exotic derivative products; and, they tend to keep large amounts of liquidity. In particular, this preference for higher liquidity—particularly relevant for our analysis—may be induced by various reasons: on one hand, Islamic banks maintain substantial buffers of liquid assets for risk management purposes, given that there is no lender of last resort (LOLR) facility available to them, and since they don't have access to liquidity from the interbank market; on the other hand, Islamic banks tend to keep excess liquidity also because of the lack of interest free short-term investment opportunities, as real economic investments may require some development period.

Third, the banking system in MENA displays relatively low levels of competition and a high degree of concentration. We may observe this from some aggregate statistics at the regional level, based on the data collected by the World Bank for the Global Financial Development Database (GFDD). In the last available year of the survey (2011), we notice that—in the context of emerging and developing economies—the banking system in MENA presents the highest average value of the five-bank asset concentration ratio (71.16), as a measure of market structure, as well as the highest average value of the Lerner Index (0.31), as an indicator of bank market power. So, on average, the banking market is highly concentrated since the largest intermediaries hold a quite substantial market share. In principle, high market concentration doesn't necessarily imply large market power in the determination of prices, if there is potential competition from other banks which may enter the market. However, the banking sector in the region is subject to significant barriers to entry due to activity restrictions and entry requirements; in various countries, it is also dominated by state-owned intermediaries, which would benefit from public support in case of distress. Also, because of such barriers to entry, banking markets are mostly national, except for the activities of some institutions in the GCC area, which are more involved in cross-border banking. For such reasons,

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[4] By GCC countries we mean the member states of the Gulf Cooperation Council: Oman, Qatar, United Arab Emirates, Saudi Arabia, Kuwait, Bahrain.

banks in MENA tend to exploit the relevant market concentration also to exercise—on average—some degree of market power, as highlighted by the value of the Lerner Index.

Fourth, and in line with the limited impact of the global financial crisis, the banking sector in MENA has proved to be financially sound with respect to various indicators of financial stability, such as solvency, liquidity, and credit quality. As for competition, some aggregate statistics from the Global Financial Development Database may be useful for comparing the features of the banking system in MENA with other regions.[5] In particular, we evaluate bank solvency by using the Z-Score[6] as a measure of distance to default and we assess bank liquidity by computing a liquidity ratio defined as the ratio between liquid assets and the sum of deposits and short-term borrowing. Also, we consider the credit quality of bank assets on the basis of the Non-Performing Loans Ratio[7]. Based on such criteria, we notice that the banking sector in MENA—compared with other developing and emerging economies—displays the highest degree of bank solvency (as indicated by a value of the Z-Score equal to 23.55) as well as the largest buffer of liquidity (as measured by a value of the liquidity ratio equal to 41.98). Moreover, the banks in MENA display—on average across the region—a quite satisfactory credit quality of their loan portfolio, as the overall system shows one of the lowest average ratios of Non-Performing Loans among the developing regions (equal to 1.86).

The above discussed features explain why the MENA banking system may be considered an interesting setting for analyzing the relationship between bank competition and stability. Indeed, the banking sector displays, in general, high concentration, low competition, and solid levels of financial stability in terms of bank solvency, liquidity, and credit quality. In this respect, it could be considered eventually as a potential paradigm of the competition-fragility view, according to which banking systems less subject to competitive pressures would also be more financially stable. However, the results of the paper show that such an argument would not be supported by the empirical analysis, given that we have to distinguish between various dimensions of financial stability, and that bank competition may affect each of them in a different way. Moreover, the institutional framework for prudential regulation and supervision may substantially affect the incentives and then the conduct of financial intermediaries in terms of risk-taking such that, if we isolate the effects of the regulatory framework, the impact of competition on stability may actually be different from the one observed at first glance.

To sum up, the MENA banking system presents a few relatively peculiar features for some aspects, such as the limited exposure to the shocks of the global financial crisis, the coexistence of conventional and Islamic banks, and the significant presence of state-owned banks. However, at the same time, the remarkable combination of low competition and high financial stability observed at the aggregate level makes the MENA banking sector an appealing setting for the analysis on competition and stability for the following reason. If the analysis were to put under discussion the competition-fragility hypothesis for this sample, where the aggregate data would seem to lead in such a direction, then we would expect that it might be even more unlikely to find this prediction fully confirmed for other samples of countries, which don't display such trade-offs at the aggregate level. So, even if the results of this study may not be immediately applicable to other world regions,

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[5] This doesn't exclude the existence of possibly significant heterogeneities across countries in the region. In this context, we are mainly interested in capturing and comparing some general features at the regional level.

[6] It is constructed as the sum of the average return on assets and the average ratio of equity to assets, divided by the standard deviation of the return on assets. For a more extensive description of the Z-Score, as used in the empirical analysis, see section III.B

[7] It is computed as the ratio of Non-Performing Loans to Gross Loans

Figure 1. Middle East and North Africa: Bank Competition and Stability, 2011

Lerner Index

5-Bank Asset Concentration

Bank Z-Score

Liquidity Ratio

NPL to Gross Loans

Source: Global Financial Development Database, World Bank, 2011

Legenda: MENA (Middle East and North Africa); CIS (Commonwealth of Independent States); LAC (Latin America and Caribbean); SSA (South-Saharian Africa)
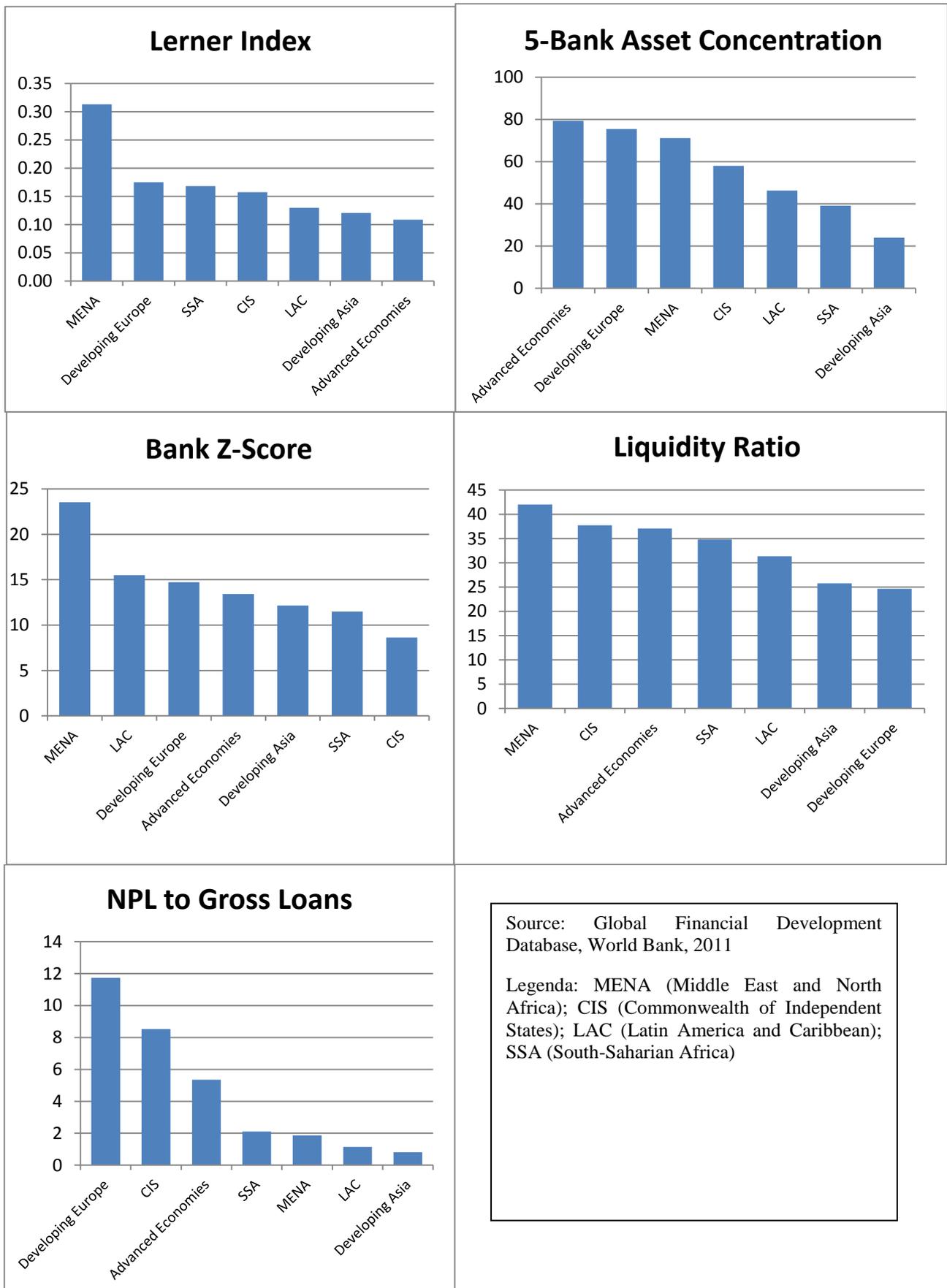
the empirical setting of this paper—particularly for the classification of different types of risk and for the role of institutional factors in the competition-risk relationship—may suggest a conceptual framework useful for more fully investigating the link between competition and stability at the global level.

The interesting features of the banking system in MENA may be important also for the policy implications of this work, both from a regional perspective, and a global one. The banking sector in MENA may be considered as an example of a banking system in developing economies with low levels of competition. For this reason, some considerations on the implementation of pro-competitive reforms in the MENA banking sector can be applied, to some extent, also to other developing regions, where similar policies for the financial sector may be desirable. The key policy issue behind this analysis is how to ensure that the measures enacted to increase competition in the banking markets would not imply additional risks for financial stability by incentivizing bank risk-taking. As the results of the empirical analysis will show, competition policy in the banking sector should be coordinated with the framework for prudential regulation and supervision, because capital requirements, banking supervision, and market regulation can significantly shape the sign and the size of the relationship between competition and risk.

III. LITERATURE REVIEW AND EMPIRICAL HYPOTHESES

The relationship between bank competition and financial stability has been widely discussed in the theoretical and empirical literature, though with conflicting views.

According to the competition-fragility view, based on the charter value hypothesis (Keeley, 1990), an increase in the degree of competition may lead both to a decrease in lending rates and a rise in deposit rates, with a consequent reduction in profit margins. This would also cause a decrease in the franchise value of banks and incentivize more risk-taking, with a possibly negative impact on the stability of the individual institutions and of the whole system. On the contrary, according to the competition-stability view (Boyd and De Nicolò, 2005), a rise in the degree of competition, by reducing the interest rates charged by banks, may imply better credit conditions for borrowers. This would make it easier for them to repay bank loans, thereby reducing the risk of the loan portfolio and improving the stability of individual institutions.

More recently, in order to reconcile the two opposite views, some papers have explored the possibility of some nonlinear relationship (Martinez-Miera and Repullo, 2010). Also, some theoretical work (Freixas and Ma, 2014) has been conducted on the impact of competition on different aspects of financial stability. The paper considers various types of risk—both at the individual institution level and at the systemic level—and examines the role of leverage in driving the relationship in each case.

The existing empirical studies have provided different results and conclusions. Some studies have analyzed the issue from a cross-country perspective, using large datasets of banks from different countries (Liu, Molyneux and Wilson, 2013; Schaeck and Cihak, 2014; Beck, De Jonghe, and Schepens, 2013; Berger, Klapper, and Turk-Ariss, 2009; Turk-Ariss, 2010). Other analyses have examined the topic at the country level, using more granular datasets based on supervisory data, to account also for the possible multiplicity of bank products (Jimenez, Lopez, and Saurina, 2013; Kick and Prieto, 2013).

In our empirical work, we analyze the relationship between bank competition and financial stability for the banks in the Middle East and North Africa. In particular, we estimate the impact of price competition on distinct sources of individual bank risk: solvency, liquidity, and credit risk. In the

following paragraphs, we define and describe—also on the basis of the existing literature—the main hypotheses we aim to investigate for the competition-stability nexus.

A. Solvency Risk

The solvency risk defines the risk that a bank cannot meet maturing obligations because it has a negative net worth; that is, the value of its assets is smaller than the amount of its liabilities. This may happen when a bank suffers some losses from its assets because of the write-offs on securities, loans, or other bank activities, but then the capital base of the institution is not sufficient to cover those losses. In such a case, the bank unable to meet its obligations defaults and loses its franchise value. In order to avoid such risk, banks need to keep an adequate buffer of capital, so that in case of losses, the bank can reduce capital accordingly and remain solvent.

On this reasoning, we may consider the solvency position of a bank as determined by two main factors: the availability of an appropriate buffer of capital and the profitability of bank activities. The indicator of bank solvency generally used in the empirical analysis, the Z-Score, reflects these two factors because it is computed as the sum of the equity-asset ratio (bank capital) and the return on assets (bank profitability), divided by the standard deviation of the return on assets (profit volatility). Then, in order to study the relationship between competition and solvency and to formulate our hypotheses for the empirical analysis, we need to investigate whether, and how, price competition may affect these two components of bank solvency.

We start from the nexus between competition and profitability, which is less subject to debate and interpretation. An increase in price competition (or a decrease in market power) reduces the profit margins of a bank. This implies that banks with large market power are also more profitable. So, if we consider profitability as a determinant of bank solvency, then we can argue that competition may have a negative impact on profitability and so may reduce solvency.

On the other hand, we have to inquire whether, and how, price competition may affect the capital position of a bank. In this respect, we can formulate two hypotheses, depending on our assumptions about the determinants of bank capital structure.

According to one argument, the amount and composition of bank capital would be mainly determined by the provisions of solvency regulation. Indeed, the existing microprudential framework defines some minimum capital requirements to cover for the unexpected losses, provided that banks build appropriate provisions for the expected losses. Then, if solvency requirements are binding, the capital ratio of a bank can be treated as an exogenous constant, simply fixed by regulation.

If this argument is true, we should expect a change in price competition to have no impact on the capital ratio of the bank, just because it is fixed at the target set by solvency requirements. By implication, an increase in price competition would only have the effect of reducing bank profitability, while it would not change the bank capital ratio. Then the overall effect of higher competition on bank solvency would be negative, thanks to the decrease in bank profits.

However, some studies have also shown that banks, even when subject to minimum solvency requirements, tend to hold more capital than required by regulation as they implement an active management of their capital; in other words, they determine the optimal amount of capital with respect to the credit risk of the assets in their portfolio and then adjust their capital levels over time according to their targets. If this counterargument holds, then we can infer that a change in the competitive conditions may affect the optimal solution of the bank capital problem.

For instance, an increase in price competition—by reducing the profit margins of a bank and, consequently, the amount of possibly retained earnings—may induce credit institutions to set a higher target for their capital ratios, to ensure an adequate level of solvency in case of bank distress. Then, if banks are able to raise capital in the short term, higher competition may also imply an increase in their equity-asset ratios[8]. In such a case, the increase in price competition would have two counteracting effects on bank solvency: on one side, a reduction in bank profits, and on the other, a rise in bank capital. If the decrease in bank profits prevails over the increase in bank capital, the overall effect of higher competition would be negative, with more competition reducing bank solvency. Conversely, if the profitability effect is smaller than the capital effect, an increase in price competition would improve bank solvency.

In fact, the two explanations of the bank capital dynamics presented here are not necessarily incompatible, given that the decisions banks make regarding capital structure may be determined both by the incentives of capital requirements and by the optimal assessment of the asset credit risk. Then, the two hypotheses define the range of effects we can observe in the empirical analysis: if banks fulfill their capital requirements in a relatively passive way, then we can expect price competition to reduce bank solvency. However, if banks adopt a more active management of their capital, the relationship between price competition and bank solvency may be positive or negative, depending on the relative size of the profitability effect and of the capital effect.

Many factors, such as the conditions for market entry, the quality of bank regulation and supervision, and the type of bank business model, may have a decisive role in changing the size of these effects. For this reason, we introduce some interaction terms for the measure of price competition and the country-specific indicators of bank regulation and supervision, and of market entry, to understand how they may affect the competition-stability nexus.

B. Liquidity Risk

Liquidity risk is the risk that a bank will not be able to meet its short-term payment obligations, either because it is not able to accrue enough funding on the wholesale market (funding liquidity), or because its securities or investments cannot be sold quickly enough to get the right market price (market liquidity). For the purpose of this analysis, we focus our attention on the concept of funding liquidity risk: we explore how bank competition may affect the liquidity position of financial intermediaries, by considering their availability of liquid assets in relation to their short-term funding needs.

We can formulate our hypotheses in terms of two possibly competing arguments. Does competition increase the funding liquidity risk of banks, by inducing them to get funds from short-term wholesale markets, which may be cheaper in good times but not stable over time? Or does competition induce banks to increase their availability of liquid assets to cover their future funding needs, given that low profit margins preclude banks from relying on costly funding sources?

In the first argument, competition may increase the amount of short-term borrowing, whereas in the second argument competition may induce a rise in the holdings of liquid assets. In fact, the two

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[8] The impact of credit market competition on bank capital decisions has been examined - from the theoretical point of view - in Allen, Carletti and Marquez (2011). They find that, under perfect competition, market discipline from the asset side may induce banks to hold positive capital. The prediction that bank capital levels vary with the degree of competition finds also empirical support in Schaek and Cihak (2012). They show that European banks present higher capital ratios when operating in more competitive markets.

effects may not be exclusive; a bank may obtain short-term funding from the wholesale market and then purchase securities such as government bonds to increase the availability of liquid assets. Then, in order to analyze the overall impact in terms of the liquidity position, we introduce, as a dependent variable, the ratio between liquid assets and short-term borrowing. An increase in this ratio would mean an improvement in the liquidity position of a bank, while a reduction would imply an increase in the bank liquidity risk.

The relationship between price competition and liquidity risk has not been explored in the empirical literature, and only few theoretical papers have suggested some possible explanations. Carletti and Leonello (2012) model the portfolio allocation problem of banks between reserves or loans and, in particular, examine the ability of banks to withstand liquidity shocks in the case of a bank run. They show that the model has two equilibria: a no-default one and a mixed one with safe and risky banks. The authors explain that under intense market competition (with low lending rates) banks keep enough reserves, while in the presence of market power some banks default with positive probability.

The empirical prediction of this model would be that competition has a positive impact on bank liquidity, because banks subject to stronger competition tend to keep a larger buffer of liquid assets in relation to their short-term borrowing. In this respect, competition would enforce a self-discipline mechanism on bank funding decisions, because banks with low profit margins would not be able to afford costly funding sources and would then need to behave more prudently in terms of liquidity management.

C. Credit Risk

Credit risk is the risk that a borrower will not be able to repay the debt to a bank. In this sense, the debtor may be the receiver of a bank loan, the issuer of a debt security, or even another bank borrowing in the interbank market. Given the main focus of banking activity on credit provision, we analyze the effects of price competition on the quality of bank lending, by investigating the credit risk of the loans extended to customers.

In general, an increase in price competition implies a decrease in the lending rates charged by banks to borrowers. However, this may affect the credit risk of the loan portfolio in two different ways. In one case, corresponding to the argument in Boyd and De Nicolò (2005), the reduction in lending rates may improve the credit conditions for borrowers by making it easier for them to repay bank loans and then by reducing the probability of default on bank credit. If this improvement in credit quality is extended to the whole portfolio of a bank, then an increase in price competition may reduce the average credit risk of the loan portfolio. In the other case, the decrease in lending rates may contract the profit margins from the provision of credit, thereby potentially reducing the franchise value of the financial intermediary. As a consequence, if managers are interested in increasing bank profitability, banks may increase risk-taking by extending more credit also to riskier borrowers, with a consequent rise in the average credit risk of the loan portfolio.

These two effects may not be mutually exclusive, since they concern two distinct aspects of credit risk determination. In the first case, price competition directly affects the risk from the borrower's side, by reducing the adverse selection problems in the credit market between lenders and borrowers. In the second case, price competition has an effect on the amount of risk that the lender is willing to take, in order to achieve a given target for bank profitability.

Moreover, if banks are able to screen and differentiate borrowers with respect to their credit risk, we may also expect that market power may be used by some banks to exercise price discrimination

across loan applicants on the basis of their creditworthiness. As a consequence, banks with large market power would be able to charge different lending rates as a function of the borrower's credit risk, while banks with limited market power would be constrained to apply low lending rates to all applicants. In such a case, high-risk borrowers would have an incentive to get credit from banks with little market power because they apply lower interest rates. This could also explain why banks with large market power may have an advantage in terms of the credit quality of their loan portfolio.

IV. EMPIRICAL STRATEGY

The empirical work analyzes the effects of bank competition on the stability of financial intermediaries at the institution-level. The stability of a bank can be evaluated with regard to different sources of risk: the solvency risk, the liquidity risk, and the credit risk of the asset portfolio. This classification is useful in order to reconcile—in a more exhaustive framework—those views which seem to be contradictory but which, in fact, refer to distinct types of bank risk. Moreover, this can also be helpful for policy purposes in order to provide more case-specific recommendations, based on the peculiarities of specific banking systems, and on the types of risk under consideration.

A. Data Sample and Empirical Specification

The analysis is conducted for a sample of 367 banks in the Middle East and North Africa, based on their bank balance sheet data provided by Bankscope. From the specialization point of view, the sample includes commercial banks (258), cooperative banks (2), real estate and mortgage banks (8), and Islamic banks (99). In particular, for the purpose of the analysis, we will compare conventional banks[9] with Islamic banks. Investment banks are not included in the sample, to ensure some homogeneity in the type of banking activities and to allow for data comparability. The data are available on an annual basis from 1999 to 2013.

In the baseline specification, we estimate the following panel regression by using bank fixed effects:

$$Risk_{ijt} = \alpha_i + \beta_1 Comp_{ijt-1} + Z\, BankControls_{ijt-1} + \Delta\, CountryControls_{jt-1} + \varepsilon_{ijt}$$

where *i* indicates the bank, *j* defines the country, and *t* denotes the year. The dependent variable is a measure of bank risk, that is solvency risk, liquidity risk, and credit risk. The key explanatory variable is an indicator of price competition at the bank-level, the Lerner Index, which measures the market power of a bank. We also include, as control variables, bank-level balance sheet variables and country-specific macroeconomic variables. In the baseline specification, we introduce one-year lagged terms for the explanatory variables.

For each type of bank risk (solvency, liquidity, and credit), we estimate different specifications for panel regressions, in order to take into account the role of other factors which can interact with price competition in affecting the stability of financial intermediaries.

1. To analyze the effect of market power and of market entry, we run the following regression:

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[9] In the category of conventional banks we include commercial, mortgage, and cooperative banks.

$$Risk_{ijt} = \alpha_{ij} + \beta_1 Lerner_{ijt-1} + \beta_2 Lerner_{ijt-1} \cdot MarketEntry_{jt-1} + \Delta\, CountryControls_{jt-1} + Z\, BankControls_{ijt-1} + \varepsilon_{ijt}$$

where $MarketEntry_{jt-1}$ is a country-specific variable for market contestability, measuring the intensity of the barriers to entry and of the activity restrictions to financial intermediaries, based on the World Bank Survey on Bank Regulation and Supervision. In this respect, the interaction term $Lerner_{ijt-1} \cdot MarketEntry_{jt-1}$ may be considered as an indicator of bank market power, adjusted for the entry conditions in a given market.

This may be useful also in considering the possible future dynamics of the market, which could affect the competitive behavior of the incumbents. A bank may currently have low market power in terms of pricing behavior, but it may operate in a market which significantly restricts the entry of new institutions; this implies that, in the future, it might be able to increase prices or it may collude with other incumbents. Also, a bank may dispose of a relatively high market power but in a market which is widely open to the entry of potential competitors; therefore, in the future it might be able to preserve that pricing power only if the supplied products and services are discernibly better than the ones offered by the competitors.

As the empirical analysis would suggest, the market power, per se—meaning the ability of a bank to profitably raise the price of a product or a service over the marginal cost—may not necessarily imply negative effects on stability, as long as the market is relatively contestable and subject to low barriers to entry. However, if high entry barriers limit the access of other banks to the market, a credit institution with some degree of market power could be interested in exploiting the additional profits to further expand its activities and increase risk taking. In fact, entry restrictions can significantly encourage such risk-taking attitudes from incumbent banks operating in a concentrated and closed market. Indeed, they may take advantage from increasing the size of their balance sheets and then their systemic relevance, through the higher likelihood of an implicit support by the government. This would actually be a source of major concern for our analysis. On the contrary, such incentives would be less relevant in a contestable market, where new entrants could easily start a banking business; in such a case, a bank potentially interested in more risk taking would have to internalize the additional costs from an excessive expansion of its activities, in terms of the higher probability of default, since the case of a government intervention might be less likely.

2. To examine the interaction of market power with bank regulation and supervision, we estimate the following equation:

$$Risk_{ijt} = \alpha_{ij} + \beta_1 Lerner_{ijt-1} + \beta_2 Lerner_{ijt-1} \cdot BankRegulSuperv_{jt-1} + \Delta\, CountryControls_{jt-1} + Z\, BankControls_{ijt-1} + \varepsilon_{ijt}$$

where $BankRegulSuperv_{jt-1}$ is a country-specific variable for the quality of the regulatory and supervisory framework. In particular, we consider some indicators from the World Bank Survey on Bank Regulation and Supervision, concerning various aspects: capital stringency, depositor protection schemes, supervisory effectiveness, supervisory independence, and presence of government-owned banks. We analyze the interaction of the main explanatory variable for market power, the Lerner index, with an indicator of country-specific bank regulation and supervision, by using a relevant subcomponent of the World Bank Survey, depending on the specification for the dependent variable.

3. To investigate the role of Islamic banking, we run the following regression:

$$Risk_{ijt} = \alpha + \beta_1 Lerner_{ijt-1} + \beta_2 Lerner_{ijt-1} \cdot Islam_{ij} + \beta_3 Islam_{ij} + \Delta\, CountryControls_{jt-1}$$
$$+ Z\, BankControls_{ijt-1} + u_{ij} + \varepsilon_{ijt}$$

where $Islam_{ij}$ is a bank-specific dummy variable for Islamic banks, based on the specialization classified in Bankscope.[10] We are interested in exploring ex ante whether Islamic banks may behave differently in terms of solvency, liquidity, and asset quality. Then we investigate whether the business model of Islamic banks may have a role in affecting the sign or the magnitude of the relationship between bank competition and stability. Because the Islamic dummy is a time-invariant constant for a given bank during the considered time period, it may play a role similar to a fixed effect in the regression. For this reason, we estimate such panel regression by using a GLS random-effect specification.

B. Data Sources and Description of Variables

We use data from a variety of sources, by combining bank-level balance sheet data with country-level data on market entry conditions, bank regulation and supervision, and macroeconomic developments. In particular, we obtain the bank-level balance sheet variables from Bankscope, while we take the country-level information on market entry conditions and on the quality of the regulatory framework from the World Bank Survey on Bank Regulation and Supervision. Finally, we control for the macroeconomic conditions at the country level by using the data from the IMF World Economic Outlook database.

Bank Competition

The degree of competition in the banking market can be analyzed through different measures that are related to three different concepts: price competition, market contestability, and market concentration. In particular, we use as key explanatory variables in our analysis:
1. Bank-specific measures of price competition (in particular the Lerner index)
2. Country-level indicators of regulatory restrictions (based on the World Bank indicators for barriers to entry and activity restrictions).

We measure competition at the bank level by computing the Lerner Index, which is a measure of bank market power. Indeed, it is defined as the ratio between the markup (the difference between the price and the marginal cost) and the average price of bank activities:

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

We investigate the pricing behavior of banks producing a single output and we proxy the price by the ratio of total revenues to total earning assets, where total revenues include interest income and non-interest operating income and equity-accounted profit/loss operating income. We derive the marginal cost from the estimation of a translog production function at the bank level for each country, including bank and time fixed effects:

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[10] Such classification doesn't take into account the fact that some conventional banks may have also some Islamic windows. Indeed, banks are classified according to their main specialization. Nevertheless, we can argue that the presence of some Islamic windows, mainly aimed at satisfying the demand of some customers with tailored products, should not sensibly affect the guiding principles for the management of a conventional bank.

$$lnC_{it} = \alpha_i + \delta_t + \alpha_1 lnQ_{it} + \alpha_2(lnQ_{it})^2 + \sum_{j=1}^{3} \beta_j \ln c_{it}^j + \sum_{j=1}^{3}\sum_{k=1}^{3} \ln c_{it}^j \cdot \ln c_{it}^k + \sum_{j=1}^{3} \gamma_j \ln c_{it}^j \cdot \ln Q_{it} + u_{it}$$

where C_{it} denotes the total operating costs, Q_{it} defines the amount of total assets, the input prices indicate the price of fixed assets (c^{Fixed}), the price of labor (c^{Labor}), and the price of funding (c^{Funds}). The price of labor is constructed as the ratio of personnel expenses over total assets. The price of funding is defined as the ratio of total interest expenses to the total amount of deposits, money market, and short-term funding. The price of fixed assets is computed as the ratio of other operating expenses to total assets.

The marginal cost is computed as follows:

$$MC_{it} = \frac{C_{it}}{Q_{it}}\left(\hat{\alpha}_1 + \hat{\alpha}_2 \ln Q_{it} + \sum_{j=1}^{2} \hat{\gamma}_j \frac{c_{it}^j}{c_{it}^3} \right)$$

In the analysis we also introduce the market share of a given bank, which may be representative of the banks' position in terms of market concentration. The rationale for that is the structural distinction between market power and market concentration; for instance, Claessens and Laeven (2004) have shown that even if market concentration may be a good indicator for market structure, highly concentrated markets can also be quite competitive, either because banks price loans and deposits as in a competitive setting or because the market is open to new entrants.

Financial Stability

We consider three dimensions of financial stability at the individual bank level with respect to distinct sources of risk: the solvency risk, the liquidity risk, and the credit risk of the asset portfolio.

The solvency risk can be measured through various bank balance sheet indicators, which are directly available on Bankscope (equity-asset ratio, regulatory capital ratio) or which can be computed from that (Z-Score). For the purpose of the empirical analysis, and following other works on the topic (Beck, De Jonghe and Schepens, 2013; Berger, Klapper and Turk-Ariss, 2009), we use the Z-Score as a measure of the distance of a bank from insolvency. It is computed as the sum of the equity-asset ratio (E/A) and of the return on assets (RoA), divided by the standard deviation of the RoA, as follows:

$$Z - Score_{it} = \frac{E/A_{it} + RoA_{it}}{\sigma(RoA)_{it}}$$

where higher value means higher solvency of a bank. In order to reduce the impact of the changes in assets during the year, we use the Return on Average Assets. Moreover, to allow for the variability of our indicator, we compute the standard deviation of the Return on Average Assets on a rolling base for a four-year interval.

The funding liquidity risk can be measured through different indicators which can be computed from the balance sheet data available in Bankscope (Bonfirm and Kim, 2012). In particular, in our analysis, we define the Liquidity Ratio as the ratio between liquid assets and short-term borrowing—it explains the size of the liquid assets buffer a bank has at its disposal.

The credit risk is the risk related to the quality of bank assets and it mainly includes the credit risk of the loans extended by the bank and of the securities held on balance sheet. Provided that the

major component of on-balance-sheet assets is given by loans, a good measure for the asset portfolio risk is the Non-Performing Loans (NPLs) ratio, which is available from Bankscope.

Bank Regulation and Supervision

To capture the effects of the quality of the country-specific regulatory framework on the stability of financial intermediaries, we use some indicators from the World Bank Survey on Bank Regulation and Supervision.[11] This extensive survey was conducted in four waves (2001, 2003, 2007, 2011) and it provides information on multiple institutional dimensions for banking activities in 143 jurisdictions. In particular, we focus on two main groups of indicators: market entry conditions, and prudential regulation and supervision.

For market entry conditions and regulation, we consider three indicators: Activity Restrictions, Entry into Banking Requirements, Fraction of Denied Applications. As for the quality of prudential regulation and supervision, we consider five indices: Capital Regulation Stringency, Supervisory Power, Supervisory Independence, Deposit Insurance Scheme and the Fraction of Government-Owned Bank Assets at the country level.

V. EMPIRICAL RESULTS

We present the results of the empirical analysis, distinguishing the different types of bank risk: solvency, liquidity, and credit risk. Also, for each type of bank risk, we discuss the estimates of distinct regression specifications, aimed at exploring the questions introduced in the previous section: the effect of market power and of entry barriers on bank stability; the interaction between market competition and banking regulation and supervision, and the implications thereof for financial stability; and the potential role of Islamic banking in the nexus between competition and stability.

A. Solvency Risk

In this section we explore whether, and how, price competition may affect the solvency risk of credit institutions, as measured by the Z-Score.

From the baseline specification in **Table I.A**, we observe that an increase in the Lerner Index—for instance, a decrease in price competition—improves the bank solvency in terms of the Z-Score. In particular, a one-standard deviation rise in the banks' market power implies an increase in the banks' Z-Score by 4.68, which is a sizeable effect given that - from the summary statistics - the bank-level Z-Score has a mean of 9.73 and a standard deviation of 18.88. This means that banks with large market power also present higher solvency than banks with limited or no market power. This result, consistent with the empirical findings on competition and solvency in the previous literature, confirms that an increase in market power may improve bank solvency by increasing the profit margins available for the bank.

This potentially negative effect of price competition on bank solvency is even stronger if we consider as an explanatory variable—instead of the bank-level Lerner Index—the country-average Lerner Index, which reflects the overall competitive conditions in the economy. Indeed, a one-standard deviation increase in the average market power of banks in a given country is associated

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[11] For the last edition of the Survey, see Cihák, Demirgüç-Kunt, Martínez Pería and Mohseni (2012). For earlier rounds of the Survey and an accurate description of the database, see Barth, Caprio and Levine (2006).

with a rise in the bank Z-Score by 7.29, an effect 56 percent larger than the effect of a corresponding increase in bank market power. This means that, if the other banks operating in a given country use the additional profits from their market power to build adequate capital buffers, each individual bank will also be incentivized to improve its solvency; that is, the opportunity cost of being insolvent is higher in a banking system where, on average, the other banks are solvent.

Also, bank balance sheet factors may affect the solvency position of credit institutions. We consider a series of control variables, regarding the composition and quality of bank assets, the diversification in bank activities, and the sources of bank funding. The ratio of government bond exposures to total assets may be considered as an inverse measure of the banks' appetite for risk, provided that government bonds are high-quality assets. Indeed, banks with a larger share of government bonds among their total assets also display higher solvency in terms of the Z-Score. Also, the growth rate of total assets may be used as an indicator of the potential risks coming from an excessive expansion in the bank balance sheet; if banks increase their assets in a disproportionate way, for instance by extending new credit to riskier borrowers, this may increase the solvency risk of a bank, because of the losses coming from these new bank activities. Moreover, the ratio of non-performing loans to total assets is an inverse measure of the quality of bank assets, and is associated with a worsening of bank solvency. The banks which present a higher rate of non-performing loans, because they invest in riskier assets, are more frequently subject to losses and are therefore less solvent. Finally, the ratio of non-interest income over total revenues is a measure of diversification in the sources of bank income and it shows a positive impact on bank solvency. An increase in the diversification ratio implies better bank performance, because banks receiving a larger fraction of their income from fee-based activities would present lower profit volatility than other banks more reliant on interest revenues.

In **Table I.A**, we investigate whether, and how, market entry conditions may affect the relationship between price competition and bank solvency. The positive impact of market power on bank solvency may be significantly reduced if credit institutions operate in a market with heavy restrictions on banking activities and a high percentage of denied applications. Such limitations to market contestability might actually reverse the sign of the relationship between price competition and bank solvency.

We can give some economic meaning to the estimation results by looking at the threshold values of the interacted variables, for which we can observe a change in the sign of the relationship. If the supervisory authorities in charge of assessing the applications for banking licenses had to reject more than 85 percent of submissions, an increase in the market power of the incumbent banks would have the effect of reducing their solvency; therefore, in such a case, more price competition among the existing banks would be beneficial for financial stability. Also, if the regulatory authorities applied the maximum level of restrictions to bank activities (Activity Restrictions may take a maximum value of 12), the positive effect of market power on solvency would be completely offset by the negative impact of restrictions on activity.

The rationale behind the results is that, when access to the market is restricted to potential competitors, the incumbent banks may be induced to exploit their position in order to further increase their profits and take more risks. While in a contestable market credit institutions may be prevented from increasing their risk taking by the concern for the default risk, in a restricted market with limited entry, large banks disposing of market power know that in the case of bank distress they might benefit from some implicit public support, because of their systemic relevance. This may have some relevant policy implications for regulatory reforms in the financial sector.

Improving market contestability by liberalizing activity and by allowing for market entry may be beneficial not only for consumer welfare but also for financial stability, to the extent that it can prevent the incumbent banks from exploiting the advantages of market concentration and of systemic relevance to increase their risk taking. In this respect, country authorities should be interested in modifying those banking activity regulations which may unduly restrict market contestability, unless they are required to pursue other relevant policy objectives.

In fact, we can argue that not all the regulations which restrict entry should have a negative effect on stability. Indeed, if the regulations for market entry are aimed at establishing more stringent requirements based on prudential considerations—that is, to promote the safety and resilience of the entrants—some market power may still have a positive impact on bank solvency (through the effect on bank profitability), provided that the level of entry requirements is above a given threshold. For the countries in the sample, the indicator of prudential entry requirements—proposed in the World Bank Survey—is included in a range between four and eight, and its average value is 7.80. The threshold based on the estimation coefficient is equal to 5.81. This means that, above that value, the prudential entry requirements may help ensure that incumbent banks with larger market power would adopt adequate management of their solvency. In this respect, entry regulations would have an effect on bank solvency which is analogous to the impact of prudential requirements for capital adequacy. In the absence of such prudential entry requirements, that is below that threshold, the opposite effect would hold: price competition would have a positive effect on the solvency of incumbent banks, although this would not necessarily guarantee the safety of the entrant banks.

In **Table I.B**, we examine the effect of the interaction between price competition and bank regulation and supervision on the solvency of credit institutions.

Specifically, we explore whether, and to what extent, capital regulation may play some role in affecting the nexus between competition and solvency. Based on our hypotheses, we can identify two possible arguments. First, if bank capital is considered as an exogenous constant fixed by regulation, then the negative effect of competition on solvency can be explained simply as a consequence of the reduction in bank profits that follows the decrease in lending rates. On the contrary, if bank capital is modeled as an endogenous variable determined by an optimal bank decision, then the negative impact of competition on solvency may result from a combination of two counteracting effects: 1) a substantial decline in bank profits, and 2) a modest increase in bank capital (where the second effect arises because banks adjust their capital levels to compensate for a fall in profitability).

In order to disentangle this issue, we are interested in separating—in the results of the empirical analysis—the effect of price competition from the impact of capital regulation on bank solvency. For this purpose, we introduce an interaction term between the competition measure (the Lerner Index) and the indicator of capital stringency from the World Bank database. In this way, we can estimate the marginal effects of price competition on bank solvency for different values of capital stringency.

In the specification of Column 2, we consider separately the coefficient for the Lerner Index and the coefficient for the interaction between competition and capital regulation. We observe that in the hypothesis of a total absence of capital regulation, a one-standard deviation increase in price competition would imply an improvement in bank solvency; that is, a rise in the Z-Score, by almost

one-standard deviation.[12] This means that, in the absence of capital regulation, price competition would reduce bank profitability but would also induce banks to increase their capital base as a buffer for loss absorption. Then, in the same regression, the interaction term for capital regulation is positive and an increasing function of capital stringency. This implies that, in the presence of solvency requirements, an increase in market power improves bank solvency as measured by the Z-Score, provided that banks are induced to use the additional profits from their market power to build capital buffers.

Finally, if we combine the effects of the two coefficients, we observe that the overall impact of price competition on bank solvency would be negative, as long as the indicator of capital regulation is higher than a given threshold. In particular, this threshold value for capital stringency would be equal to 6.17, provided that the index is in a range between three and 10 for the countries in the sample, and given that its average value is 7.03. This means that, for the average value of capital stringency in our sample, market power would actually have a positive effect on bank solvency. From the decomposition of our empirical results, we can explain this effect with respect to the interplay of incentives between bank capital management and prudential requirements.

Without capital regulation, banks would adopt a more active management of their capital and choose their optimum capital level. In such a case, more competition could imply higher solvency, because banks with low market power would increase their capital base to a relevant extent, while banks with large market power could afford a lower equity-asset ratio thanks to their profitability. But once we introduce capital requirements, banks tend to take a more passive approach to capital management, by keeping the level of capital required by the regulation. In that case, more competition would reduce bank solvency (or more market power would increase bank solvency).

We also estimate the interaction of market power with other aspects of bank regulation and supervision. In Column 4 of Table I.B, we consider the effect of supervisory independence in relation to price competition. The positive effect of market power on solvency is an increasing function of the degree of supervisory independence. This means that banks with large market power may still be more solvent, provided the existence of an effective and independent supervisor induces them to manage their capital more prudently.

Also, in Column 5, we consider the possible role of deposit insurance. We observe that when there is no explicit deposit insurance, the differences in bank solvency between banks with large market power and banks with limited market power are rather small; whereas in the presence of deposit insurance, banks disposing of some market power tend to show higher solvency than banks with competitive pricing. In order to understand this difference, we have to consider that in general banks with some market power obtain more profits than banks with competitive pricing and then— in the absence of changes to bank capital—they are expected to have a better solvency position. However, if capital is endogenous, banks may increase their equity-asset ratio to improve their resilience. In particular, they would do so depending on the opportunity cost of a potential insolvency situation, which may depend on some institutional factors such as deposit insurance.

In fact, the absence of a deposit insurance scheme would likely raise the opportunity cost of a potential insolvency. In such a case, banks with limited market power and consequently low profitability would have stronger incentives to raise their capital in such a way as to offset the negative effect of competition on bank profitability. Indeed, banks know that otherwise they could

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[12] A one-standard deviation decrease in bank market power (the Lerner Index) increases the bank Z-Score by 17.73, provided that the Z-Score has a standard deviation equal to 18.88.

be easily subject to a bank run if depositors—fearing potential insolvency—were to withdraw their funds. On the contrary, such incentives to increase capital would be lower in the presence of deposit insurance, because in that case banks could benefit from the protection of the insurer for depositors. This incentive problem may explain why, under deposit insurance, banks with limited market power could be less solvent; the potential increase in bank capital would not compensate the decrease in the amount of profits.

Finally, **Table I.C** explores the possible impact of Islamic banking on the relationship between price competition and bank solvency. In this case, the empirical results don't show any significant difference in bank solvency between conventional and Islamic banks. Also, looking at the interaction term, we don't find evidence that the nexus between competition and solvency works differently for Islamic banks than for conventional ones.

B. Liquidity Risk

In this section we explore whether, and how, bank market power affects the availability of liquid assets with respect to a bank's short-term borrowing. The results from the baseline specification, as presented in Table II.A, reveal that a decrease in the Lerner index—that is, an increase in price competition—implies an improvement in the liquidity ratio. In particular, we observe that a one-standard deviation decrease in the bank-level Lerner Index (increase in price competition) induces an increase in the liquidity ratio by 3.7 percent for that institution. This would be an economically significant effect, given that for the banks in our sample, the ratio between liquid assets and short-term borrowing has a mean equal to 47 percent and a standard deviation equal to 4 percent.

This positive effect of competition on liquidity is confirmed across all the specifications, and when we take into account the possible role of other factors for market entry and for banking regulation and supervision.

Also, if we consider the average price competition across all banks in a given country, we notice that a one-standard deviation decrease in the country-average Lerner Index (that is, an increase in competition at the country level) implies an improvement in the bank-level liquidity ratio by 7.4 percent, which is—in terms of magnitude—twice as large as the effect of a corresponding change in the bank-level Lerner Index. This means that the intensity of price competition at the market level may be even more important than the extent of the bank-specific market power in affecting the incentives for bank liquidity.

Bank-level balance sheet factors and country-specific macroeconomic developments may also have a significant impact on bank liquidity as control factors. In particular, the quantity and the quality of bank lending may affect banks' liquidity position. Looking at balance sheet volumes, banks with larger lending activity with respect to their total assets present a wider liquidity mismatch between their assets and liabilities and show higher liquidity risk. But then, after controlling for the volumes, the quality of bank lending may have a self-disciplining effect on liquidity management: as banks with a higher rate of nonperforming loans need to have more liquid assets as a buffer against shortfalls in the expected cash flows from borrowers. Likewise, diversification in the sources of bank income may be relevant for liquidity: provided that fee-based revenues may be less volatile, banks with a higher fraction of non-interest income over total revenues may need to hold less liquidity than other banks that rely more on the conjuncture of credit markets. Moreover, bank profitability also improves the liquidity position by increasing the amount of cash revenues available to banks.

The results obtained from the bank balance sheet controls would support the idea that—at least for the sample under our consideration—credit institutions tend to implement an active management of their liquidity by adjusting the amount of their liquid buffers with respect to the effective risks that may affect their cash flows. The positive effect of price competition on bank liquidity would be consistent with this approach: banks would react to the reduction in profit margins by increasing the availability of liquid assets, in order to ensure the holdings of adequate buffers to face future cash outflows. This may also have some policy implications for the financial sector in MENA because it shows that, on average, the banks operating in those countries adopted a quite prudent management of their liquidity during the under analysis period. On the other hand, even during the crisis, the banking system in the MENA region was not as subject to significant liquidity shocks such as the ones which strongly affected the banking systems in advanced economies.

In **Table II.A**, we examine also the effect of the interaction between price competition and market entry conditions on bank liquidity. From the results in Columns 4 and 5, we see that the positive effect of price competition (and then the negative effect of market power) on the liquidity ratio is even larger when national regulators introduce some restrictions on the ability of banks to engage in other activities (securities, insurance, or real estate) or they establish some legal requirements for bank entry. We can provide some economic explanation of this effect based on the estimation results. An increase in the activity restrictions from the minimum (3) to the maximum value (12) would raise the benefits of price competition[13] for the liquidity ratio from 2.1 percent to 8.5 percent. Also, a rise in the banking entry requirements from the minimum (4) to the maximum (8) would actually change the marginal effect of competition on liquidity from being negative to positive, that is from -2.6 percent[14] to 3.8 percent. In the latter case, price competition may induce a positive effect on the bank liquidity position, provided that regulators introduce adequate entry requirements above a given threshold. In particular, the threshold level for entry requirements that would ensure the positive effect on liquidity would be 5.61, while, in fact, the average value of this indicator in our sample is well above that threshold (7.80). This confirms—for the average value of entry requirements in our sample—the positive impact of competition on liquidity.

We can interpret these results by observing that some restrictions to bank activities and, particularly, some requirements for entry into banking, may be necessary in order to ensure that institutions operating in the market are managed in a prudent way. In the case of liquidity, both activity restrictions and entry requirements support the market mechanism in which more competition improves the liquidity position of financial intermediaries. On the contrary, in the absence of such entry requirements, the positive impact of bank competition on liquidity might be significantly reduced or reversed as—without the proper incentives from the prudential framework—credit intermediaries might react to competition by increasing the recourse to short-term funding sources.

In **Table II.B**, we investigate the role bank regulation and supervision has on the relationship between price competition and bank liquidity. As mentioned earlier, the existing framework for prudential regulation has focused mainly on capital requirements; only after the crisis have international regulators decided to introduce some minimum liquidity ratios. The policy debate underlying the Basel III negotiations has also considered the issue of the potential complementarity or substitutability between capital and liquidity requirements,[15] because of the concern that the

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[13] For simplicity, from now on, in the quantification of the effects we consider always the impact of a one standard deviation decrease in the bank Lerner Index.

[14] This means a negative effect of competition on liquidity.

[15] For instance, see Vives (2014).

focus on solvency regulation—prior to the crisis—may have had some adverse effects on bank liquidity.

The empirical evidence observed for the banks in MENA supports the view that prudential requirements for capital adequacy may strengthen the liquidity-enhancing effect of price competition. Indeed, a rise in the stringency of capital regulation from the minimum (3) to the maximum value (10) increases the positive effect of higher competition on the bank liquidity ratio from 2 percent to 6.6 percent. The intuition is that, if capital regulation is binding, banks are even more incentivized by competition to practice prudent management of their liquidity, because they have to prevent temporary liquidity shocks from creating potential consequences in terms of insolvency. In this respect, stringent capital regulation would increase the opportunity cost of bank illiquidity.

The quality of bank supervision may also affect the competition-liquidity nexus. Whereas the interaction with the supervisory power displays a nonsignificant coefficient, supervisory independence may reduce the positive effect of competition (or the negative impact of market power) on the bank liquidity position. We can interpret this effect by considering how bank supervision may shape the liquidity incentives of banks with some degree of market power. In general, financial intermediaries with larger pricing power may obtain more profits and then wider cash flows. Because of that, they may have less need for short-term funding (implying higher liquidity ratio) but also—in the expectation of future cash flows—they may decide to hold smaller amounts of liquid assets (meaning lower liquidity ratio). Given these two effects, stronger supervision may reinforce the incentives—also of banks with some market power—to keep an appropriate amount of liquid assets, in such a way as to reduce the negative impact of pricing power on the bank liquidity position.

Looking at the indicators in the World Bank Survey, we can argue that higher independence would strengthen the de facto effectiveness of banking supervision. Then, when price competition among the incumbent banks is limited, an independent supervisor would be able to ensure that such market power does not produce adverse consequences for bank liquidity. For this reason, the independence of bank supervisors would provide a corrective mechanism—for banks with large market power— to reduce the incentives for slack liquidity management.

Moreover, the existence of deposit insurance may also change the preferences of banks for liquidity (Column 5). If the government provides an explicit deposit insurance scheme or, failing that, if depositors were fully compensated on the occasion of the last bank failure, the liquidity-enhancing effect of bank competition may not work anymore because of the moral hazard induced by the existing insurance. On the contrary, if banks know that in the case of a liquidity shock no protection scheme will be activated for depositors, under competitive pressures they will be induced to manage their liquidity more prudently because, in the case of a bank run, they would default and then lose their franchise value.

Finally, the presence of government-owned banks may affect the competition-liquidity nexus, particularly in MENA, where governments have wide control of the banking system (on average 24 percent of the total assets of the banking system are government-owned). The public ownership could also imply the willingness of the government to intervene in support of a distressed bank by providing liquidity facilities; this might induce some moral hazard in the liquidity management of government-owned banks. The evidence supports this hypothesis. The negative effect of bank market power on liquidity position increases if the fraction of government-owned banks is larger. Banks with large market power are even less incentivized to prudently manage their liquidity if the government owns a large stake in the banking sector. In principle, this effect should concern mainly

the institutions which are actually government-owned, but it might also affect other banks, if the presence of a large public stake in the banking sector raises expectations of more public intervention in the event of bank distress.[16]

In **Table II.C**, we explore the role Islamic banking has on the liquidity position of financial intermediaries, either directly (through the impact of the bank business model) or indirectly (through the effect of bank competition). From Column 2, we observe that Islamic banks tend to have larger liquidity buffers compared with conventional banks, because their liability structure is less reliant on short-term funding. Provided that the average liquidity ratio for the banks included in the sample is equal to 47 percent, the Islamic dummy would imply that, on average, a bank would have a liquidity ratio higher by 14 percent. To compare the magnitude of the coefficients, we notice that a one-standard deviation decrease in the Lerner Index—that is, an increase in price competition—implies only an improvement of 3.5 percent in the liquidity ratio. This means that the liquidity position of Islamic banks is mainly driven by their specific business model, while other factors play a less relevant role.

In this respect, price competition doesn't seem to have a significant effect on bank liquidity for Islamic banks; or, if anything, it may have the opposite effect. From Column 3 we observe that, for Islamic banks, the overall effect of an increase in the Lerner Index may even be positive, if we sum the coefficients for the Lerner Index and for the interaction term. This means that banks with larger market power may also have wider liquidity buffers. We can explain this effect with regard to the specific preferences of Islamic banks for liquidity; provided they don't have access to the interbank markets and cannot obtain wholesale funding by paying interest rates, they tend to use their cash flows to build large buffers of liquid assets. For this reason, banks which are more profitable thanks to their market power may also have larger cash flows and wider liquidity buffers at their disposal. From this point of view, we could argue that, whereas conventional banks tend to have active management of their liquidity (which would also explain the liquidity-enhancing effect of price competition), Islamic banks show a more passive management of their liquidity; that is, they build liquidity buffers on the basis of their cash flows and then as a function of their profits (which would justify the positive effect of market power on liquidity).

C. Credit Risk

In this section we investigate whether, and to what extent, price competition may affect the credit risk of the banks' asset portfolio. The empirical results suggest that an increase in price competition—that is, a decrease in the Lerner Index—implies a rise in the ratio of nonperforming loans to total credit. This means that banks with large market power also display a lower rate of nonperforming loans, because they are less interested in taking additional risks, given their profitability. Recalling the two arguments proposed in the discussion on credit risk (Section III.C), and on the basis of our results, we can argue that when price competition increases and banks reduce their lending rates, the effect of an increase in bank risk taking from the lender's side may be more relevant than the effect of a potential decrease in credit risk from the borrower's side.

In particular, if we look at the baseline specification from **Table III.A**, we observe that a one-standard deviation decrease in the Lerner Index—in other words, an increase in price competition—

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[16] Unfortunately, the available data on Bankscope don't provide enough information to identify the ownership of each individual bank, so we cannot always say whether a specific credit institution is owned by the government. For this reason, we use as interaction term the fraction of government-owned bank assets, as provided in the World Bank Database for Bank Regulation and Supervision.

implies a rise in the rate of nonperforming loans by 1.6 percent. This would be a relevant impact, provided that in our sample the rate of nonperforming loans has an average value of 10.3 percent with a standard deviation of 12.1 percent. The negative impact of competition on credit quality is also confirmed when we consider, instead of the bank-level Lerner Index, the country-average Lerner Index. Actually, price competition at the economy level can even have a larger effect, given that a one-standard deviation decrease in the country-average Lerner Index reduces the ratio of nonperforming loans by 3.2 percent.

To compare the effects of market power with market concentration, we also introduce as a control variable the bank market share, computed as the ratio between the asset size of a bank and the total assets of the banking system in the country. In this case, we observe that—unlike the results on solvency risk—market share and market power have different effects on credit risk. Whereas higher market power implies, on average, a better quality of the loan portfolio, a larger market share is associated with a higher rate of nonperforming loans. In this respect, market share may also be considered as a proxy of the systemic relevance of a bank. Thanks to the implicit subsidy from public support, large banks may be induced to assume more risk taking than small banks and can then provide riskier loans. A percentage point increase in the bank market share implies a 0.26 percent rise in the rate of nonperforming loans.

Market dynamics may also significantly impact the role price competition has on credit quality. If the entry into the banking market is substantially restricted by high denial of license applications, the impact of market power on credit quality may be reversed. In particular, if the fraction of denied applications is higher than 72 percent, an increase in market power induces an opposite effect—that is, a rise in the ratio of nonperforming loans—because banks operating in a restricted market may be incentivized to increase risk-taking behavior. For this reason, it is crucial to ensure enough market contestability by allowing entry to new banks, subject to certain prudential requirements.

Bank balance sheet factors concerning bank profitability, funding liquidity, and asset composition may have a relevant effect on the rate of nonperforming loans. In particular, the sources of bank funding may influence the credit quality of the loan portfolio by affecting the screening and monitoring incentives of the lender. According to the idea of delegated monitoring in banking (Diamond 1984), banks which are more reliant on funding from wholesale markets are expected to be more selective about the credit quality of the borrowers, because they know that the counterparties can easily withdraw their funds. On the other hand, banks mostly funded through deposits, especially if they are protected by deposit insurance, have less incentive to ensure the credit quality of their loan portfolios, because depositors are not able, or not interested, in monitoring the bank with regard to its lending decisions. The empirical results confirm this argument: an increase in the fraction of deposits over total funding has a positive impact on the rate of nonperforming loans.

The composition of bank assets may also reflect some banks' preferences in risk taking. The ratio of government bond exposures to total assets may be considered as an inverse measure of the bank risk appetite: the institutions which invest a larger part of their assets in government bonds prefer to have a more balanced risk profile. Indeed, banks with a larger share of treasury bonds over their total assets also display a lower rate of nonperforming loans, because they also tend to be more conservative in their credit provision. Finally, bank profitability is a key determinant of the credit quality of the loan portfolio: more profitable banks tend to provide credit to less risky borrowers. In fact, a higher rate of return on average equity is associated with a lower rate of nonperforming loans. This result is also consistent with the interpretation of the positive effect of market power on credit quality in terms of risk-taking incentives for bank lending.

Finally, macroeconomic developments may also affect the credit risk of the loan portfolio. Both the GDP growth rate and the CPI inflation rate are negatively related to the rate of nonperforming loans. The asset quality of bank lending improves in the presence of favorable macroeconomic conditions, as captured by high values of the GDP growth rate and of the CPI inflation rate.

In **Table III.B**, we investigate the role of bank regulation and supervision in the relationship between price competition and credit risk. In this respect, the results obtained for credit risk are qualitatively analogous to the outcomes observed for solvency risk.

Capital regulation plays a key role in determining the sign and the size of the competition-stability nexus. Based on the empirical results, we can argue that—in the absence of solvency requirements—more competition would imply a higher quality of credit provision, as long as banks are incentivized by market pressures to select the most creditworthy borrowers, so as to reduce the credit risk of their loan portfolios. However, such market mechanism may not work completely in a credit market with asymmetric information, where lenders may not be able to perfectly screen borrowers. Also, if some banks have large market power at their disposal, they may exploit that power to take on additional risks.

Then, the regression estimates show that capital regulation may be a useful tool for addressing such market failures, to the extent it incentivizes banks to use the additional profits from their market power to build appropriate capital buffers. Indeed, considering the coefficients for the Lerner Index and for the interaction term, we observe that market power may have a positive impact on credit quality if the country-level indicator of capital regulation is higher than a given threshold (5.27), whereas the average value of such index for the banks in our sample is equal to 7. In this respect, capital regulation provides a key contribution to ensure that the exercise of market power doesn't imply any adverse consequences in terms of credit quality for the loan portfolio.

Also the quality of prudential supervision may be relevant for the relationship between price competition and credit risk. Provided that banks with low market power may provide credit to more risky borrowers, either for profitability incentives or because unable to practice price discrimination, the existence of a strong supervisory power may reduce the negative effect of such risk taking on credit quality. In particular, an increase in the prerogatives of supervisory authorities to take preventive and corrective actions reduces the negative effect of price competition on credit quality. Indeed, a rise in the supervisory power from the minimum (5) to the maximum value (15) decreases the effect of price competition on the nonperforming loans ratio from 3.6 percent to 0.3 percent (almost no impact).

Finally, the presence of deposit insurance may affect the credit quality of the lending process, by inducing some moral hazard in the decisions of all banks, irrespective of their market power. Indeed, if there is an explicit deposit insurance scheme, or if depositors are fully reimbursed in the event of bank failure, all banks are incentivized to take risk to such an extent that the relationship between price competition and credit risk is not significant anymore.

Table III.C discusses the role Islamic finance has on the relationship between price competition and credit risk. If we introduce a dummy variable for Islamic banks, as well as an interaction term between the Lerner Index and the Islamic dummy, we observe that only the coefficient for the Islamic dummy is negative and significant. This means that Islamic banks have, on average, a lower rate of nonperforming loans compared with conventional banks. Provided that the banks in the sample show an average rate of nonperforming loans of 10.3 percent, the Islamic nature of a bank reduces this nonperforming loan ratio by 6.6 percent. This result is consistent with previous findings in the literature on Islamic banking (Baele, Farooq and Ongena, 2014; Beck, Demirguc-

Kunt and Merrouche, 2013). However, the empirical analysis doesn't provide any significant evidence that the relationship between price competition and credit risk may work differently for Islamic banks. We can only argue that—in banking systems characterized by a high presence of Islamic banking—the credit quality of the loan portfolio may be higher, but this is essentially a consequence of the specific business model of Islamic banks and is not related to the competition-stability nexus.

VI. Conclusions

This paper analyzes the relationship between bank competition and financial stability for banks in the Middle East and North Africa. The banking system in this region presents some specific peculiarities, given that it generally shows some low level of competition and relatively high market concentration. At the same time, it has achieved a quite satisfactory performance in terms of financial stability, as shown during the global financial crisis. Indeed, in a comparison with other banking systems around the world, it displays a high level of bank solvency, as well as large buffers of liquid assets with respect to deposits and short-term borrowings. Moreover, it presents relatively limited risk taking as indicated by the markedly lower rate of nonperforming loans compared with financial sectors elsewhere.

Given this motivation, we investigate how the nexus between competition and stability works for the banks in MENA, also taking into account the peculiarities of the bank business model, such as the coexistence of conventional and Islamic banks. In particular, we provide three main contributions with respect to the previous literature. First, we explore whether and how competition may affect stability with regard to three different types of bank risk at the institution level—solvency, liquidity, and credit risk—and we show that the heterogeneous effects observed in the existing literature may be explained in terms of different types of risk. Second, we examine how market entry, bank regulation, and bank supervision may shape, or change, the impact of competition on different sources of bank risk. Third, we study whether competition may have different effects on stability for Islamic banks and we find that this might be the case for funding liquidity, given the peculiar business model of Islamic banks, which are less reliant on wholesale funding.

The empirical results suggest that the effects of bank competition on stability may differ depending on the type of risk. In particular, we observe that competition has a positive effect on bank liquidity, while it may have a potentially negative impact on solvency and credit quality.

Price competition improves the liquidity position of a bank by inducing a self-discipline mechanism on the choice of bank funding sources. If banks are subject to strong competition, they get lower profit margins and are then unable to afford costly funding sources; for this reason, they prefer to keep larger buffers of liquid assets. Capital regulation may strengthen the liquidity-enhancing effect of price competition, while deposit insurance may reduce such incentives.

Also, price competition may reduce bank profits and then imply a possibly negative effect on solvency. In general, if banks pursue active management of their capital, they may respond to a decrease in profitability by increasing their capital base so as to improve their resilience. In such a case, competition may have a positive effect on bank solvency if the increase in bank capital is sufficiently large to compensate for the reduction in bank profits. Then, a country's regulatory framework may affect the incentives of banks in various ways. On one hand, the presence of a deposit insurance scheme reduces the opportunity cost of a potential insolvency for competitive banks and so the rationale for a capital increase. On the other hand, prudential requirements may

provide an effective mechanism for banks with market power to safely manage their additional profit margins and increase their capital buffers.

Price competition may increase the credit risk of the loan portfolio if banks are induced to take on additional risks to improve their profitability. In such a case, the effect of an increase in bank risk taking from the lender's side would be more relevant than the effect of a potential decrease in credit risk from the borrower's side. As also observed for solvency, capital regulation may provide the appropriate incentives for prudent management of banks with market power.

The paper also suggests various policy implications for the design and implementation of financial sector reforms in the Middle East and North Africa, particularly in the area of market contestability. Indeed, a reduction in competition may determine an increase in bank risk, particularly for solvency and credit risk, if the market is heavily regulated by restrictions on activity or if access is restricted by the frequent denial of license applications. In such cases, banks may be incentivized to exploit their position in noncontestable markets as a way of taking on additional risks. For this reason, policy authorities may be interested in adopting reforms that promote price competition among the incumbent banks in the regulated markets, and modify and reduce those regulations which may create unnecessary restrictions to the contestability of banking markets, if these are not justified by other major policy objectives.

At the same time, other policy reforms should aim to improve the quality and independence of prudential supervision and reduce the control of governments on the financial sector, in order to limit the impact of distortionary incentives on bank behavior. In fact, in the cases where competition may induce some possible incentives for bank risk taking, a strong supervisory power may induce banks to adopt more appropriate risk management in their lending, to avoid an excessive and risky expansion of credit just for profitability considerations. Also, the reduction of the government stake in the financial sector may reduce the moral hazard incentives of banks with large market power, which may otherwise adopt imprudent management of their liquidity because of their reliance on support from the public sector.

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Table 1. Sources and Description of the Variables

VARIABLE	DESCRIPTION	SOURCE
Market Power and Competition		
Bank-level Lerner Index	It is a measure of the market power of a bank. It is computed as the ratio between the bank mark-up (price – marginal cost) and the average price of bank assets.	Calculated from BANKSCOPE
Country-average Lerner Index	The average value, at the country level, of the Lerner Index of all the banks in that country. Higher value indicates more market power and less price competition at the country-level	
Market Share	The ratio of the total assets of a bank to the total assets of all the banks in a given country. Higher value means larger market share of a bank with respect to its domestic market.	
Bank Solvency		
Z-Score	It is a measure of the distance of a bank from insolvency. It is computed as the sum of the equity-asset ratio and of the return on assets (RoA), divided by the standard deviation of the RoA. Higher value means better solvency of a bank.	Calculated from BANKSCOPE
Equity-Asset Ratio	The ratio between total equity and total assets	BANKSCOPE
Return on Average Assets	The ratio of bank net income to the average value of assets	
Bank Liquidity		
Liquid Assets/Short-Term Borrowing Ratio	The ratio between liquid assets and short-term borrowing	BANKSCOPE
Credit Risk		
Non-Performing Loans Ratio	The ratio between non-performing loans and total loans	BANKSCOPE
Bank Balance Sheet Controls		
Non Interest Income Ratio	The ratio of non-interest income to total revenues	BANKSCOPE
Return on Average Equity	The ratio of bank net income to the average value of equity	
Government Bonds Ratio	The ratio of the bank exposures to government bonds over the bank total assets	
Loans to Total Assets Ratio	The ratio of the bank net loans to the amount of total loans	
Deposits to Total Funding Ratio	The ratio of total deposits to the total funding	
Growth of Total Assets	The growth rate of total assets	

VARIABLE	DESCRIPTION	SOURCE
Macro Variables		
GDP Growth Rate	The annual growth rate of real GDP	World Economic Outlook
CPI Inflation Rate	The inflation rate based on the consumer price index	(IMF)
Market Entry Conditions		
Activity Restrictions	The extent to which banks may engage in securities, insurance and real estate, within a range between 3 and 12. Higher value means more activity restrictions.	Banking Regulation and Supervision (World Bank)
Entry into Banking Requirements	Whether various types of legal submissions are required to obtain a banking license, within a range between 0 and 8. Higher value means more entry requirements.	
Fraction of Denied Applications	Percentage of applications to enter banking which are denied.	
Bank Regulation and Supervision		
Capital Regulation	The stringency of capital requirements, within a range between 0 and 10. Higher value means more stringent regulation.	Banking Regulation and Supervision (World Bank)
Supervisory Power	The power of supervisory authorities to take specific actions to prevent and correct problems, within a range between 0 and 15. Higher value means stronger supervisory power.	
Independence of Supervisors	Whether the supervisory authority is independent from the government and legally protected from the banking industry, in a range bet. 0 and 3. Higher value means stronger independence.	
Fraction of Government Owned Bank Assets	Percentage of the banking system's assets in banks that are government-controlled.	
Deposit Insurance Scheme	Whether there is an explicit deposit insurance scheme and depositors were fully compensated the last time a bank failed. It is equal to 0 in presence of insurance and to 1 in absence of that.	

Table 2. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
BANK COMPETITION					
Bank Lerner Index	1941	.3257241	.349005	-1.80814	1.792211
Country Average Lerner Index	2706	.3216213	.2488896	-.5921693	1.149032
Weighted Average Lerner Index	2912	.310748	.2752441	-.6521511	1.195757
Bank Market Share	3390	.0917404	.1346114	.000185	1
BANK SOLVENCY					
Bank Z-Score	2543	9.731529	18.8839	-29.59916	241.604
Country Average Z-Score	4677	1.753135	.5518894	-1.167987	3.238249
Weighted Average Z-Score	5872	17.17372	15.63936	-1.167987	67.4677
Tot Regulatory Capital Ratio	1744	22.04591	13.56645	8.05	92
Tier 1 Capital Ratio	1178	19.64578	12.31565	7.2	83
BANK PROFITABILITY					
Return on Average Equity	3374	11.05414	13.34129	-51.66	50.04
Return on Average Assets	3375	1.495665	2.636938	-10.27	13.2
Net Interest Margin	3332	3.613487	3.015037	-3.82	18.05
BANK CREDIT RISK					
Non-Performing Loans Ratio	1739	.1032941	.1214676	.0012	.683
Loan Loss Provisions to Interest Revenues	2761	.2716322	.4864896	-.6169	3.1066
BANK LIQUIDITY					
Deposit to Total Funding Ratio	3243	.8104914	.2161244	.0416	1
Liquid Assets/Short-Term Borrowing Ratio	3311	.4705926	.4017674	.0364	2.6928
BANK BALANCE SHEET VARIABLES					
Loans to Assets Ratio	3313	.4392514	.212958	.0034	.8959
Government Bonds Ratio	1539	.1617269	.1368704	0	.9526576
Non Interest Income Ratio	3326	.2725004	.3492946	-13.99998	2.370414
Total Assets	3390	6345850	10,800,000	26240.31	55,900,000
Growth Total Assets	3115	18.54746	26.07108	-26.67	152.59
MACROECONOMIC VARIABLES					
GDP Growth Rate	5653	4.838977	7.295436	-62.07599	104.4833
CPI Inflation Rate	5634	5.62938	7.314547	-9.86305	53.24779
MARKET ENTRY					
Activity Restrictions	3900	7.818462	1.526501	3	12
Entry into Banking Requirements	4496	7.800203	.6680363	4	8
Fraction of Denied Applications	2548	.2619675	.3426484	0	1
BANK REGULATION AND SUPERVISION					
Capital Regulation Stringency	3720	7.030538	1.714338	3	10
Supervisory Power	4044	11.71893	2.305612	5	15
Supervisory Independence	3368	1.5962	.7955234	0	3
Government Owned Bank Assets	2448	23.56516	29.17612	0	95.78
Deposit Insurance Coverage	1092	.0628674	.1769852	.002	.7
No Deposit Insurance	3692	.5016251	.5000651	0	1

Table I.A

The Effects of Bank Competition and of Market Entry on Solvency Risk

VARIABLES	(1) Z-Score	(2) Z-Score	(3) Z-Score	(4) Z-Score	(5) Z-Score	(6) Z-Score
Lerner_1	0.134***		0.136***	0.302***	-0.355*	0.218**
	(0.0466)		(0.0465)	(0.0960)	(0.191)	(0.103)
Average Lerner_1		0.293***				
		(0.0839)				
Market Share_1			0.706**			
			(0.347)			
Lerner_1 * Activity Restrictions				-0.0241**		
				(0.0121)		
Lerner_1* Entry Requirements					0.0611***	
					(0.0235)	
Lerner_1* Denied Applications						-0.255*
						(0.146)
Loans Assets Ratio_1	0.122	0.225*	0.161	0.0588	-0.0206	-0.217
	(0.138)	(0.133)	(0.139)	(0.136)	(0.133)	(0.243)
Government Bond Ratio_1	0.256**	0.214*	0.247**	0.268**	0.322***	0.299
	(0.119)	(0.114)	(0.119)	(0.115)	(0.112)	(0.187)
Deposit Funding Ratio_1	0.130	0.166	0.132	0.141	0.139	0.686***
	(0.126)	(0.119)	(0.126)	(0.131)	(0.119)	(0.258)
Non-Interest Income Ratio_1	0.321**	0.149	0.337**	0.146	0.222*	0.153
	(0.133)	(0.113)	(0.133)	(0.144)	(0.128)	(0.265)
Growth Assets_1	-0.125**	-0.0924*	-0.140**	-0.0756	-0.0910*	-0.0591
	(0.0580)	(0.0557)	(0.0583)	(0.0630)	(0.0544)	(0.105)
Non-Performing Loans Ratio_1	-0.251**	-0.209*	-0.251**	-0.293**	-0.294**	-0.312
	(0.125)	(0.119)	(0.125)	(0.123)	(0.117)	(0.219)
GDP Growth_1	0.0983	0.0232	0.109	-0.0918	-0.0684	0.177
	(0.225)	(0.222)	(0.225)	(0.242)	(0.212)	(0.421)
CPI Inflation_1	-0.174	-0.149	-0.155	-0.161	-0.209	-0.654
	(0.247)	(0.242)	(0.246)	(0.275)	(0.231)	(0.457)
Constant	-13.67	-24.09*	-22.53	-8.510	-5.984	-40.79*
	(13.14)	(12.99)	(13.81)	(13.59)	(12.35)	(24.51)
Bank Fixed Effects	YES	YES	YES	YES	YES	YES

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table I.B

The Effects of Bank Competition and of Bank Regulation and Supervision on Solvency Risk

VARIABLES	(1) Z-Score	(2) Z-Score	(3) Z-Score	(4) Z-Score	(5) Z-Score	(6) Z-Score
Lerner_1	0.134***	-0.508***	0.313**	-0.0898	0.148***	0.0253
	(0.0466)	(0.129)	(0.141)	(0.0740)	(0.0510)	(0.0405)
Lerner_1 * Capital Regulation		0.0823***				
		(0.0154)				
Lerner_1 * Supervisory Power			-0.0157			
			(0.0119)			
Lerner_1 * Supervisory Independence				0.102***		
				(0.0266)		
Lerner_1 * No Deposit Insurance					-0.125**	
					(0.0571)	
Lerner_1 * Government Owned Banks						-0.00107
						(0.00182)
Loans Assets Ratio_1	0.122	-0.131	0.0757	0.00647	-0.113	-0.194
	(0.138)	(0.137)	(0.137)	(0.145)	(0.130)	(0.121)
Government Bond Ratio_1	0.256**	0.308***	0.270**	0.354***	0.279**	-0.0256
	(0.119)	(0.113)	(0.116)	(0.125)	(0.109)	(0.124)
Deposit Funding Ratio_1	0.130	0.147	0.237*	0.0428	0.110	0.0551
	(0.126)	(0.127)	(0.133)	(0.135)	(0.119)	(0.111)
Non-Interest Income Ratio_1	0.321**	0.239*	0.214	0.260*	0.192	0.0572
	(0.133)	(0.139)	(0.145)	(0.139)	(0.136)	(0.119)
Growth Assets_1	-0.125**	-0.0589	-0.104	-0.0948	-0.0773	-0.0894*
	(0.0580)	(0.0617)	(0.0660)	(0.0584)	(0.0587)	(0.0534)
Non-Performing Loans Ratio_1	-0.251**	-0.291**	-0.237*	-0.300**	-0.413***	-0.503***
	(0.125)	(0.120)	(0.124)	(0.128)	(0.115)	(0.133)
GDP Growth_1	0.0983	-0.135	-0.0772	0.00612	-0.0952	-0.0854
	(0.225)	(0.236)	(0.253)	(0.237)	(0.227)	(0.247)
CPI Inflation_1	-0.174	-0.179	-0.249	-0.0856	-0.199	0.106
	(0.247)	(0.269)	(0.282)	(0.265)	(0.233)	(0.260)
Constant	-13.67	-0.601	-18.85	0.593	2.759	19.50
	(13.14)	(13.33)	(13.74)	(14.28)	(12.55)	(11.84)
Bank Fixed Effects	YES	YES	YES	YES	YES	YES

Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table I.C

The Effects of Bank Competition and of Islamic Banking on Solvency Risk

VARIABLES	(1) Z-Score	(2) Z-Score	(3) Z-Score	(4) Z-Score
Lerner_1	0.0851***	0.0856***	0.0852***	0.0885***
	(0.0281)	(0.0283)	(0.0282)	(0.0287)
Lerner_1 * Islamic		-0.0222		-0.164
		(0.0921)		(0.226)
Islamic			0.275	7.611
			(4.503)	(11.06)
Loans Assets Ratio_1	-0.0144	-0.0135	-0.0134	-0.00919
	(0.0632)	(0.0634)	(0.0635)	(0.0639)
Government Bond Ratio_1	0.147*	0.147*	0.149*	0.150*
	(0.0863)	(0.0867)	(0.0868)	(0.0870)
Deposit Funding Ratio_1	0.152**	0.153**	0.152**	0.165**
	(0.0610)	(0.0612)	(0.0614)	(0.0640)
Non-Interest Income Ratio_1	0.137	0.140	0.138	0.138
	(0.0909)	(0.0912)	(0.0914)	(0.0916)
Growth Assets_1	-0.0837*	-0.0829	-0.0842*	-0.0800
	(0.0506)	(0.0508)	(0.0507)	(0.0511)
Non-Performing Loans Ratio_1	-0.362***	-0.362***	-0.361***	-0.356***
	(0.0940)	(0.0943)	(0.0943)	(0.0947)
GDP Growth_1	0.126	0.131	0.124	0.134
	(0.190)	(0.191)	(0.191)	(0.192)
CPI Inflation_1	-0.117	-0.118	-0.116	-0.116
	(0.197)	(0.198)	(0.198)	(0.198)
Bank Fixed Effects	NO	NO	NO	NO

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note. The Islamic dummy is a time-invariant constant for a given bank during the considered time period, so it may play a role equivalent to bank fixed effects in the regression. For this reason, we estimate such panel regression by using a GLS random-effect specification.

Table II.A

The Effects of Bank Competition and of Market Entry on Liquidity Risk

VARIABLES	(1) Liq Ratio	(2) Liq Ratio	(3) Liq Ratio	(4) Liq Ratio	(5) Liq Ratio	(6) Liq Ratio
Lerner_1	-0.106***		-0.104***	0.0379	0.256**	-0.00829
	(0.0210)		(0.0210)	(0.0473)	(0.108)	(0.0370)
Average Lerner_1		-0.299***				
		(0.0357)				
Market Share_1			0.250*			
			(0.137)			
Lerner_1 * Activity Restrictions				-0.0204***		
				(0.00600)		
Lerner_1* Entry Requirements					-0.0456***	
					(0.0132)	
Lerner_1* Denied Applications						0.0555
						(0.0540)
Loans Assets Ratio_1	-0.643***	-0.571***	-0.634***	-0.652***	-0.594***	-0.199**
	(0.0591)	(0.0559)	(0.0592)	(0.0634)	(0.0621)	(0.0840)
Non-Interest Income Ratio_1	-0.175***	-0.157***	-0.164***	-0.121*	-0.166***	-0.138*
	(0.0573)	(0.0518)	(0.0576)	(0.0649)	(0.0592)	(0.0799)
Return on Average Equity_1	0.205***	0.148***	0.197***	0.192***	0.150***	0.0371
	(0.0551)	(0.0512)	(0.0552)	(0.0574)	(0.0574)	(0.0831)
Growth Assets_1	0.0146	0.0323	0.0113	0.00907	0.0171	-0.00414
	(0.0253)	(0.0244)	(0.0253)	(0.0279)	(0.0256)	(0.0323)
Non-Performing Loans Ratio_1	0.352***	0.276***	0.345***	0.339***	0.342***	0.253***
	(0.0599)	(0.0559)	(0.0599)	(0.0620)	(0.0603)	(0.0766)
GDP Growth_1	-0.0286	0.134	-0.0335	-0.216*	-0.00337	-0.0612
	(0.107)	(0.103)	(0.107)	(0.125)	(0.108)	(0.166)
CPI Inflation_1	-0.221*	-0.300**	-0.205	-0.337**	-0.186	0.265
	(0.126)	(0.121)	(0.126)	(0.151)	(0.127)	(0.182)
Constant	67.18***	71.51***	64.36***	67.22***	64.87***	38.90***
	(3.332)	(3.311)	(3.667)	(3.463)	(3.469)	(4.537)
Bank Fixed Effects	YES	YES	YES	YES	YES	YES

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table II.B

The Effects of Bank Competition and of Bank Regulation and Supervision on Liquidity Risk

VARIABLES	(1) Liq Ratio	(2) Liq Ratio	(3) Liq Ratio	(4) Liq Ratio	(5) Liq Ratio	(6) Liq Ratio
Lerner_1	-0.106***	0.0411	-0.171**	-0.193***	-0.0434	0.0510
	(0.0210)	(0.0615)	(0.0744)	(0.0360)	(0.0287)	(0.0315)
Lerner_1 * Capital Regulation		-0.0188**				
		(0.00745)				
Lerner_1 * Supervisory Power			0.00577			
			(0.00617)			
Lerner_1 * Supervisory Independence				0.0394***		
				(0.0130)		
Lerner_1 * No Deposit Insurance					-0.0843***	
					(0.0319)	
Lerner_1 * Government Owned Banks						-0.00885***
						(0.00117)
Loans Assets Ratio_1	-0.643***	-0.635***	-0.673***	-0.667***	-0.621***	-0.595***
	(0.0591)	(0.0645)	(0.0626)	(0.0711)	(0.0655)	(0.0834)
Non-Interest Income Ratio_1	-0.175***	-0.0875	-0.116*	-0.183**	-0.147**	0.00943
	(0.0573)	(0.0643)	(0.0635)	(0.0777)	(0.0670)	(0.0874)
Return on Average Equity_1	0.205***	0.149**	0.151***	0.216***	0.167***	0.0839
	(0.0551)	(0.0586)	(0.0581)	(0.0636)	(0.0592)	(0.0690)
Growth Assets_1	0.0146	0.00631	0.0115	0.00414	-0.00139	0.0195
	(0.0253)	(0.0280)	(0.0290)	(0.0314)	(0.0282)	(0.0378)
Non-Performing Loans Ratio_1	0.352***	0.337***	0.315***	0.389***	0.353***	0.375***
	(0.0599)	(0.0623)	(0.0623)	(0.0712)	(0.0625)	(0.0976)
GDP Growth_1	-0.0286	-0.163	-0.0933	-0.0145	-0.0501	-0.336*
	(0.107)	(0.124)	(0.125)	(0.134)	(0.123)	(0.180)
CPI Inflation_1	-0.221*	-0.348**	-0.363**	-0.275*	-0.269*	-0.352*
	(0.126)	(0.152)	(0.156)	(0.151)	(0.138)	(0.204)
Constant	67.18***	64.99***	68.04***	69.10***	64.37***	63.88***
	(3.332)	(3.519)	(3.389)	(3.987)	(3.571)	(4.874)
Bank Fixed Effects	YES	YES	YES	YES	YES	YES

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table II.C

The Effects of Bank Competition and of Islamic Banking on Liquidity Risk

VARIABLES	(1) Liq Ratio	(2) Liq Ratio	(3) Liq Ratio	(4) Liq Ratio
Lerner_1	-0.0991***	-0.107***	-0.101***	-0.104***
	(0.0203)	(0.0207)	(0.0202)	(0.0208)
Lerner_1* Islamic		0.138**		0.0467
		(0.0705)		(0.0903)
Islamic			13.55**	11.27
			(5.440)	(6.958)
Loans Assets Ratio_1	-0.542***	-0.539***	-0.548***	-0.546***
	(0.0520)	(0.0520)	(0.0520)	(0.0521)
Non Interest Income Ratio_1	-0.0281	-0.0301	-0.0360	-0.0342
	(0.0552)	(0.0552)	(0.0552)	(0.0552)
Return on Average Equity_1	0.163***	0.166***	0.169***	0.169***
	(0.0545)	(0.0544)	(0.0544)	(0.0545)
Growth Assets_1	0.0170	0.0147	0.0162	0.0155
	(0.0256)	(0.0256)	(0.0256)	(0.0256)
Non-Performing Loans Ratio_1	0.355***	0.354***	0.360***	0.359***
	(0.0585)	(0.0584)	(0.0583)	(0.0584)
GDP Growth_1	-0.0689	-0.0752	-0.0681	-0.0707
	(0.108)	(0.108)	(0.108)	(0.108)
CPI Inflation_1	-0.262**	-0.270**	-0.258**	-0.262**
	(0.123)	(0.123)	(0.123)	(0.123)
Constant	61.34***	60.89***	60.25***	60.23***
	(3.422)	(3.428)	(3.447)	(3.444)
Bank Fixed Effects	NO	NO	NO	NO

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note. The Islamic dummy is a time-invariant constant for a given bank during the considered time period, so it may play a role equivalent to bank fixed effects in the regression. For this reason, we estimate such panel regression by using a GLS random-effect specification.

Table III.A

The Effects of Bank Competition and of Market Entry on Credit Risk

VARIABLES	(1) NPL Ratio	(2) NPL Ratio	(3) NPL Ratio	(4) NPL Ratio	(5) NPL Ratio	(6) NPL Ratio
Lerner_1	-0.0462*** (0.0134)		-0.0442*** (0.0134)	-0.0617** (0.0302)	-0.0357 (0.0659)	-0.0791*** (0.0267)
Average Lerner_1		-0.127*** (0.0244)				
Market Share_1			0.262** (0.102)			
Lerner_1 * Activity Restrictions				0.00256 (0.00384)		
Lerner_1* Entry Requirements					-0.00131 (0.00804)	
Lerner_1* Denied Applications						0.110*** (0.0382)
Deposit Funding Ratio_1	0.121*** (0.0349)	0.113*** (0.0345)	0.124*** (0.0348)	0.139*** (0.0393)	0.128*** (0.0360)	0.150** (0.0588)
Return on Average Equity_1	-0.241*** (0.0333)	-0.260*** (0.0325)	-0.245*** (0.0332)	-0.252*** (0.0357)	-0.251*** (0.0354)	-0.0868 (0.0586)
Government Bond Ratio_1	-0.0766** (0.0329)	-0.0649** (0.0324)	-0.0822** (0.0329)	-0.0914*** (0.0350)	-0.0822** (0.0345)	-0.179*** (0.0465)
Growth Assets_1	-0.0242 (0.0164)	-0.0140 (0.0162)	-0.0279* (0.0164)	-0.0300 (0.0187)	-0.0249 (0.0168)	-0.0456** (0.0228)
GDP Growth_1	-0.252*** (0.0662)	-0.174*** (0.0662)	-0.248*** (0.0660)	-0.247*** (0.0767)	-0.240*** (0.0681)	-0.261** (0.108)
CPI Inflation_1	-0.377*** (0.0746)	-0.367*** (0.0719)	-0.366*** (0.0744)	-0.507*** (0.0902)	-0.373*** (0.0765)	-0.588*** (0.122)
Constant	8.497*** (3.115)	11.70*** (3.184)	5.961* (3.258)	8.199** (3.512)	8.288*** (3.204)	8.018 (5.103)
Bank Fixed Effects	YES	YES	YES	YES	YES	YES

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table III.B

The Effects of Bank Competition and of Bank Regulation and Supervision on Credit Risk

VARIABLES	(1) NPL Ratio	(2) NPL Ratio	(3) NPL Ratio	(4) NPL Ratio	(5) NPL Ratio	(6) NPL Ratio
Lerner_1	-0.0462***	0.0807*	-0.151***	-0.0342	-0.0230	-0.0269
	(0.0134)	(0.0433)	(0.0463)	(0.0251)	(0.0179)	(0.0183)
Lerner_1 * Capital Regulation		-0.0153***				
		(0.00498)				
Lerner_1 * Supervisory Power			0.00944**			
			(0.00391)			
Lerner_1 * Supervisory Independence				-0.00176		
				(0.00885)		
Lerner_1 * No Deposit Insurance					-0.0377*	
					(0.0204)	
Lerner_1 * Government Owned Banks						0.000125
						(0.000795)
Deposit Funding Ratio_1	0.121***	0.139***	0.129***	0.189***	0.141***	0.0740
	(0.0349)	(0.0383)	(0.0393)	(0.0413)	(0.0386)	(0.0451)
Return on Average Equity_1	-0.241***	-0.276***	-0.271***	-0.271***	-0.264***	-0.239***
	(0.0333)	(0.0363)	(0.0363)	(0.0372)	(0.0374)	(0.0426)
Government Bond Ratio_1	-0.0766**	-0.0977***	-0.0972***	-0.0708*	-0.0951***	0.0607
	(0.0329)	(0.0348)	(0.0351)	(0.0388)	(0.0360)	(0.0509)
Growth Assets_1	-0.0242	-0.0311*	-0.0243	-0.0128	-0.0276	-0.0651***
	(0.0164)	(0.0186)	(0.0192)	(0.0201)	(0.0190)	(0.0237)
GDP Growth_1	-0.252***	-0.244***	-0.242***	-0.351***	-0.245***	-0.0632
	(0.0662)	(0.0752)	(0.0780)	(0.0771)	(0.0777)	(0.106)
CPI Inflation_1	-0.377***	-0.502***	-0.459***	-0.324***	-0.383***	-0.357***
	(0.0746)	(0.0896)	(0.0928)	(0.0902)	(0.0839)	(0.114)
Constant	8.497***	8.036**	9.068***	3.545	7.914**	10.27**
	(3.115)	(3.414)	(3.503)	(3.702)	(3.464)	(4.022)
Bank Fixed Effects	YES	YES	YES	YES	YES	YES

Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table III.C

The Effects of Bank Competition and of Islamic Banking on Credit Risk

VARIABLES	(1) NPL Ratio	(2) NPL Ratio	(3) NPL Ratio	(4) NPL Ratio
Lerner_1	-0.0478***	-0.0476***	-0.0475***	-0.0498***
	(0.0119)	(0.0120)	(0.0119)	(0.0121)
Lerner_1 * Islamic		-0.00745		0.0794
		(0.0457)		(0.0698)
Islamic			-3.139	-6.580*
			(2.608)	(3.996)
Deposit Funding Ratio_1	0.104***	0.104***	0.101***	0.0981***
	(0.0278)	(0.0279)	(0.0280)	(0.0281)
Return on Average Equity_1	-0.259***	-0.259***	-0.259***	-0.259***
	(0.0312)	(0.0312)	(0.0312)	(0.0312)
Government Bond Ratio_1	-0.0248	-0.0254	-0.0281	-0.0297
	(0.0291)	(0.0292)	(0.0292)	(0.0293)
Growth Assets_1	-0.0269*	-0.0267*	-0.0261	-0.0274*
	(0.0161)	(0.0161)	(0.0161)	(0.0161)
GDP Growth_1	-0.251***	-0.251***	-0.249***	-0.249***
	(0.0646)	(0.0646)	(0.0646)	(0.0645)
CPI Inflation_1	-0.319***	-0.318***	-0.317***	-0.322***
	(0.0683)	(0.0684)	(0.0683)	(0.0684)
Constant	8.931***	8.948***	9.479***	9.840***
	(2.556)	(2.564)	(2.596)	(2.618)
Bank Fixed Effects	NO	NO	NO	NO

Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Note. The Islamic dummy is a time-invariant constant for a given bank during the considered time period, so it may play a role equivalent to bank fixed effects in the regression. For this reason, we estimate such panel regression by using a GLS random-effect specification.