Bank Competition and Financial Stability: Exploring Solvency, Liquidity and Credit Risk [1]

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Abstract

The paper analyses the relationship between bank competition and stability, with a specific focus on the Middle East and North Africa. Price competition is positively associated with 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 potentially negative implications 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 analysis suggests implications for policy reforms designed to improve market contestability and to increase the quality and independence of prudential supervision.

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1 Introduction

What is the relation between bank competition and financial stability? Is this relationship univocal or does it require a separate consideration of the different sources of bank risk, like solvency, liquidity and credit risk? And does this relationship work differently for distinct types of banking systems, for instance conventional versus Islamic 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 organisation 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 emerging economies and 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 liberalisation 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 emerging economies and developing countries requires, among other issues, an accurate analysis of the link between bank competition and 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 favouring 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 incentivised 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 characterised by low levels of competition and high barriers to entry. At the same time, the banking system in the Region, if compared with the banking sectors of other world regions before the crisis, appears to be relatively stable, as on average banks displayed higher distance-to-default measures, larger buffers of liquidity and lower percentages of non-performing loans. Based on these considerations, the banking system in the MENA Region could

be considered in abstract as a good example of the competition-fragility hypothesis, which implies that banking systems less subject to competition would display higher levels of financial stability.

The paper explores the link between bank competition and financial stability in relation to the different sources of bank risk at the bank level, especially solvency risk, liquidity risk, and credit risk. Most empirical studies on this topic have analysed 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[5]. 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 micro-prudential 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; at the same time, 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.

[5] Few contributions on bank competition and liquidity are provided in the theoretical literature. In particular, Carletti and Leonello (2016) 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.

This classification of multiple dimensions of financial stability, with respect to distinct sources of bank risk, may 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 micro-prudential 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 follow-up work, we may be interested in considering also the macro-prudential 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 results of this empirical work also show that the degree of market contestability and the quality of banking regulation and supervision may play a key role in determining the sign and the size of the observed relationship[6].

The interaction with the country-specific framework for banking regulation and supervision is particularly important in explaining the results on solvency risk, given that the existing micro-prudential policies in previous years were focused on this, while the liquidity risk was not subject to any regulation and the sensitiveness of capital requirements to credit risk was enhanced only in the Basel II accord[7]. We find that the solvency position and the asset quality of banks are indeed affected by the requirements of prudential regulation and supervision. For this reason, the effects of price competition on bank stability must be examined in conjunction with the regulatory and supervisory framework of the country.

The interaction of bank market power with 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 for banks with large market power. Indeed, when banks dispose of some market power, capital regulation and supervisory independence provide an effective mechanism for them to safely manage their additional profit margins and increase their capital buffers.

Second, when banks are subject to competitive pressures and then to limited profitability, it is important for the supervisory authority to dispose of a large set of preventive and corrective

[6] 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.

[7] Moreover, this was implemented by the countries in the MENA Region only with some delay, though with differences across countries

powers in order to intervene and limit potential incentives for excessive risk-taking due to the decrease in the franchise value of these banks.

Third, in the presence of high barriers to entry, the incumbent banks may be interested in exploiting their market position to increase their risk-taking, eventually also by taking advantage of any implicit public support. In such case, an increase in market contestability may be useful to avoid a potentially negative impact of market power on bank stability. In this respect, country authorities may want to minimise those barriers to entry which - by limiting the number of potential competitors and increasing concentration - may unduly reduce market contestability and restrict the possibility of competition.

Fourth, some prudential entry requirements aimed at setting minimum standards for entrant banks may be however necessary to ensure a sound financial management of the institutions interested in entering the banking market.

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 competition-stability nexus may work differently for conventional and Islamic banks. We don't find statistically significant differences in this relationship for Islamic banks in the case of bank solvency and liquidity. However, we do find some relevant differences in the case of credit risk: while the relation between the bank market power and the loan delinquency rate is negative for conventional banks, it is actually positive for Islamic banks, meaning that for Sharjah-compliant banks an increase in price competition is beneficial for the credit quality of the loan portfolio. This can be explained with respect to some principles of Islamic banking: the profit-and-loss sharing, reducing the risk-taking incentives for banks in their loan provision; the equity principle which - by implying the prohibition of interest payments and of excessive uncertainty - allows for an improvement in the credit conditions for borrowers and then generates stronger repayment incentives for debt holders.

2 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 has 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[8] are more integrated with the global financial markets, both for the presence of a few subsidiaries of US or EU 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 characterised 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

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

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, 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[9]. In particular, we evaluate bank solvency by using the Z-Score[10] 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[11]. 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).

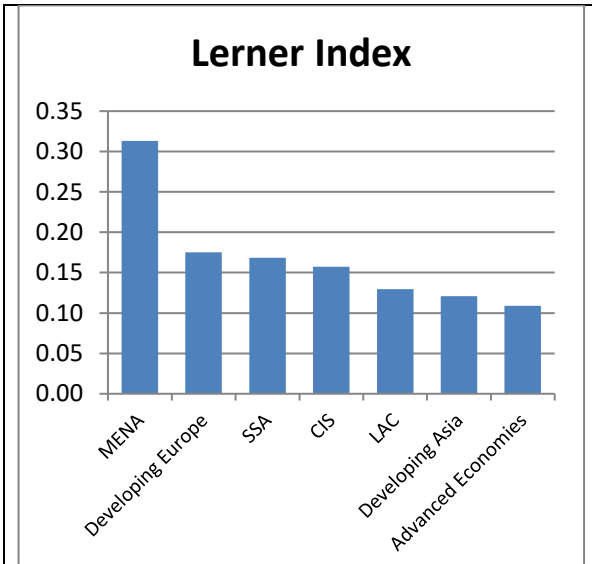
The above discussed features explain why the MENA banking system may be considered an interesting setting for analysing the relationship between bank competition and stability. Indeed, the banking sector displays, in general, high concentration, low competition,

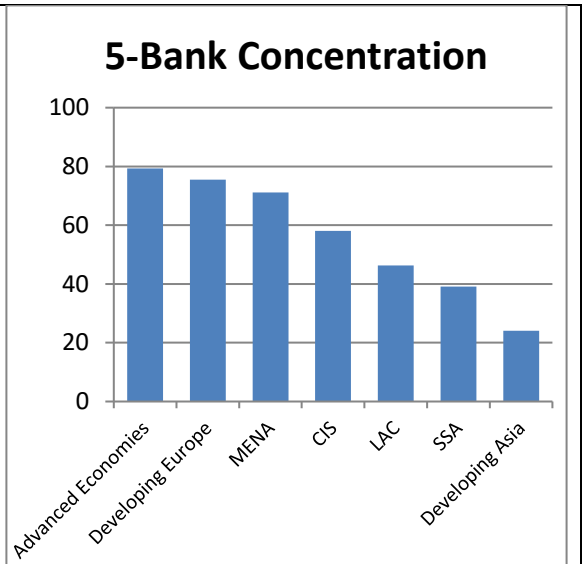
[9] This doesn't exclude the existence of possibly significant heterogeneities across countries in the region. In this context, we are mainly interested in capturing and comparing some general features at the regional level.

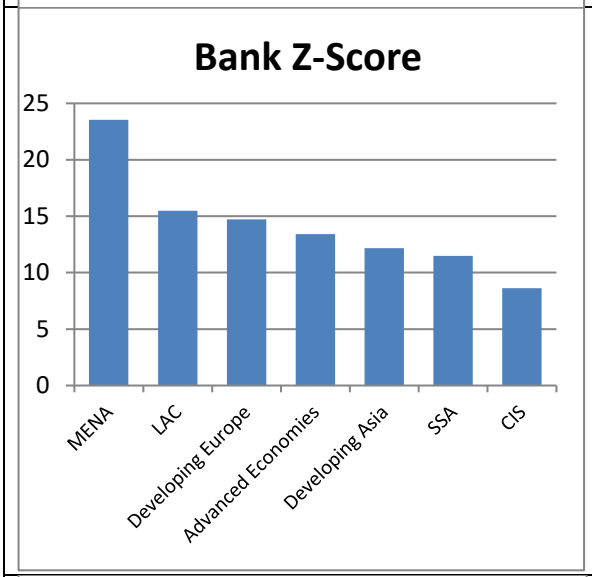
[10] It is constructed as the sum of the average return on assets and the average ratio of equity to assets, divided by the standard deviation of the return on assets. For a more extensive description of the Z-Score, as used in the empirical analysis, see section 4.2

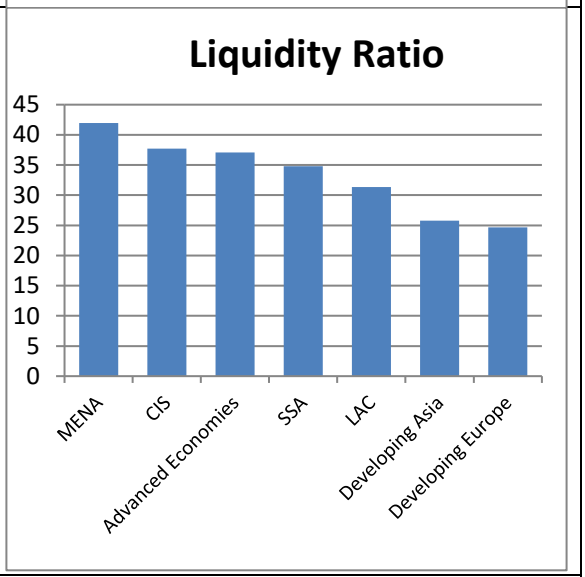
[11] It is computed as the ratio of Non-Performing Loans to Gross Loans

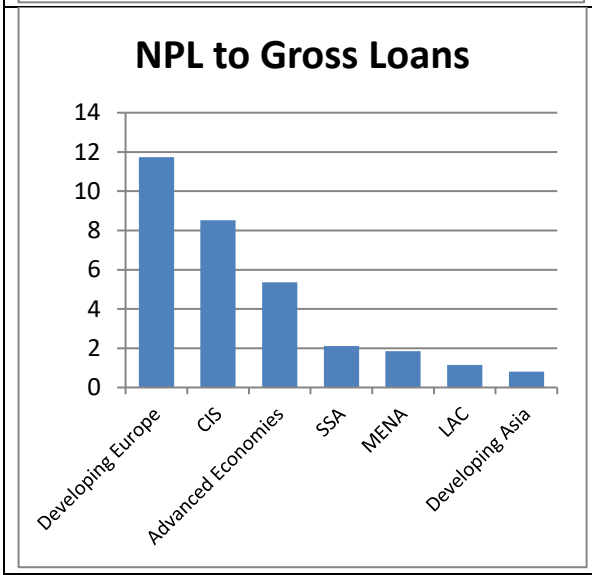
Figure 1 Aggregate Facts on Bank Competition and Stability across the World











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)

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 presented in the following sections show that this argument based on an aggregate overview would not be supported by the bank-level empirical evidence, given that we have to distinguish between various sources of financial instability, and that bank competition may be related to each of them in a different way. Moreover, the institutional framework for prudential regulation and supervision may substantially shape the incentives and then the conduct of financial intermediaries in terms of risk-taking.

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. Most importantly, 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. Indeed, 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. In addition, the empirical setting of this paper—particularly for the classification of different types of risk and for the role of institutional factors in these distinct competition-risk relationships—may suggest a conceptual framework useful for more fully investigating the link between competition and stability also 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 desirability of pro-competitive reforms can be applied, to some extent, also to other developing regions, where similar policies for the financial sector may be in course of implementation. 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 incentivising 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 the distinct sources of bank risk.

3 Literature Review and Hypotheses Development

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, 2015) 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 analyse the relationship between bank competition and financial stability for a large sample of banks in a Region, the Middle East and North Africa, with peculiar and interesting characteristics as described above. In particular, we estimate the relationship between bank competition and 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.

3.1 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 hypothesize that competition may reduce bank profitability and then – through this channel - have negative implications on bank solvency.

On the other hand, we have to inquire whether, and how, price competition may change the incentives for the management of a bank's capital position. 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 micro-prudential 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, because of the decrease in bank profits.

However, some studies[12] 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 for pre-cautionary reasons, 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 potentially lead to an increase in their equity-asset ratios[13]. 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 adjustment 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 results we can observe in the empirical analysis: if banks fulfil 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.

[12] See for example Berger, DeYoung, Flannery, Lee and Oztekin (2008)

[13] 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: in particular, they show that "competition in the credit market provides an incentive for banks to use capital as a way to commit to greater monitoring". 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.

Many factors, such as the conditions for market entry, the type of bank business model, the quality of bank regulation and supervision (and in particular the stringency level of capital requirements), 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.

3.2 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.

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 (2016) 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: 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.

We can then 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 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 analyse the overall variation in terms of 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.

3.3 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 analyse the relation between price competition and 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.

4 Empirical Strategy

The empirical work analyses the relation between bank competition and the stability of financial intermediaries at the bank-level. The stability of a credit institution 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 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.

4.1 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 specialisation 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 classify conventional[14] and 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:

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

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

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. It characterises the ability of a bank to profitably raise the price of a product or a service over the marginal cost: it is then computed as the ratio between the mark-up (the difference between the price and the marginal cost) and the price of bank activities. We also include, as control variables, bank-level balance sheet variables and country-specific macroeconomic variables. In order to account for market concentration, we also include the market share of a bank[15]. 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 further specifications, in order to take into account the role of bank-specific characteristics or of country-level factors which can interact with price competition in affecting the stability of financial intermediaries.

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

$$(2)\ Risk_{ijt} = \alpha + \beta_1 Lerner_{ijt-1} + \beta_2 Lerner_{ijt-1} \cdot Islam_{ij} + \Delta\ CountryControls_{jt-1} + Z\ BankControls_{ijt-1} + u_{ij} + \varepsilon_{ijt}$$

where $Islam_{ij}$ is a bank-specific dummy variable for Islamic banks, based on the specialisation classified in Bankscope[16]. We are interested in exploring 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.

2. To analyse the interaction between market power and country-level market entry conditions, we run the following regression:

$$(3)\ Risk_{ijt} = \alpha_{ij} + \beta_1 Lerner_{ijt-1} + \beta_2 Lerner_{ijt-1} \cdot MarketEntry_{jt-1} + MarketEntry_{jt-1} + \Delta\ CountryControls_{jt-1} + Z\ BankControls_{ijt-1} + \varepsilon_{ijt}$$

where $MarketEntry_{jt-1}$ is a country-specific variable for market structure and entry. In particular, we consider various aspects, based on the World Bank Survey on Bank Regulation and

[15] It is computed as the ratio of the bank's total assets to the amount of total assets of the banking system in a given country. The banks in the MENA Region operate mostly in domestic markets and are limitedly active in cross-border banking. In such (very few) cases, we consider the subsidiaries operating in each national banking market.

[16] 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.

Supervision: the intensity of the activity restrictions to financial intermediaries, the fraction of denied applications, the strength of entry requirements, and the percentage of government-owned bank assets in the national banking sector.

The interaction term $Lerner_{ijt-1} \cdot MarketEntry_{jt-1}$ is introduced to investigate the interplay between the individual bank's market power and the country-level market entry conditions. The rationale for this interaction is that the competitive behaviour of the incumbents is indeed strictly interlinked with the foreseeable future dynamics of the market. A bank may currently have low market power in terms of pricing behaviour, but it may operate in a market which significantly restricts the entry of new institutions. On the other hand, a bank may dispose of a relatively high market power but in a market which is widely open to the entry of potential competitors. We investigate whether the country-level conditions for market entry may affect the relationship between the market power and the stability of individual banks.

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

$$(4)\ Risk_{ijt} = \alpha_{ij} + \beta_1 Lerner_{ijt-1} + \beta_2 Lerner_{ijt-1} \cdot BankRegulSuperv_{jt-1} + BankRegulSuperv_{jt-1} + \Delta\ CountryControls_{jt-1} + Z\ BankControls_{ijt-1} + \varepsilon_{ijt}$$

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 power, and supervisory independence. We analyse the interaction of bank market power with the various indicators of country-specific bank regulation and supervision.

4.2 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[17]. 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.

[17] See appendix 3.A for the specific definition of all variables and for the indication of the data sources

Bank Competition

We measure price 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 mark-up (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 behaviour 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 trans-log production function at the bank level for each country, including bank and time fixed effects:

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

where C_{it} denotes the total operating costs, Qit defines the amount of total assets, the input prices indicate the price of fixed assets (c^{Fixed}), the price of labor (c^{Labour}), 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:

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

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[18]. This extensive survey was conducted in four waves (2001, 2003, 2007, 2011) and it provides information on multiple institutional dimensions for banking

[18] 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)

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

5 Empirical Results

We present the results of the empirical analysis, distinguishing the various components of financial stability with regard to 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.

5.1 Bank Solvency

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

5.1.1 Bank Solvency: Baseline Specification and Z-Score Components

From the baseline specification in Table 1, we observe that an increase in the Lerner Index—i.e. a decrease in price competition—improves the bank solvency in terms of the Z-Score.

In particular, a one-basis-point increase in the Lerner index is associated with an increase of the Z-Score by 0.134 (Table 1, Col. 1). This means that a one-standard-deviation rise in the bank's market power implies an increase in the bank's 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. Taking into account the identification though bank fixed

Table 1 Bank Competition and Solvency: Baseline Specification

VARIABLES	(1) Z_Score	(2) Z_Score	(3) Z_Score	(4) Z_Score	(5) Z_Score	(6) Z_Score
COMPETITION						
Lerner_1	0.134***	0.136***	0.137***		0.0821*	
	(0.0508)	(0.0502)	(0.0514)		(0.0454)	
Market Share_1		0.706				
		(0.661)				
Lerner_1 * Islamic			-0.237			
			(0.300)			
Country Lerner_1				0.293***		0.162
				(0.0996)		(0.117)
BANK CONTROLS						
Loans Assets Ratio_1	0.122	0.161	0.126	0.225	-0.190	-0.110
	(0.149)	(0.148)	(0.148)	(0.149)	(0.146)	(0.148)
Gov Bonds Ratio_1	0.256*	0.247*	0.256*	0.214	0.119	0.0597
	(0.145)	(0.146)	(0.145)	(0.139)	(0.138)	(0.137)
Depos Funding Ratio_1	0.130	0.132	0.135	0.166	0.0384	0.0632
	(0.128)	(0.130)	(0.127)	(0.122)	(0.111)	(0.102)
Non-Inter Inc Ratio_1	0.321*	0.337**	0.322*	0.149	0.237	0.105
	(0.168)	(0.169)	(0.169)	(0.140)	(0.151)	(0.125)
Growth Total Assets_1	-0.125***	-0.140***	-0.119***	-0.0924**	-0.0232	-0.00800
	(0.0409)	(0.0411)	(0.0405)	(0.0396)	(0.0371)	(0.0362)
Non-Perf Loans Ratio_1	-0.251*	-0.251*	-0.247*	-0.209	-0.0968	-0.0739
	(0.139)	(0.141)	(0.139)	(0.135)	(0.125)	(0.118)
MACRO CONTROLS						
GDP Growth_1	0.0983	0.109	0.0968	0.0232	-0.0696	-0.0717
	(0.226)	(0.227)	(0.226)	(0.215)	(0.251)	(0.236)
CPI Inflation_1	-0.174	-0.155	-0.173	-0.149	-0.459	-0.428
	(0.227)	(0.216)	(0.226)	(0.214)	(0.372)	(0.355)
Constant	-13.67	-22.53	-14.11	-24.09	7.059	2.308
	(14.50)	(17.59)	(14.41)	(15.38)	(12.37)	(12.99)
Observations	725	725	725	749	725	749
R-squared	0.055	0.061	0.056	0.049	0.152	0.144
Number of bank	110	110	110	113	110	113
Bank FE	YES	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	YES	YES

Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

effects, this suggests that banks increasing their market power also improve their solvency position, in terms of distance-to-default.

This result, consistent with the empirical findings on competition and solvency in the previous literature, is robust to alternative specifications, controlling for the bank's market share in the domestic market (Table 1, Col.2) and for the conventional or Islamic nature of the bank (Table 1, Col.3). The interaction term between the Lerner index and the Islamic dummy displays a negative but non-significant coefficient. Then, although the interaction term seems to point towards a change in the sign of the relationship for Islamic banks (see also Fig. 2 Plot 9), we don't

find statistically significant evidence for that[19]. Also, the positive sign of the competition-solvency relationship is confirmed when we add also year fixed effects, though with a smaller coefficient (Table 1, Col. 5).

Moreover, this negative effect of price competition on bank solvency appears to be 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 of the banking sector in a given economy. Indeed, a one-standard deviation increase in the average market power of banks in a given country is associated with a rise in the bank's Z-Score by 7.29, an effect significantly larger than the effect of a corresponding increase in bank market power (Table 1, Col. 4). 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 incentivised to improve its solvency; that is, the opportunity cost of being insolvent is higher in a banking system where, on average, the other banks dispose of large market power.

Also, bank balance sheet factors may affect the solvency position of credit institutions. We consider a series of control variables, all one-year lagged, 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 were supposed to be 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 highlight 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 may have some implications for bank solvency. Indeed, the banks which present a higher rate of non-performing loans, as they lent to riskier borrowers, 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 relationship with bank solvency. An increase in the diversification ratio implies better bank performance, because banks receiving a larger fraction of their income from

[19] Some papers in the literature (e.g. Beck, Demirguc-Kunt and Merrouche, 2013) have shown that in general Islamic banks are better capitalised, looking at samples of countries with both bank types, however without taking into account specific considerations about their market power.

Table 2 Bank Competition and Solvency: Z-Score Components

Panel 1. Simultaneous measures of market power

VARIABLES	(1) Equity Ratio	(2) Equity Ratio	(3) RoAA	(4) RoAA	(5) St Dev RoA	(6) St Dev RoA
COMPETITION						
Lerner	0.00956**		0.00470**		-0.00418***	
	(0.00463)		(0.00195)		(0.00120)	
Country Lerner		0.0284***		0.00329		-0.00858***
		(0.00815)		(0.00340)		(0.00210)
Bank Controls	YES	YES	YES	YES	YES	YES
Macro Controls	YES	YES	YES	YES	YES	YES
Observations	838	866	838	863	740	764
R-squared	0.071	0.078	0.132	0.127	0.052	0.055
Number of bank	116	120	116	120	111	114
Bank FE	YES	YES	YES	YES	YES	YES

Panel 2. One-year lagged measures of market power

VARIABLES	(1) Equity Ratio	(2) Equity Ratio	(3) RoAA	(4) RoAA	(5) St Dev RoA	(6) St Dev RoA
COMPETITION						
Lerner_1	0.00970**		-0.000763		-0.00231*	
	(0.00455)		(0.00191)		(0.00123)	
Country Lerner_1		0.0277***		0.000582		-0.00729***
		(0.00839)		(0.00350)		(0.00219)
Bank Controls	YES	YES	YES	YES	YES	YES
Macro Controls	YES	YES	YES	YES	YES	YES
Observations	838	866	835	863	740	764
R-squared	0.093	0.076	0.147	0.126	0.034	0.047
Number of bank	117	120	117	120	111	114
Bank FE	YES	YES	YES	YES	YES	YES

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

fee-based activities would present lower profit volatility than other banks more reliant on interest revenues.

In Table 2, we consider the various components of the Z-Score in order to shed light on the channels explaining this effect. We run the same regression as in the baseline specification, but instead of using the Z-Score as the dependent variable we introduce the three components of this measure: the equity-to-assets ratio, the return on average assets (RoAA) and the standard deviation of the RoAA. We use the Lerner indices both of the current year (Panel 1) and of the previous year (Panel 2), in order to consider both the simultaneous and the lagged effects.

We observe that an increase in the bank-level Lerner index is associated with an increase in the equity-to-assets ratio (Table 2, Col.1 in both Panel 1 and 2) and with a decrease in the RoAA standard deviation (Table 2, Col. 5 in both Panel 1 and 2): this holds both as a simultaneous variation and as a one-year lagged change. A rise in market power is related to an improvement in the capital position of a bank, possibly because the additional profit margins are retained to increase the equity base. At the same time, an increase in market power seems to reduce the volatility of bank profits: this could be eventually explained via a potential reduction in the risk-

taking of credit institutions, for instance a bank with larger market power may choose to invest in less risky assets, whose returns are also less volatile[20]. Overall, the increase in the equity-to-assets ratio (in the numerator) and the reduction in the profit volatility (in the denominator) contribute to explain the increase in the Z-Score for higher values of the bank-level Lerner index. Moreover, as expected, we find a positive simultaneous relation between the Lerner index and the RoAA: a higher market power improves bank profitability in the same period.

This inspection of the Z-Score components allows us to test the hypotheses laid down in section 1 for the relation between market power and bank solvency: on one hand, the evidence confirms the importance of the profitability channel, i.e. market power increases bank profits, as observed from the simultaneous increase in the RoAA; on the other hand, the results do not provide evidence of a capital adjustment effect for banks subject to more competition, given that in general banks with larger market power display higher equity-to-assets ratios[21]. In addition, the reduction in profit volatility for banks with more market power highlights the link between competitive pressures and bank risk-taking, as analysed for the credit risk of the loan portfolio in section 5.3.

These trends observed at the level of individual banks are confirmed also with larger coefficients when we consider as main explanatory variable, instead of the bank-level Lerner index, a country-average Lerner index, representative of the price competition for the overall banking industry in a given country. Banks operating in national markets with less competitive pricing tend to have larger equity-to-assets ratios and display lower volatility in their profits (Table 2, respectively Col. 2 and 4 in both panels).

5.1.2 Bank Solvency: the Interaction with Country Factors

Then we study the interaction between bank-level market power and some country-level variables, related to market entry and structure, or to prudential regulation and supervision. The full set of regression results is displayed in Table 3. Figure 1 displays the plots for the average marginal effect (AME) of a 1-point increase in the Lerner index on the Z-Score. It is computed on the basis of the coefficient estimates for the Lerner index and for the interaction

[20] Some support for this explanation comes also from the results on the credit risk of the asset portfolio (see Section 5.3). They highlight, at least for the credit provision, that an increase in the market power is accompanied by a reduction in the ratio of non-performing loans.

[21] In fact, as discussed in the following section, when we consider the interaction of the Lerner index with country-level regulation, we observe that the capital adjustment effect may play some role mainly in countries with relatively low levels of capital stringency.

Table 3 Bank Competition and Solvency: Interaction with Country Variables

Panel 1. Market Entry and Structure

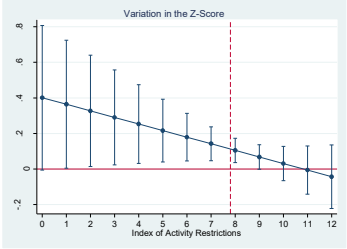
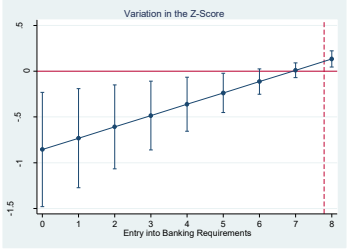
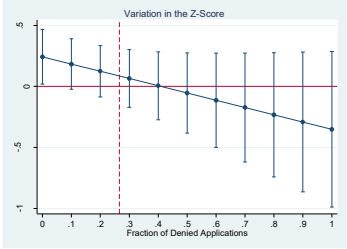
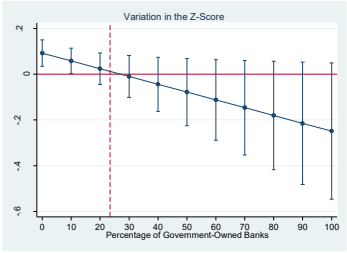
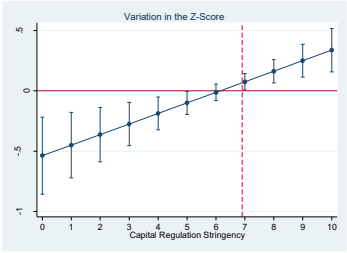
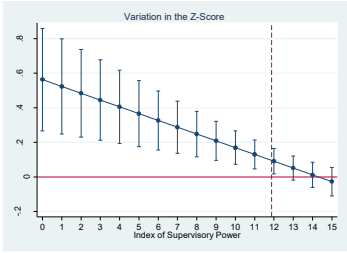
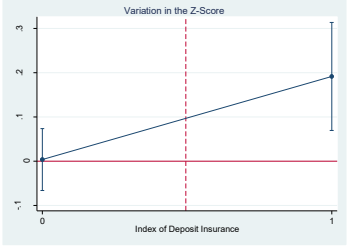
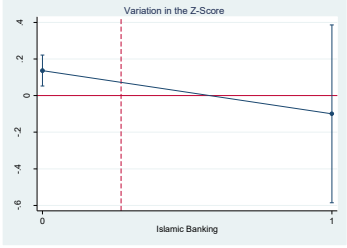
VARIABLES	(1) Z_Score	(2) Z_Score	(3) Z_Score	(4) Z_Score	(5) Z_Score
Lerner_1	0.134***	0.401	-0.856**	0.243*	0.0917**
	(0.0508)	(0.247)	(0.379)	(0.136)	(0.0350)
Activity Restrict_1		1.555			
		(1.142)			
Lerner_1* Activ Restrict_1		-0.0370			
		(0.0288)			
Entry Requir_1			-3.587		
			(2.235)		
Lerner_1* Entry Requir_1			0.124**		
			(0.0508)		
Denied Applic_1				25.58*	
				(14.51)	
Lerner_1* Denied Applic_1				-0.594	
				(0.422)	
Gov Banks_1					0.891***
					(0.295)
Lerner_1* Gov Banks_1					-0.00340*
					(0.00190)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	YES	YES	YES	YES	YES
Observations	725	654	716	323	487
R-squared	0.055	0.056	0.065	0.098	0.074
Number of bank	110	106	109	89	81
Bank FE	YES	YES	YES	YES	YES

Panel 2. Prudential Regulation and Supervision, Deposit Insurance

VARIABLES	(1) Z_Score	(2) Z_Score	(3) Z_Score	(4) Z_Score	(5) Z_Score
Lerner_1	0.134***	-0.537***	0.563***	-0.121	0.00378
	(0.0508)	(0.194)	(0.180)	(0.0956)	(0.0424)
Capital Regul_1		0.111			
		(1.350)			
Lerner_1* Capital Regul_1		0.0875***			
		(0.0293)			
Superv Power_1			-0.838*		
			(0.472)		
Lerner_1* Superv Power_1			-0.0393***		
			(0.0135)		
Superv Independ_1				-2.222	
				(1.689)	
Lerner_1* Superv Independ_1				0.112*	
				(0.0571)	
Deposit Insur_1					-4.732
					(3.703)
Lerner_1* Deposit Insur_1					0.188**
					(0.0781)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	YES	YES	YES	YES	YES
Observations	725	654	644	623	660
R-squared	0.055	0.106	0.084	0.075	0.062
Number of bank	110	106	107	106	102
Bank FE	YES	YES	YES	YES	YES

Robust (bank clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 2 Bank Competition and Solvency. Interaction Plots

Plot 1	Plot 2	Plot 3
ACTIVITY RESTRICTIONS	**ENTRY REQUIREMENTS**	**DENIED APPLICATIONS**
		
Plot 4	Plot 5	Plot 6
GOVERNMENT BANKS	**CAPITAL REGULATION**	**SUPERVISORY POWER**
		
Plot 7	Plot 8	Plot 9
SUPERV. INDEPENDENCE	**DEPOSIT INSURANCE**	**ISLAMIC BANKING**
		

term between the Lerner index and the country-level variable. The average marginal effect in terms of Z-Score variation is plotted for different values of the country-level indicators for Bank Regulation and Supervision (World Bank Survey).

First, we investigate whether, and how, market entry conditions may affect the relationship between price competition and bank solvency. In general, we observe that the positive link between market power and bank solvency may be reduced if credit institutions operate in non-contestable markets, restricted to external entry. In particular, the positive relationship between market power and bank solvency may reverse sign in markets where the national

Government holds a large fraction[22] in the total assets of the domestic banking sector (see Fig. 2, Plot 4, and Table 3, Panel 1, Col. 5).

The rationale behind this result could be that, when the access to the market is restricted to competitors and particularly when the market is dominated by publicly-owned banks, the incumbent institutions with large market power may be induced to exploit their position in order to take more risks. While in a contestable private market credit institutions may be prevented from increasing their risk taking by the concern for the default risk, in a restricted market with strong public presence, banks disposing of market power may expect that in the case of distress they might benefit from public support, because of their systemic relevance or of their public status.

This may be relevant for the process of reforms in the financial sector, particularly in emerging markets. Improving market contestability by liberalising activity and allowing for private entry would 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 power and of the implicit public support to increase their risk taking. In this respect, country authorities might be interested in removing those entry restrictions which may unduly limit market contestability particularly from private institutions, unless they are required to pursue other relevant policy objectives.

In fact, not all the regulations which restrict entry would have negative implications on the risk-taking of incumbent banks with market power. 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—we can still observe the positive link between market power and bank solvency, for a level of entry requirements above a given threshold[23]. 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 (Fig. 2 Plot 2). In this respect, entry regulations would have an effect on bank solvency which is analogous to the impact of prudential requirements for capital adequacy (see for example Fig. 2 Plot 4).

Second, we examine the effect of the interaction between price competition and bank regulation and supervision on the solvency of credit institutions.

[22] The average percentage of government-owned bank assets in our sample is equal to 23.6%. As observed in the Plot 4 of Fig. 3.2, the AME becomes negative for a percentage higher than 27%. This threshold is computed by considering the significant coefficients for the Lerner Index (positive) and for the interaction term between the Lerner index and the percentage of government-owned bank assets (negative).

[23] 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 6.9.

Specifically, we explore whether, and to what extent, capital regulation may play some role in affecting the nexus between competition and solvency. Based on the hypotheses presented in Section 3.1, we can identify two possible explanations for the negative relation between competition and solvency. First, if bank capital is an exogenous constant fixed by regulation, then the above result is simply a consequence of the reduction in bank profits that follows the decrease in lending rates. On the contrary, if bank capital is determined by an optimal bank decision, then the negative relation between competition and solvency may result from a combination of two counteracting effects: 1) a substantial decline in bank profits, and 2) an insufficient increase in bank capital to adjust for the fall in profitability.

In order to disentangle this issue, we need to distinguish - in the empirical analysis - the effects of market power and of capital regulation on bank solvency. Also, we introduce an interaction term between the Lerner Index and the indicator of capital stringency to estimate the marginal effects of market power on bank solvency for different values of capital stringency.

In the specification of Col. 2 (Table 3, Panel 2), we consider separately the coefficient for the Lerner Index and the coefficient for the interaction term. In absence of capital regulation, a decrease in market power (an increase in price competition) would imply an improvement in bank solvency, in the measure of a one-by-one standard deviation rise in the Z-Score[24]. Following the theoretical arguments proposed by Allen, Carletti and Marquez (2011) and in line with the empirical evidence in Schaeck and Cihak (2012), 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 effect of the Lerner index on bank solvency would be positive, as long as the indicator of capital regulation is higher than a given threshold[25]. From the decomposition of our empirical results, we can then describe the interplay of incentives between bank capital management and prudential requirements as follows (Fig. 2, Plot 5).

Without or with low levels of capital regulation, banks would adopt a more active management of their capital and choose their optimum capital level. In such a case, more

[24] In particular, a one-standard deviation decrease in bank market power (the Lerner Index) increases the bank Z-Score by 18.74 (the Z-Score has a standard deviation equal to 18.88).

[25] In particular, this threshold value for capital stringency would be equal to 6.14, provided that the index is in a range between 3 and 10 for the countries in the sample, and given that its average value is 7.03. This confirms that, for the average value of capital stringency in our sample, market power would actually have a positive effect on bank solvency.

competition could imply higher solvency, as 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 more stringent capital requirements, banks tend to take a more passive approach to capital management. 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 some aspects of prudential supervision, namely supervisory power and supervisory independence. Strong and independent banking supervision may be relevant - for different reasons - both for banks more subject to competitive pressures and for banks with large market power.

In Col. 3 (Table 3, Panel 2), we consider the role of supervisory power[26]. The positive effect of the Lerner index on the Z-Score is reduced when the supervisory authorities dispose of wider power to intervene in specific situations (Fig. 2, Plot 6). This means that supervisory power may be useful in attenuating the negative implications of price competition on bank solvency, particularly for those banks more subject to competitive pressures.

In Col. 4 (Table 3, Panel 2), we focus on supervisory independence. The positive effect of market power on bank solvency is an increasing function of the degree of supervisory independence (Fig. 2, Plot 7). This means that banks with larger market power are more solvent, provided that the existence of an effective and independent supervisor induces them to manage their capital more prudently.

Finally, we consider the possible role of deposit insurance (Table 3, Panel 2, Col. 5). 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 with market power tend to show higher solvency than banks with competitive pricing (Fig. 2, Plot 8).

To provide a possible interpretation, we need to consider that in general banks with 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, as discussed earlier, 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 be relevant in increasing 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

[26] It defines the prerogatives of supervisory authorities to take specific actions to prevent and correct problems.

of competition on bank profitability. Indeed, banks may expect that otherwise they could 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. Also this result would be in line with the theoretical predictions in Allen, Carletti and Marquez (2011) for their model development in the case of deposit

5.2 Bank Liquidity

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.

5.2.1 Bank Liquidity: Baseline Specification

The results from the baseline specification, as presented in Table 4, reveal that a decrease in the Lerner index—that is, an increase in price competition—is associated with 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) is related to 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. Given our identification through bank fixed effects and the intertemporal nature of the liquidity decisions of a bank, this result suggests that banks reducing their market power (and consequently their profit margins) tend to increase their buffers of liquid assets, potentially for precautionary reasons for the future. This would be in line with the hypothesis of price competition as a self-discipline mechanism for liquidity choices and with the theoretical predictions by Carletti and Leonello (2016).

This positive relation between price competition and funding liquidity is confirmed also when we control for the market share of the individual credit institution (Table 4, Col. 2) and for the Islamic or conventional nature of the bank (Table 4, Col. 3). The interaction term between the Lerner index and the Islamic dummy displays a positive but non-significant coefficient. Although the interaction seems to suggest a reduction in the size of this relationship for Islamic banks, we don't find statistically significant evidence for that.

Table 4 Bank Competition and Liquidity: Baseline Specification

VARIABLES	(1) Liq Ratio	(2) Liq Ratio	(3) Liq Ratio	(4) Liq Ratio	(5) Liq Ratio	(6) Liq Ratio
COMPETITION						
Lerner_1	-0.106***	-0.104***	-0.109***		-0.0197	
	(0.0284)	(0.0286)	(0.0293)		(0.0263)	
Market Share_1		0.251				
		(0.240)				
Lerner_1 * Islamic			0.0823			
			(0.0581)			
Country Lerner_1				-0.299***		-0.169***
				(0.0521)		(0.0489)
BANK CONTROLS						
Loans Assets Ratio_1	-0.643***	-0.634***	-0.637***	-0.571***	-0.523***	-0.441***
	(0.108)	(0.104)	(0.109)	(0.100)	(0.0906)	(0.0939)
Non-Inter Inc Ratio_1	-0.175**	-0.163**	-0.174**	-0.156**	-0.0700	-0.151*
	(0.0805)	(0.0769)	(0.0806)	(0.0747)	(0.0803)	(0.0815)
Return on Av Equity_1	0.205***	0.197***	0.205***	0.148**	-0.0158	-0.00884
	(0.0624)	(0.0614)	(0.0626)	(0.0680)	(0.0726)	(0.0695)
Growth Total Assets_1	0.0146	0.0114	0.0137	0.0324	-0.0291	-0.00736
	(0.0308)	(0.0307)	(0.0307)	(0.0320)	(0.0269)	(0.0273)
Non-Perf Loans Ratio_1	0.352***	0.345***	0.350***	0.276***	0.119	0.110*
	(0.0923)	(0.0916)	(0.0926)	(0.0688)	(0.0748)	(0.0653)
MACRO CONTROLS						
GDP Growth_1	-0.0284	-0.0333	-0.0319	0.134	-0.0121	0.0790
	(0.102)	(0.102)	(0.103)	(0.114)	(0.0992)	(0.112)
CPI Inflation_1	-0.221	-0.205	-0.227	-0.300*	0.181	0.0310
	(0.151)	(0.150)	(0.151)	(0.157)	(0.147)	(0.193)
Constant	67.20***	64.37***	66.87***	71.53***	69.49***	69.91***
	(6.408)	(5.666)	(6.470)	(5.860)	(5.619)	(5.482)
Observations	1,123	1,123	1,123	1,165	1,123	1,165
R-squared	0.244	0.246	0.244	0.260	0.365	0.357
Number of bank	138	138	138	141	138	141
Bank FE	YES	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	YES	YES

Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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 price competition at the country level) is associated with an improvement in the bank-level liquidity ratio by 7.4 percent (Table 4, Col.4), 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 play an important role, also more than the extent of the bank-specific market power, in affecting the incentives for bank liquidity. This effect of the overall competitive environment on bank liquidity choices is confirmed, with a still sizeable coefficient, also when we add year fixed effects (Table 4, Col. 6)[27].

[27] The interpretation of this result could benefit from the recent empirical evidence (see for example Silva, 2016) on the importance of strategic complementarity in banks' funding liquidity choices. Provided that

Bank-level balance sheet factors and country-specific macroeconomic developments may also play a significant role in explaining 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: as their asset composition is more focused on lending, they dispose of smaller buffers of liquid assets. Then, after controlling for the volumes, the quality of bank lending seems to have some implications for liquidity management: as banks with a higher rate of nonperforming loans tend 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 tend 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 be consistent with 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 relation between price competition and bank liquidity would be also in line with this argument: 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 the Region because it shows that, on average, the banks operating in those countries adopted a quite prudent management of their liquidity during the analysed period[28].

5.2.2 Bank Liquidity: the Interaction with Country Factors

We study the interaction between bank-level market power and some country-level variables, related to market entry and structure, or to prudential regulation and supervision. The full set of regression results is displayed in Table 5. Figure 3 displays the plots for the average marginal effect (AME) of a 1-point increase in the Lerner index on the Z-Score. It is computed on the basis

individual institutions adjust their liquidity buffers to a decrease in their market power, if there is a general market increase in price competition, the network effect coming from the increase in the liquidity holdings of individual banks can induce some additional second-round effects. This could explain the larger effect observed for a country-level increase in price competition.

[28] 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.

of the coefficient estimates for the Lerner index and for the interaction term between the Lerner index and the country-level variable. The average marginal effect in terms of Z-Score variation is plotted for different values of the country-level indicators for Bank Regulation and Supervision (World Bank Survey).

In Table 5, Panel 1, we study the interaction between price competition and market entry conditions and assess its implications on bank liquidity.

The results suggest that the self-discipline mechanism of price competition on bank liquidity may work effectively as long as the market is open enough to potential entrants. Low mark-ups in the pricing of bank products may induce positive incentives for sound liquidity management but may not be sufficient if there is not appropriate market contestability.

From Col. 2, we see that the positive effect of price competition (or the negative effect of market power) on the liquidity ratio is reduced when national regulators introduce excessive restrictions on the ability of banks to engage in other activities (securities, insurance, or real estate). Fig. 3 Plot 1 shows that the size of this effect diminishes (up to becoming non-significant) the stronger is the level of the activity restrictions.

Also, the competition-liquidity relationship can reverse sign if supervisory authorities reject a large number of entry applications above a certain threshold (Table 5, Panel 1, Col. 4). Fig. 3 Plot 3 displays that the relation becomes negative if the percentage of denied applications is higher than 70%. Our interpretation for these results would be that the incentives for a prudent and precautionary liquidity position can be weaker in a market which is unnecessarily restricted to new entrants.

On the other hand, as discussed for solvency, some entry requirements aimed at setting minimum prudential standards for all entrants may be actually useful or even necessary in order to ensure that institutions operating in the market are managed in a prudent way. In Col. 3 (Table 5, Panel 1), the interaction between the Lerner index and the indicator of entry requirements shows that a decrease in market power (or an increase in price competition) may improve bank liquidity only if there is an appropriate level of prudential requirements for new entrants, i.e. above a minimum threshold[29] (see also Fig. 3 Plot 2). Such entry requirements would indeed support the market mechanism by which more competition improves the liquidity position of financial intermediaries. 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

[29] Based on the regression estimates, the minimum threshold for entry requirements that would ensure the positive effect of competition on liquidity would be 6.57, 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 the estimated sample—the positive impact of competition on liquidity.

Table 5 Bank Competition and Liquidity: Interaction with Country Variables

Panel 1. Market Entry and Structure

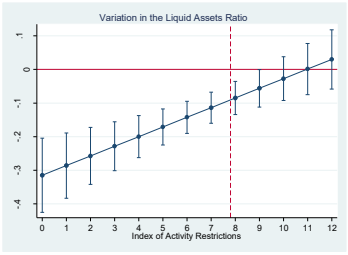
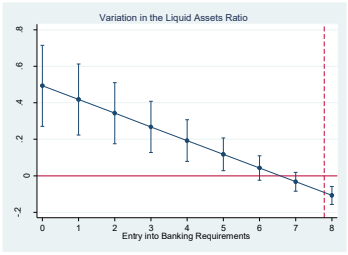
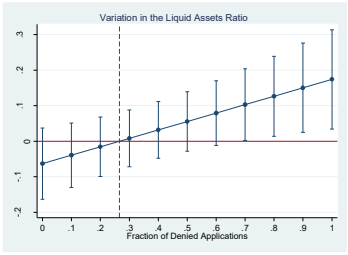
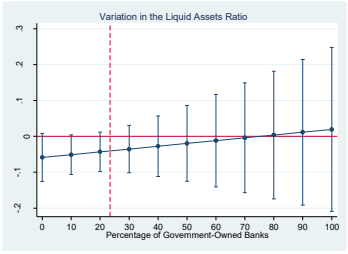
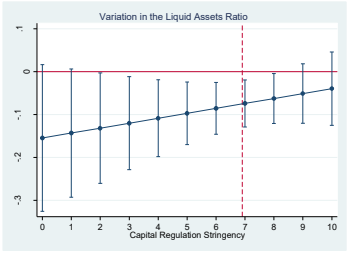
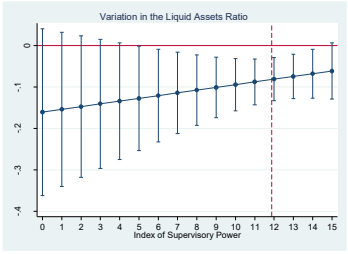
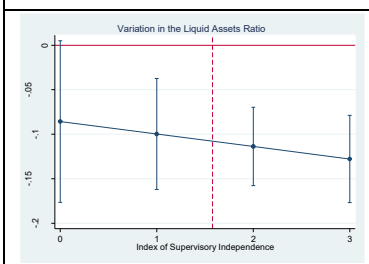
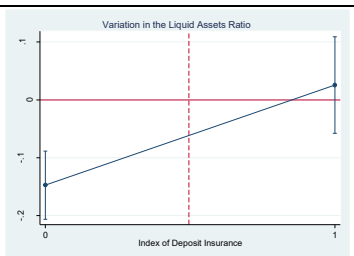
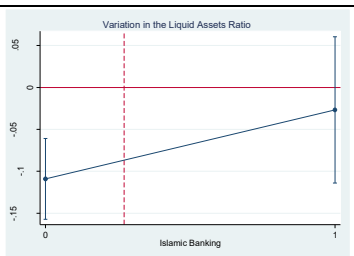
VARIABLES	(1) Liq Ratio	(2) Liq Ratio	(3) Liq Ratio	(4) Liq Ratio	(5) Liq Ratio
Lerner_1	-0.106***	-0.315***	0.493***	-0.0630	-0.0589
	(0.0284)	(0.0671)	(0.135)	(0.0611)	(0.0406)
Activity Restrict_1		-4.043***			
		(0.595)			
Lerner_1* Activ Restrict_1		0.0287***			
		(0.00888)			
Entry Requir_1			1.571*		
			(0.837)		
Lerner_1* Entry Requir_1			-0.0750***		
			(0.0172)		
Denied Applic_1				-13.03**	
				(6.247)	
Lerner_1* Denied Applic_1				0.237**	
				(0.107)	
Gov Banks_1					-1.292***
					(0.209)
Lerner_1* Gov Banks_1					0.000782
					(0.00159)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	YES	YES	YES	YES	YES
Observations	1,123	975	1,102	517	667
R-squared	0.244	0.297	0.244	0.078	0.348
Number of bank	138	133	137	119	103
Bank FE	YES	YES	YES	YES	YES

Panel 2. Prudential Regulation and Supervision, Deposit Insurance

VARIABLES	(1) Liq Ratio	(2) Liq Ratio	(3) Liq Ratio	(4) Liq Ratio	(5) Liq Ratio
Lerner_1	-0.106***	-0.155	-0.160	-0.0857	-0.148***
	(0.0284)	(0.104)	(0.122)	(0.0552)	(0.0358)
Capital Regul_1		-2.295***			
		(0.793)			
Lerner_1* Capital Regul_1		0.0115			
		(0.0138)			
Superv Power_1			0.643		
			(0.486)		
Lerner_1* Superv Power_1			0.00662		
			(0.00966)		
Superv Independ_1				5.064***	
				(1.327)	
Lerner_1* Superv Independ_1				-0.0140	
				(0.0211)	
Deposit Insur_1					-9.050***
					(3.028)
Lerner_1* Deposit Insur_1					0.173***
					(0.0633)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	YES	YES	YES	YES	YES
Observations	1,123	975	986	904	960
R-squared	0.244	0.264	0.250	0.282	0.259
Number of bank	138	133	134	131	131
Bank FE	YES	YES	YES	YES	YES

Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 3 Bank Competition and Liquidity. Interaction Plots

Plot 1	Plot 2	Plot 3
ACTIVITY RESTRICTIONS	**ENTRY REQUIREMENTS**	**DENIED APPLICATIONS**
		
Plot 4	Plot 5	Plot 6
GOVERNMENT BANKS	**CAPITAL REGULATION**	**SUPERVISORY POWER**
		
Plot 7	Plot 8	Plot 9
SUPERV. INDEPENDENCE	**DEPOSIT INSURANCE**	**ISLAMIC BANKING**
		

the prudential framework—credit intermediaries might react to competition by weakening their liquidity management, for instance by increasing their recourse to short-term funding sources.

In Table 5, Panel 2, we investigate the role bank regulation and supervision has on the relationship between price competition and bank liquidity.

In fact, the existing framework for prudential regulation before the crisis was focused mainly on capital requirements; only after the crisis international regulators have decided to introduce some minimum liquidity ratios. Nevertheless, the policy debate underlying the Basel III negotiations has considered also the issue of the potential complementarity or substitutability

between capital and liquidity requirements[30], to the extent prudential requirements for capital adequacy may induce some incentives potentially relevant also for liquidity management.

The empirical evidence observed for the banks in the sample suggests that banks established in countries with more stringent capital regulation presented lower liquid assets ratios (Table 5, Panel 2, Col. 2), suggesting indeed some potential substitutability between capital stringency and liquidity position. Also, banks subject to a more independent prudential supervision showed larger buffers of liquid assets (Table 5, Panel 2, Col. 4), highlighting the importance of supervisory independence for a prudent funding liquidity management of banks.

On the other hand, the interaction terms for the country-level variables of prudential regulation and supervision display non-significant coefficients. Although the interaction terms display some patterns observable from the plots in Fig. 3, we don't find statistically significant evidence that the country-level variables for prudential regulation and supervision could have affect the relation between competition and liquidity during the considered period. In fact, this would be consistent with the fact that the prudential framework under consideration was indeed not focused on liquidity.

As expected, the existence of deposit insurance may have some relevant implications for the funding liquidity preferences of banks (Table 5, Panel 2, Col. 5). Firstly, banks in countries with deposit insurance schemes present lower liquid assets ratios. Moreover, deposit insurance plays a key role in the competition-liquidity nexus: 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.

5.3 Credit Risk

In this section we investigate whether, and to what extent, price competition may affect the credit risk of the banks' asset portfolio.

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

5.3.1 Bank Credit Risk: Baseline Specification

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 have less incentives in taking additional risks, given their profitability. Recalling the two arguments proposed in the discussion on credit risk (Section 3.3), 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 6, we observe that a one-standard deviation decrease in the Lerner Index—i.e. an increase in price competition—implies a rise in the rate of nonperforming loans by 1.6 percent (Col. 1). 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 effect observed for the bank-level Lerner index is confirmed also when we control for the market share of the individual credit institutions (Col. 2).

Moreover, 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 (Col. 4). 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 (Col. 4).

The interaction of the Lerner index with the Islamic dummy (in Col. 3) is positive and significant, while the coefficient for the Lerner index is positive. This implies that, while for conventional banks an increase in market power is associated with an improvement in the credit quality of the loan portfolio, this relationship changes sign for Islamic banks: then, in such case, more price competition[31] is related to lower rates of non-performing loans (see also Fig. 4 Plot 9).

[31] For the purpose of the Lerner index, the average price of the banking activities is computed by considering all the revenues, not only the interest income (in principle missing in Islamic banking), but also the non-interest operating income (fees and commissions) and the equity-accounted profit/loss – operating income. So we capture all the revenues for both conventional and Islamic banks in such a way that we can compare the pricing for both bank types.

Table 6 Bank Competition and Credit Risk: Baseline Specification

VARIABLES	(1) NPL Ratio	(2) NPL Ratio	(3) NPL Ratio	(4) NPL Ratio	(5) NPL Ratio	(6) NPL Ratio
COMPETITION						
Lerner_1	-0.0452***	-0.0438***	-0.0467***		0.0169	
	(0.0139)	(0.0134)	(0.0142)		(0.0135)	
Market Share_1		0.261				
		(0.194)				
Lerner_1 * Islamic			0.151**			
			(0.0643)			
Country Lerner_1				-0.129***		-0.00745
				(0.0337)		(0.0316)
BANK CONTROLS						
Depos Fund Ratio_1	0.124*	0.125*	0.123*	0.111*	0.140**	0.135**
	(0.0669)	(0.0662)	(0.0668)	(0.0630)	(0.0591)	(0.0564)
Return Av Equity_1	-0.237***	-0.244***	-0.238***	-0.255***	-0.321***	-0.318***
	(0.0529)	(0.0514)	(0.0525)	(0.0506)	(0.0427)	(0.0458)
Non-Inter Inc Ratio_1	-0.0152	-0.00577	-0.0168	0.00450	0.0786	0.0774
	(0.0491)	(0.0493)	(0.0487)	(0.0518)	(0.0503)	(0.0486)
Gov Bonds Ratio_1	-0.0786	-0.0829	-0.0784	-0.0676	-0.0776	-0.0584
	(0.0737)	(0.0734)	(0.0737)	(0.0708)	(0.0673)	(0.0657)
Growth Total Assets_1	-0.0237	-0.0277	-0.0258	-0.0175	-0.0305	-0.0291
	(0.0215)	(0.0217)	(0.0217)	(0.0225)	(0.0206)	(0.0218)
MACRO CONTROLS						
GDP Growth_1	-0.249***	-0.247***	-0.248***	-0.179*	-0.172**	-0.170**
	(0.0929)	(0.0928)	(0.0928)	(0.100)	(0.0790)	(0.0832)
CPI Inflation_1	-0.375***	-0.366***	-0.378***	-0.372***	-0.239***	-0.272***
	(0.0951)	(0.0918)	(0.0943)	(0.0897)	(0.0808)	(0.0813)
Constant	8.497	5.973	8.476	11.91**	7.489	8.070*
	(5.220)	(5.421)	(5.189)	(4.682)	(4.662)	(4.393)
Observations	851	851	851	879	851	879
R-squared	0.212	0.219	0.214	0.219	0.365	0.347
Number of bank	117	117	117	120	117	120
Bank FE	YES	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	YES	YES

Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

This result can be explained in relation to the peculiar business model of Islamic banks, which in general present better asset quality and lower default rates (see for example Baele, Farooq and Ongena, 2014; Beck, Demirguc-Kunt and Merrouche, 2013). On one hand, the principle of the profit and loss sharing implies that Islamic banks are in general less interested in risk-taking than conventional banks. On the other hand, the principle of equity – with the consequent prohibition of predetermined interest payments – should allow for the application of potentially more favourable credit conditions to borrowers and then should make easier for borrowers to repay the loan (along the lines of the argument proposed by Boyd and De Nicolo', 2005). The combination of these two facts could actually change the balance between the two effects of a potential decrease in market power: in this case, while the increase in the risk-taking

from the lender's side could be limited, the decrease in the credit risk on the borrower's side should be larger, so in the end more competition could indeed lead to lower loan default rates.

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. Indeed, banks with a larger share of treasury bonds over their total assets also tend to have a more balanced risk profile and indeed 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 favourable macroeconomic conditions, as captured by high values of the GDP growth rate and of the CPI inflation rate.

5.3.2 Bank Credit Risk: the Interaction with Country Factors

We study the interaction between bank-level market power and some country-level variables, related to market entry and structure, or to prudential regulation and supervision. The full set of regression results is displayed in Table 7. Figure 4 displays the plots for the average marginal effect (AME) of a 1-point increase in the Lerner index on the Z-Score. It is

Table 7 Bank Competition and Credit Risk: Interaction with Country Variables

Panel 1. Market Entry and Structure

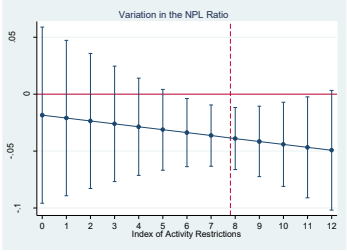
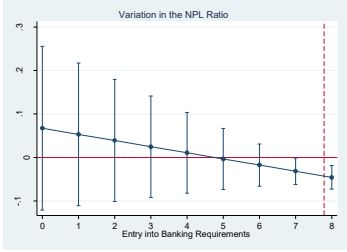
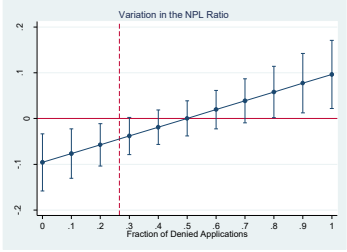
VARIABLES	(1) NPL Ratio	(2) NPL Ratio	(3) NPL Ratio	(4) NPL Ratio	(5) NPL Ratio
Lerner_1	-0.0452***	-0.0184	0.0672	-0.0958**	-0.0169
	(0.0139)	(0.0471)	(0.114)	(0.0380)	(0.0139)
Activity Restrict_1		0.528			
		(0.454)			
Lerner_1* Activ Restrict_1		-0.00258			
		(0.00598)			
Entry Requir_1			0.682		
			(0.950)		
Lerner_1* Entry Requir_1			-0.0141		
			(0.0147)		
Denied Applic_1				-7.640**	
				(3.741)	
Lerner_1* Denied Applic_1				0.192***	
				(0.0695)	
Gov Banks_1					0.0372
					(0.106)
Lerner_1* Gov Banks_1					0.000137
					(0.000696)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	YES	YES	YES	YES	YES
Observations	851	769	831	428	511
R-squared	0.212	0.225	0.215	0.197	0.223
Number of bank	117	112	115	96	86
Bank FE	YES	YES	YES	YES	YES

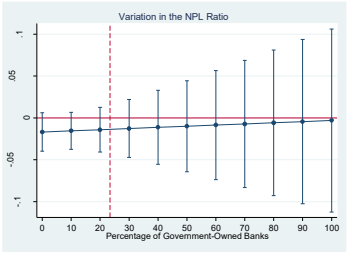
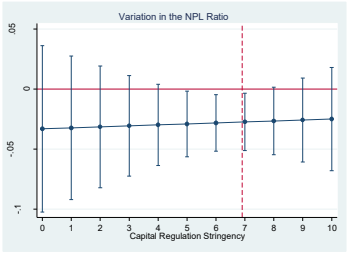
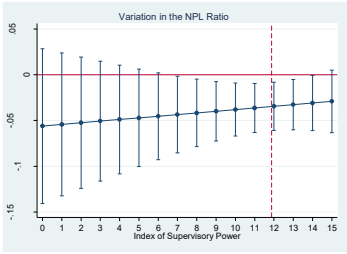
Panel 2. Prudential Regulation and Supervision, Deposit Insurance

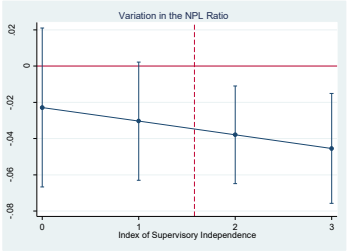
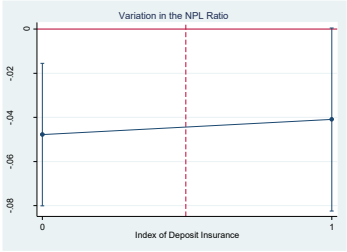
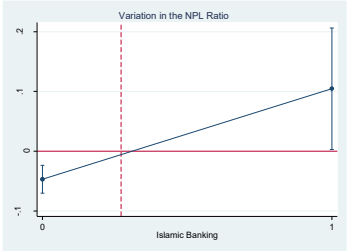
VARIABLES	(1) NPL Ratio	(2) NPL Ratio	(3) NPL Ratio	(4) NPL Ratio	(5) NPL Ratio
Lerner_1	-0.0452***	-0.0331	-0.0561	-0.0228	-0.0478**
	(0.0139)	(0.0421)	(0.0514)	(0.0267)	(0.0196)
Capital Regul_1		-1.052***			
		(0.312)			
Lerner_1* Capital Regul_1		0.000815			
		(0.00617)			
Superv Power_1			0.695**		
			(0.284)		
Lerner_1* Superv Power_1			0.00180		
			(0.00414)		
Superv Independ_1				0.641	
				(0.544)	
Lerner_1* Superv Independ_1				-0.00755	
				(0.00989)	
Deposit Insur_1					1.385
					(1.883)
Lerner_1* Deposit Insur_1					0.00686
					(0.0292)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	YES	YES	YES	YES	YES
Observations	851	769	759	707	763
R-squared	0.212	0.246	0.240	0.240	0.218
Number of bank	117	112	113	112	107
Bank FE	YES	YES	YES	YES	YES

Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 4 Bank Competition and Credit Risk. Interaction Plots

Plot 1	Plot 2	Plot 3
ACTIVITY RESTRICTIONS	**ENTRY REQUIREMENTS**	**DENIED APPLICATIONS**
		

Plot 4	Plot 5	Plot 6
GOVERNMENT BANKS	**CAPITAL REGULATION**	**SUPERVISORY POWER**
		

Plot 7	Plot 8	Plot 9
SUPERV. INDEPENDENCE	**DEPOSIT INSURANCE**	**ISLAMIC BANKING**
		

computed on the basis of the coefficient estimates for the Lerner index and for the interaction term between the Lerner index and the country-level variable. The average marginal effect in terms of Z-Score variation is plotted for different values of the country-level indicators for Bank Regulation and Supervision (World Bank Survey).

Market dynamics may 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 (Table 7, Panel 1, Col. 4 and Fig. 4 Plot 3). In particular, if the fraction of denied applications is higher than 50 percent, an increase in market power induces an opposite effect—that is, a rise in the ratio of non-performing loans—because banks operating in a restricted market may be incentivised to increase risk-taking behaviour. For this reason, it is crucial to ensure enough market contestability by allowing entry to new banks, subject to certain prudential requirements.

We also investigate whether the country-level bank regulation and supervision may have played some role in the relationship between price competition and credit risk (Table 7, Panel 2).

The results show that banks established in countries with more stringent capital regulation registered lower rates of non-performing loans (Col. 2). However, the interaction terms of the Lerner index with the country-level variables of prudential regulation and supervision don't display significant coefficients. This means that, even if the national stance of prudential regulation may have some implications on the risk-taking of credit institutions, such differences don't explain statistically significant differences across countries in the relation between competition and delinquency rate.

In fact, the prudential framework in place for the MENA countries during the considered period was based essentially on the provision of capital requirements, but without proper distinction in relation to the credit risk of the portfolio held by individual institutions. This was partly due to the global timeline in the developments of prudential standards[32] focused on risk sensitiveness, but most importantly to the implementation timing of the Basel II accord in the countries of the Region.

The surveys conducted both in advance and in the course of the Basel II implementation suggest that MENA countries adopted the new prudential guidelines with some relevant delay, though with differences across countries[33]. Also, the disaggregation of the responses to the World Bank's Survey for the specific components of the capital stringency indicator provide some additional details: only starting from the most recent wave of the survey in 2011, national regulators in the considered MENA countries have reported that the prudential framework in place allows for some variation in the minimum capital ratio as a function of an individual bank's credit risk.

This implies that, for most of the sample period, the prudential regulation and supervision in these countries was not focused on the credit risk of the loan portfolio. This would explain why the country-level prudential framework did not have direct implications on the relation between price competition and credit risk.

[32] A significant risk sensitiveness in the computation of risk-based capital requirements was introduced only in the Basel II agreement, adopted by the Basel Committee in 2004 and updated in 2005. Then only after that date we can expect that the determination of minimum capital requirements would properly take into account the heterogeneity in the credit risk for the exposures to borrowers with different creditworthiness.

[33] See the surveys produced by the Financial Stability Institute (2004, 2013)

6 Conclusions

This paper analyses the relationship between bank competition and financial stability, focusing on a sample of 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 borrowing. Moreover, it presents relatively limited risk taking as indicated by the lower rate of nonperforming loans compared with the financial sectors elsewhere.

From this point of view, the aggregate data on the banking system in the Region would seem to favour the idea that, while bank competition may increase the fragility of credit institutions, some market power may indeed be useful to reinforce the financial stability of banks. Given this motivation, we investigate the nexus between competition and stability for the banks in the Region, by using bank-level data for individual institutions and taking into account cross-country heterogeneities in market entry and structure and in prudential regulation and supervision, and by considering also the peculiarities of the bank business model in these countries, such as the coexistence of conventional and Islamic banks.

We provide three main contributions. 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 versus conventional banks with respect to different types of bank risk.

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. Adequate prudential entry requirements may strengthen the liquidity-enhancing effect of price competition, while deposit insurance may reduce such incentives because of moral hazard issues.

Also, price competition reduces bank profits and so the franchise value of credit institutions: then it is associated with a negative effect on bank solvency. In principle, if banks pursue active management of their capital, they may also 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 only if the increase in bank capital is sufficiently large to compensate for the reduction in bank profits. In this context, 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.

We also analyse the interaction between the bank-level market power and the country-level conditions for market entry and structure. With respect to bank solvency and credit quality, we find that higher market power may positively contribute to the stability of credit intermediaries, 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, because of activity restrictions or frequent rejection of banking applications, credit institutions with some market power may be interested in exploiting their position to increase their risk taking. In fact, entry restrictions can encourage a risk-taking attitude from incumbent banks operating in a concentrated and closed market, as they would take advantage from increasing the size of their balance sheets and their systemic relevance, through the higher likelihood of an implicit support by the government. This would indeed represent a source of major concern for financial stability.

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 internalise 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.

Based on that, the paper suggests some policy implications for the design and implementation of financial sector reforms in emerging markets and developing countries, in the area of market contestability. 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 (i.e. prudential policy).

At the same time, other policy reforms should aim to reinforce the stringency of capital regulation, to improve the quality and independence of prudential supervision and to reduce the control of governments on the financial sector. When banks dispose of some market power, capital regulation and supervisory independence provide an effective mechanism for them to safely manage their additional profit margins and increase their capital buffers. At the same time, in the cases where competition may induce some possible incentives for bank risk taking, a strong supervisory power may induce banks to adopt a more appropriate management of their capital position. 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 increase their risk-taking because of their reliance on the support from the public sector.

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INTERNET APPENDIX

APPENDICES

A Sources and Description of the Variables

Table A.1 Definition of Variables and Data Sources

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-Assets 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 to 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	

VARIABLE	DESCRIPTION	SOURCE
Deposits to Total Funding Ratio	The ratio of total deposits to the total funding	
Growth of Total Assets	The growth rate of total assets	
Macro Variables		
GDP Growth Rate	The annual growth rate of real GDP	World Economic Outlook (IMF)
CPI Inflation Rate	The inflation rate based on the consumer price index	
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 1 in presence of insurance and to 0 in absence of that.	

B 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
BANK LIQUIDITY					
Deposit to Total Funding Ratio	3243	.8104914	.2161244	.0416	1
Liquid Assets/Short-Term Borr.	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	3660	.4972678	.5000609	0	1

C Bank Competition and Solvency: Interaction with Country Variables

Table C.1 reports the regression coefficients from the estimation of the equations (3) and (4) for the Z-Score, by adding country-year fixed effects to control for unobserved time-varying country heterogeneity.

Table C.1 Bank Competition and Solvency: Estimation with Country-Year FE

Panel 1. Market Entry and Structure

VARIABLES	(1) Z_Score	(2) Z_Score	(3) Z_Score	(4) Z_Score	(5) Z_Score
Lerner_1	0.0480	0.204	-0.867**	0.0720	0.0344
	(0.0404)	(0.378)	(0.405)	(0.191)	(0.0371)
Lerner_1* Activ Restrict_1		-0.0188			
		(0.0460)			
Lerner_1* Entry Requir_1			0.119**		
			(0.0520)		
Lerner_1* Denied Applic_1				0.0442	
				(0.682)	
Lerner_1* Gov Banks_1					-0.00171
					(0.00307)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	NO	NO	NO	NO	NO
Observations	725	654	716	323	487
R-squared	0.282	0.237	0.243	0.246	0.252
Number of bank	110	106	109	89	81
Bank FE	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO
Country-Year FE	YES	YES	YES	YES	YES

Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

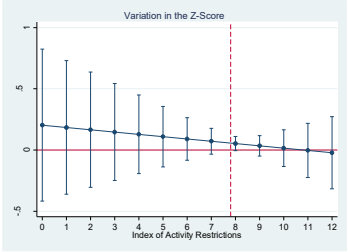
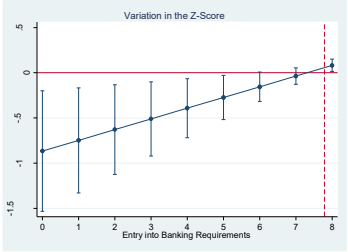
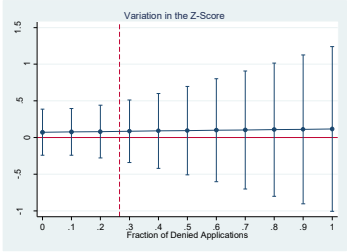
Panel 2. Prudential Regulation and Supervision, Deposit Insurance

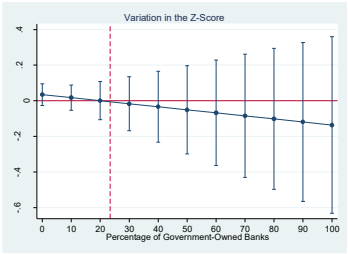
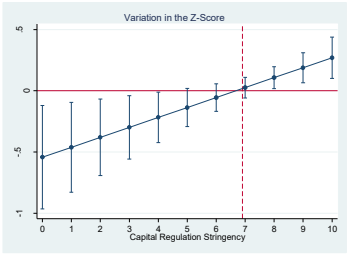
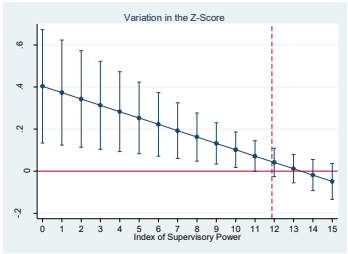
VARIABLES	(1) Z_Score	(2) Z_Score	(3) Z_Score	(4) Z_Score	(5) Z_Score
Lerner_1	0.0480	-0.543**	0.404**	-0.0673	-0.0211
	(0.0404)	(0.256)	(0.164)	(0.125)	(0.0522)
Lerner_1* Capital Regul_1		0.0812**			
		(0.0341)			
Lerner_1* Superv Power_1			-0.0302**		
			(0.0128)		
Lerner_1* Superv Independ_1				0.0562	
				(0.0586)	
Lerner_1* Deposit Insur_1					0.141
					(0.0944)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	NO	NO	NO	NO	NO
Observations	725	654	644	623	660
R-squared	0.282	0.246	0.241	0.243	0.233
Number of bank	110	106	107	106	102
Bank FE	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO
Country-Year FE	YES	YES	YES	YES	YES

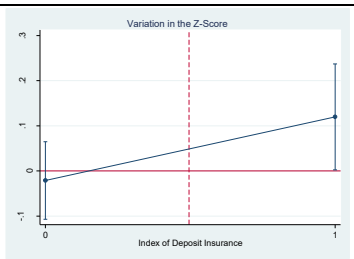
Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure C.1 displays the plots for the average marginal effect (AME) of a 1-point increase in the Lerner index on the Z-Score, based on the estimates in Table 9, to control for country-year fixed effects. It is computed on the basis of the coefficient estimates for the Lerner index and for the interaction term between the Lerner index and the country-level variable. The average marginal effect in terms of Z-Score variation is plotted for different values of the country-level indicators for Bank Regulation and Supervision (World Bank Survey).

Figure C.1 Bank Competition and Solvency: Plots with Country-Year FE

Plot 1	Plot 2	Plot 3
ACTIVITY RESTRICTIONS	**ENTRY REQUIREMENTS**	**DENIED APPLICATIONS**
		

Plot 4	Plot 5	Plot 6
GOVERNMENT BANKS	**CAPITAL REGULATION**	**SUPERVISORY POWER**
		

Plot 7	Plot 8	Plot 9
SUPERV. INDEPENDENCE	**DEPOSIT INSURANCE**	**ISLAMIC BANKING**
		

D Bank Competition and Liquidity: Interaction with Country Variables

Table D.1 reports the regression coefficients from the estimation of the equations (3) and (4) for the liquid assets ratio, by adding country-year fixed effects to control for unobserved time-varying country heterogeneity.

Table D.1 Bank Competition and Liquidity: Estimation with Country-Year FE

Panel 1. Market Entry and Structure

VARIABLES	(1) Liq Ratio	(2) Liq Ratio	(3) Liq Ratio	(4) Liq Ratio	(5) Liq Ratio
Lerner_1	0.00690	0.0133	0.309**	0.0163	0.0225
	(0.0188)	(0.106)	(0.124)	(0.0615)	(0.0260)
Lerner_1* Activ Restrict_1		0.00102			
		(0.0125)			
Lerner_1* Entry Requir_1			-0.0382**		
			(0.0160)		
Lerner_1* Denied Applic_1				0.119	
				(0.113)	
Lerner_1* Gov Banks_1					-0.000668
					(0.00215)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	NO	NO	NO	NO	NO
Observations	1,123	975	1,102	517	667
R-squared	0.659	0.672	0.654	0.364	0.687
Number of bank	138	133	137	119	103
Bank FE	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO
Country-Year FE	YES	YES	YES	YES	YES

Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

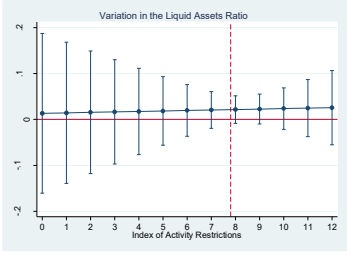
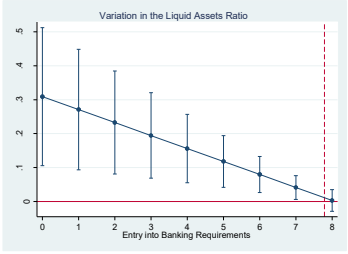
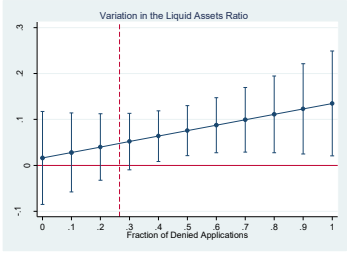
Panel 2. Prudential Regulation and Supervision, Deposit Insurance

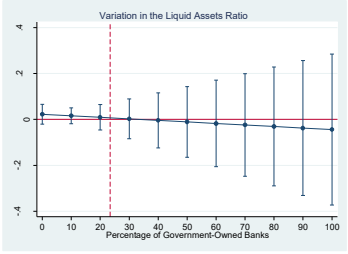
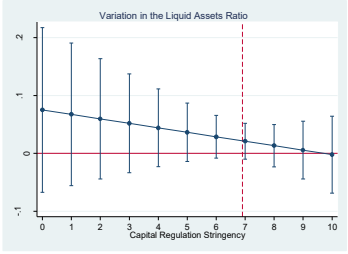
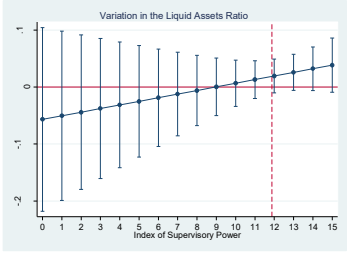
VARIABLES	(1) Liq Ratio	(2) Liq Ratio	(3) Liq Ratio	(4) Liq Ratio	(5) Liq Ratio
Lerner_1	0.00690	0.0752	-0.0567	0.0395	0.0203
	(0.0188)	(0.0865)	(0.0980)	(0.0435)	(0.0322)
Lerner_1* Capital Regul_1		-0.00774			
		(0.0120)			
Lerner_1* Superv Power_1			0.00635		
			(0.00794)		
Lerner_1* Superv Independ_1				-0.0108	
				(0.0213)	
Lerner_1* Deposit Insur_1					0.0147
					(0.0535)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	NO	NO	NO	NO	NO
Observations	1,123	975	986	904	960
R-squared	0.659	0.672	0.675	0.683	0.668
Number of bank	138	133	134	131	131
Bank FE	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO
Country-Year FE	YES	YES	YES	YES	YES

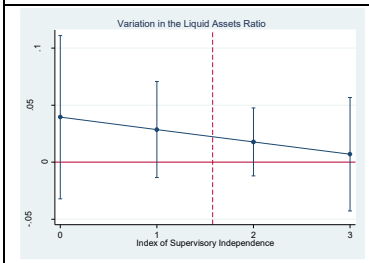
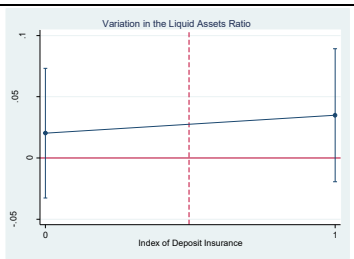
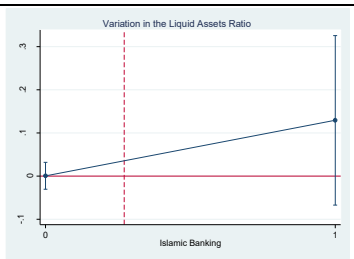
Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure D.1 displays the plots for the average marginal effect (AME) of a 1-point increase in the Lerner index on the liquid assets ratio, based on the estimates in Table 10, to control for country-year fixed effects. It is computed on the basis of the coefficient estimates for the Lerner index and for the interaction term between the Lerner index and the country-level variable. The average marginal effect in terms of Z-Score variation is plotted for different values of the country-level indicators for Bank Regulation and Supervision (World Bank Survey).

Figure D.1 Bank Competition and Liquidity: Plots with Country-Year FE

Plot 1	Plot 2	Plot 3
ACTIVITY RESTRICTIONS	**ENTRY REQUIREMENTS**	**DENIED APPLICATIONS**
		

Plot 4	Plot 5	Plot 6
GOVERNMENT BANKS	**CAPITAL REGULATION**	**SUPERVISORY POWER**
		

Plot 7	Plot 8	Plot 9
SUPERV. INDEPENDENCE	**DEPOSIT INSURANCE**	**ISLAMIC BANKING**
		

E Bank Competition and Credit Risk: Interaction with Country Variables

Table E.1 reports the regression coefficients from the estimation of the equations (3) and (4) for the non-performing loans ratio, by adding country-year fixed effects to control for unobserved time-varying country heterogeneity.

Table E.1 Bank Competition and Credit Risk: Estimation with Country-Year FE

Panel 1. Market Entry and Structure

VARIABLES	(1) NPL Ratio	(2) NPL Ratio	(3) NPL Ratio	(4) NPL Ratio	(5) NPL Ratio
Lerner_1	0.00908	0.0385	-0.000688	-0.0216	0.0174
	(0.0142)	(0.0638)	(0.182)	(0.0379)	(0.0193)
Lerner_1* Activ Restrict_1		-0.00363			
		(0.00776)			
Lerner_1* Entry Requir_1			0.00130		
			(0.0235)		
Lerner_1* Denied Applic_1				0.0487	
				(0.0655)	
Lerner_1* Gov Banks_1					-2.92e-05
					(0.000935)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	NO	NO	NO	NO	NO
Observations	851	769	831	428	511
R-squared	0.457	0.453	0.457	0.479	0.424
Number of bank	117	112	115	96	86
Bank FE	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO
Country-Year FE	YES	YES	YES	YES	YES

Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

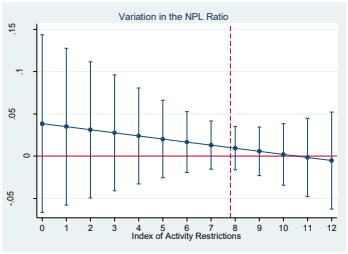
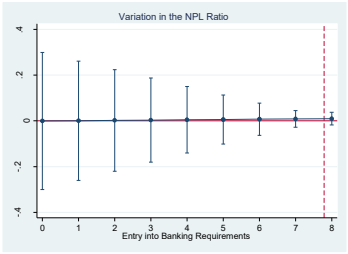
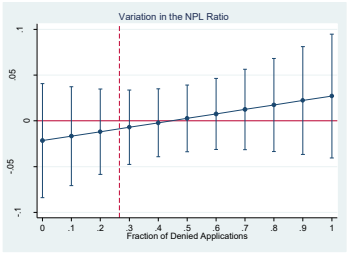
Panel 2. Prudential Regulation and Supervision, Deposit Insurance

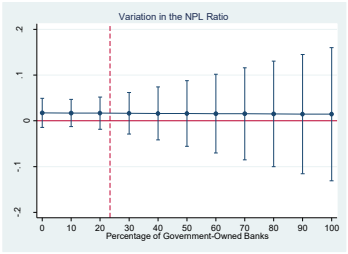
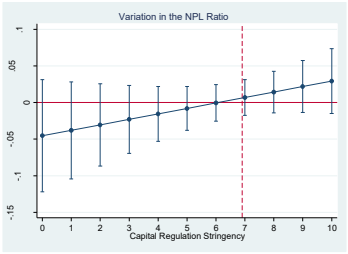
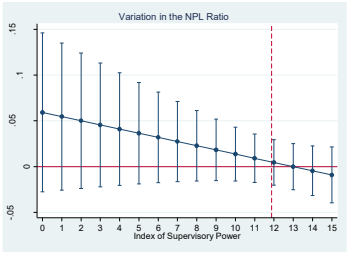
VARIABLES	(1) NPL Ratio	(2) NPL Ratio	(3) NPL Ratio	(4) NPL Ratio	(5) NPL Ratio
Lerner_1	0.00908	-0.0455	0.0592	0.00733	0.00476
	(0.0142)	(0.0465)	(0.0528)	(0.0385)	(0.0202)
Lerner_1* Capital Regul_1		0.00747			
		(0.00667)			
Lerner_1* Superv Power_1			-0.00455		
			(0.00409)		
Lerner_1* Superv Independ_1				0.00174	
				(0.0149)	
Lerner_1* Deposit Insur_1					0.0114
					(0.0353)
Bank Controls	YES	YES	YES	YES	YES
Macro Controls	NO	NO	NO	NO	NO
Observations	851	769	759	707	763
R-squared	0.457	0.453	0.446	0.455	0.455
Number of bank	117	112	113	112	107
Bank FE	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO
Country-Year FE	YES	YES	YES	YES	YES

Robust (bank-clustered) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure E.1 displays the plots for the average marginal effect (AME) of a 1-point increase in the Lerner index on the non-performing loans ratio, based on the estimates in Table 11, to control for country-year fixed effects. It is computed on the basis of the coefficient estimates for the Lerner index and for the interaction term between the Lerner index and the country-level variable. The average marginal effect in terms of Z-Score variation is plotted for different values of the country-level indicators for Bank Regulation and Supervision (World Bank Survey)

Figure E.1 Bank Competition and Credit Risk: Plots with Country-Year FE

Plot 1	Plot 2	Plot 3
ACTIVITY RESTRICTIONS	**ENTRY REQUIREMENTS**	**DENIED APPLICATIONS**
		

Plot 4	Plot 5	Plot 6
GOVERNMENT BANKS	**CAPITAL REGULATION**	**SUPERVISORY POWER**
		

Plot 7	Plot 8	Plot 9
SUPERV. INDEPENDENCE	**DEPOSIT INSURANCE**	**ISLAMIC BANKING**