Loan Delinquency in Banking Systems: How Effective Are Credit Reporting Systems?

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Abstract

The role of credit reporting systems in influencing bank loan delinquency has received limited attention in the literature. To address this issue, we combine the staggered timing of credit reporting reforms across countries of Middle East and North Africa (MENA) with bank-level data for the period 2000-2012 to examine its impact on non-performing loans (NPLs). The analysis suggests that credit reporting system reforms is associated with a decline in NPLs by roughly 40%. These results are driven by reforms of credit bureau as compared with public credit registry. The analysis also points to a differential impact on NPLs across bank business models and across countries with differing banking structures.

JEL classification: G 21; G29; L 11

Key words: credit bureau; credit registry; MENA; non-performing loans; banking

Introduction

In recent times, a lot of focus has been directed towards understanding the challenges confronting the banking sector. One key aspect of this challenge has been analysing the factors affecting the non-performing loans (NPLs) of banks. According to the International Monetary Fund (IMF, 2015), NPLs constitute a drag on economic activity, especially for countries where banks are the mainstay of financial intermediation. In addition, high NPLs dampen profitability, tie up bank capital and raise funding costs. A crucial challenge for policymakers is addressing the NPL menace so as to unlock credit supply and ultimately, promote economic growth.

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One region of the global economy where the evolution of NPLs has been relatively under-researched has been the Middle East and North Africa (MENA) region. The Article IV reports of the IMF have pointed to the high levels of NPLs in several of these countries. For instance, during 2002-2006, Tunisia and Egypt has NPLs of over 20% of gross loans. Loan delinquency was also high in the United Arab Emirates (UAE), notwithstanding several significant reforms in the financial sector. At the other end of the spectrum, in countries such as Kuwait, Qatar and Saudi Arabia, the challenges of loan non-performance were much less compelling. Although bad loans in most of these countries have trended upwards since the crisis (IMF, 2012), the impact has been uneven with NPLs (as ratio to gross loans) in 2010 being in double digits in Algeria and Egypt and significantly lower in others such as Oman, Qatar and Saudi Arabia (IMF, 2012).

At the same time, these countries have undertaken several institutional reforms to tackle the bad loan menace. Besides improvements in bank governance standards and regulatory quality, a key measure has been the establishment of credit information reporting system. During the past several years, several MENA countries have established a credit registry (CR), with the oldest one being set up in Kuwait in 2002. Other countries have taken initiatives to set up private credit bureau (CB), entailing a framework with a mix of both public and private information sharing system. The avowed purpose of such institutions is to reduce informational asymmetries and improve the flow of private credit. In their cross-country study of 129 countries, Djankov et al. (2007) show that private bank credit to GDP increases by 7-8 percentage points during the five-year period following the introduction of such institutions. How far have such institutions been effective in tackling the bad loan problem remains a moot empirical question.

To inform this debate, this paper studies the effect of credit bureau reform on bank problem loans using bank-level data. The information base comprises of a sample of over 100 banks, a quarter of which are Islamic, in 12 MENA countries during the period 2000-2012. The empirical research design exploits the exogenous variation arising from the staggered establishment of these institutions across countries and adopts a difference-in-differences (DID) research strategy to investigate the impact of credit information reporting system. We find that the economic impact of credit information system reform is quite large and associated with an overall reduction in bank NPLs by nearly 40 basis points, driven primarily by

reform of private credit bureau. The results are robust across a variety of empirical specifications and indicate that credit reporting systems are effective in lowering problem loans.

These cross-sectional heterogeneity results also mitigate concerns about omitted variables. While our identification strategy alleviates some of these concerns, it is possible that these results could be driven by other contemporaneous reforms. If this were the case, we would incorrectly attribute reduction in bank NPLs to reforms in credit information management systems. Exploiting cross-sectional heterogeneity is useful since such effects would be differenced out in the specifications. Additionally, in such a setup, we can control for year and country fixed effects. As a result, we are able to control for any changes in the regulatory and economic environment across countries and over time.

A number of factors make the banking sector in the MENA region an interesting laboratory to study this issue. First, the Financial Sector Assessment Programs (FSAPs), conducted jointly by the IMF and the World Bank have consistently reported high levels of impaired loans in several of these countries, although the position is much better in several others. Given this wide divergence, it remains a policy concern as to why some countries are better able to manage bad loans and the role that credit bureaus have played in this regard. Second, while several studies have investigated the macroeconomic and microeconomic determinants of non-performing loans (Sinkey and Greenawalt, 1991; Kwan and Eisenbis, 1997; Salas and Saurina, 2002), these have focused on developed countries. Related research for the MENA region has examined the nexus between capital regulation and credit risk (Naceur and Kandil, 2013), but did not identify the relevance of credit information systems in lowering credit risk. Finally, although the usefulness of credit reporting mechanisms as a bellwether of financial development and its positive spillovers for financial stability has been well documented (Pagano and Jappelli, 1993; Kallberg and Udell, 2003; Barth et al., 2009), compelling evidence for MENA countries on the interlinkage between credit bureau reform matters and loan delinquencies is less forthcoming, highlighting the need for careful empirical research.

The rest of the paper unfolds as follows. Section II presents an overview of the literature and highlights the contribution of the paper. An overview of the evolution of credit information bureaus in these countries against the backdrop of

their banking and financial systems follows thereafter. Section IV discusses the data and methodology and follows it up with an analytical assessment of the results. The final section concludes.

II. Background and literature

Information asymmetry in the credit market is manifest most prominently when the institutional framework is weak and does not enable reliable evaluation of borrower creditworthiness. Under these circumstances, entities which are specialized in credit risk assessment, such private credit bureaus (PCB) and public credit registries (PCR), can help mitigate some of these asymmetries.

There are three possible mechanisms by which a credit information system can address the informational challenges. First, by being able to access the credit history, the bank is able to screen the credit behavior of the borrower (Brown et al., 2009 and Djankov et al., 2007) and enhances their default predictive power (Pagano and Jappelli, 1993). Second, since the information on borrower credit history is available across lenders, it incentivizes better repayment as otherwise, it can lead to credit exclusion or higher interest premium (Padilla and Pagano, 2000). And finally, the exchange of information across lenders lowers the ability of the lending bank to appropriate informational rents and consequently leads to a decline in lending rates (Sharpe, 1990; von Thadden, 2004).

The development of information sharing systems therefore not only exerts a positive impact on the cost as well as the volume of credit, but from the standpoint of financial stability, also lowers the default rate. To be more specific, for a given rate of credit growth, information sharing is expected to lead to a decline in bank NPLs.

Several studies have examined these issues within an empirical framework. For instance, Gehrig and Stenbacka (2007), Padilla and Pagano, (2000), Pagano and Jappelli (1993) and Kallberg and Udell (2003) show that information sharing in the credit market helps to reduce adverse selection and moral hazard. Houston et al. (2010) also show that information sharing reduces bank risk-taking by ensuring better management of existing loans.

Recent research has taken a more proactive approach, segregating the impact of CR and CB. In theory, although these two types of credit information

sharing mechanisms are perfect substitutes – providing information to the lender regarding the borrowers' creditworthiness - empirical evidence suggests that in practice, private credit bureaus are more effective (Singh et al., 2009).

Cross-country evidence by Jappelli and Pagano (2002) finds that the presence of credit bureaus exerts a positive impact on bank lending and minimizes default rates. Employing data from Dun and Bradstreet, a private credit information firm, Kallberg and Udell (2003) also point to the fact that historical information collated by credit bureau have greater power in predicting the firm's default probability, thereby making banks more resilient to adverse selection and reducing credit risk. Barron and Staten (2003) also provide evidence that greater availability of information lowers bank loan default. Utilizing credit report data from Brazil and Argentina, Powell et al. (2004) find that greater information sharing lowers the probability of borrower default.

More recently, Bennardo et al. (2007) show that sharing of credit information among lenders can reduce over-indebtedness, as borrowers classified as highly indebted receive less credit. Employing data on transition economies, Brown and Zehnder (2007) empirically established that credit information sharing allows lenders to identify borrowers with good credit history and thereby lowers overall borrowing costs. Using information from the PayNet database, Doblas-Madrid and Minetti (2013) find that delinquencies are lower for information-sharing firms, especially those with low credit ratings.

Overall, the balance of evidence suggests that institutional mechanisms for information sharing on borrowers helps curtail the challenges of informational asymmetries and reduce credit risk.

We contribute to the existing literature in a few distinct ways. First, this is one of the earliest studies to examine the interface between reform of credit reporting system and NPLs. Empirical studies for developed and emerging economies have examined various facets of impaired loans. Rajan (1994) advocates herd behavior among bank managers as a major cause of loan impairment. Kwan and Eisenbis (1997) observe a U-shaped relationship between problem loans and loan growth for US banks. Berger and Udell (2004) suggests that the gradual erosion of institutional memory engenders rapid loan expansion, which is subsequently manifest as delinquent loans. Others trace the determinants of non-performing loans to unbridled banking sector liberalization which leads banks to venture into

unknown markets (Dell Ariccia and Marquez, 2006), too much competition, which erodes margins and leads banks to scramble for market shares by compromising on objectivity in credit evaluation (Jimenez, 2013) or even a decline in collateral valuation (Gabriel et al., 2006). In case of GCC banks, Espinosa and Prasad (2010) show that NPLs are inversely correlated with the business cycle. Similar conclusion were reached by Das and Ghosh (2005) who found that bank-specific factors overwhelm macroeconomic factors in influencing credit risk. Our findings suggest that credit bureaus are effective in reducing impaired loans; while PCR are useful in countries with high loan delinquency, PCB are more effective in countries with that have low levels of impaired loans.

Second, our paper also adds to the literature that examines the managerial determinants of problem loans. In an early exercise, Berger and DeYoung (1997) investigate the interrelationships among loan quality, efficiency and bank capital and find an inverse association between efficiency and problem loans. They propose several hypothesis regarding the kind of management behavior, based on the direction of these relationships.[2] Thereafter, employing a large sample of European savings banks, Williams (2004) concludes that decreases in efficiency tend to be followed by deterioration in loan quality, supportive of the bad management hypothesis. Utilizing data on over 250 banks for transition economies, Rossi et al. (2005) provide support for the bad luck hypothesis wherein deterioration in loan quality precede reduction in efficiency. Podpiera and Weill (2008) also uncover evidence in favor of bad management behavior in Czech banks. Fiordelisi et al. (2011) find that lower efficiency increases bank risk which vindicates the bad management hypothesis. Empirical evidence on the factors affecting credit risk for Tunisian banks also support the bad management hypothesis (Abid et al., 2014). Our analysis adds to this stream of literature by analyzing which of these hypotheses are most pertinent for MENA banks and find weak evidence in favor of the skimping hypothesis.

[2] The bad management hypothesis suggests indicates that a decline in efficiency leads to an increase in non-performing loans. The bad luck management hypothesis suggests that that an increase in non-performing loans lowers efficiency. Skimping behavior occurs when an increase in efficiency raises impaired loans and finally, when a reduction in capital leads to an increase in delinquent loans, this is supportive of moral hazard behavior.

Third, the paper is a contribution to the thin literature on the structural characteristics of the banking sector that influences non-performing loans and the reform of credit reporting system. In general, the quality of loan depends on two factors: information collated and guarantees provided. Following from this line of thinking, adequate information related to the borrower complemented by guarantees could improve the quality of loans. Consistent with this idea, Japelli and Pagano (2002) show that default rates are lower in countries where information sharing is well-established. Other cross-country (Galindo and Miller, 2001; Djankov et al., 2007; Singh et al., 2009) and within-country (Love and Mylenko, 2003; Doblas-Madrid and Minetti, 2009) studies also report the beneficial effects of information sharing in alleviating credit constraints and improving the flow of private credit. Research on the relevance of credit reporting systems for impaired loans is limited, an aspect we address in the paper. We show that credit bureaus are most effective in countries with high NPLs with a significant presence of foreign banks.

Finally, our analysis contributes to the stream of literature that analyzes the impact of credit bureaus on funding cost and loan rates. Employing cross-sectional data, Brown et al (2009) show that information sharing lowers the cost of finance, especially for opaque firms. Using firm-level survey data during 2002-13, Martinez Peria and Singh (2014) find that credit bureaus lower the cost of finance for firms. Our analysis shows that credit bureaus are not effective in lowering loan rates, and although they help to lower deposit costs, especially in countries with high banking concentration.

III. Banking sector and credit bureaus in MENA countries

The MENA countries comprise broadly of two groups. The first group comprise primarily of high-income Gulf Cooperation Council (GCC) countries, which are primarily oil-exporting nations (World Bank, 2015). The other set comprise, primarily non-GCC countries, are oil-importers, who depend essentially on trade, tourism and capital flows.[3] Within this overall setup, the financial sector is primary bank-based (Naceur and Omran, 2011) with the ratio of private credit to GDP averaging nearly 65%, being higher for the oil exporters (85%) as compared to the

[3] Oil exporters include Algeria, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates. The oil importers include Egypt, Jordan, Lebanon, Morocco and Tunisia. Banks in these 12 countries comprise our MENA sample.

oil importers (around 70%). On the deposit side, the deposit-to-GDP ratio for non-GCC countries are higher at 90% as compared with their GCC (80%), reflecting workers remittances and capital flows.

The banking sector is quite diverse, comprising primarily of domestic players. The share of foreign banks remains low, averaging 13% in 2012, similar to those obtaining in 2007 (Claessens and van Horen, 2014). Besides, several countries have dual banking system wherein Islamic banks (including Islamic windows) co-exist with conventional ones, although their presence is uneven across country groups. In the GCC countries for example, the share of these banks averaged 30% in 2013 with a maximum of 50% in Saudi Arabia to a minimum of 6% in Oman (Islamic Financial Services Board, 2016). In contrast, the share is much lower in non-GCC countries, with an average of 5%, being the highest in Jordan at 9%. Bank concentration remains high, with the 3-bank (usually, domestic) concentration ratio ranging between 0.5 - 0.8 and even higher in some cases. The value is the lowest in Tunisia at 0.41.

Looking across ownership, the banking sector is preponderantly domestically-owned, reflecting barriers to entry and licensing restrictions on foreign banks (Al-Hassan et al., 2010). As a result, the presence of banks across borders is primarily in the form of branches, often of unitary nature. State ownership of banks (comprising government, quasi government and domestic royal family) is high in several countries such as UAE, Saudi Arabia and Oman, although in others such as Bahrain, Kuwait and Morocco, it is much lower (Al-Hassan et al., 2010).

In tandem with the growth of banking and finance, several countries have established credit reporting systems. Several countries already had credit registries in place since long, such as in Algeria in 1964), Egypt in 1957, Jordan in 1965, Lebanon in 1962 and Morocco in 1966 to supervise banks and monitor the risk exposure of large credit (Arab Monetary Fund, 2015). Even Tunisia had a credit registry since 1958 – *Centrale de Risques* – under the supervision of the central bank.

As compared to this, private credit bureaus are of recent origin, with the oldest one being operational in Kuwait since 2002. In Oman, National Bureau Commercial Information, a private credit bureau, become functional in 2010. Likewise, the Al Etihad credit bureau was created in United Arab Emirates in 2010 as a single source of reliable data regarding credit information in the country. The

Moroccan credit bureau, which started operations in November 2009, is owned and managed by a private firm, but under the oversight of the central bank. Jordan has also adopted a similar approach. Owned and operated by the Italy-based CRIF, a large banking and credit information company, a credit bureau has become operational in December 2015, although it is regulated by the central bank. Saudi Arabia is one of the few countries in the region with both a credit bureau and a credit registry. The latter exists in the form of a B-list by the central bank, which contains both positive and negative information on credit facilities above a threshold. In 2002, SIMAH, the Saudi Credit Bureau, was established to act as a data aggregator, providing a comprehensive system of credit information sharing among banks and it became operating in 2004. Only Qatar has been an exception, having established a credit registry under the aegis of the central bank in 2010.

IV. Data and empirical strategy

The analysis combines three sets of data: bank-specific data, banking industry and macroeconomic data and finally, other country-specific data.

IV.1 Bank level data

The bank-level data is extracted from *Bankscope*, a comprehensive, global database containing information on nearly 30,000 public and private banks globally, maintained by International Credit Analysis Limited (IBCA).

We use a sample comprising of an unbalanced panel of annual report data from 2000-12 for 12 MENA countries, comprising commercial and Islamic banks. The sample initially contained nearly 120 banks, but subsequently we deleted the finance and investment companies including banks with extremely misrecorded/missing data on several of the important variables, leaving is with 102 banks, a quarter of them being Islamic. The total assets of Islamic banks was around a third of the total assets of the sample banks. At an average of 12.7 years of observations per bank, we have a maximum of 1297 bank-years. To moderate the influence of outliers, we winsorize the top and bottom 1% of observations for all bank-specific variables. In 2012, the final year of the sample, these banks, on average, accounted for roughly 60% of total banking assets in their respective countries. **Table 1** provides the sample composition.

Following from the literature, the dependent variable of interest is non-performing loans, defined as the ratio of impaired loans to gross loans. This variable has been widely employed in the literature (Berger and DeYoung, 1997; Das and Ghosh, 2005; Fiordelisi et al., 2011; Garrido et al., 2016). In all specifications, we include the standard, bank-level explanatory variables (see, for instance, Salas and Saurina, 2002; Hu et al., 2006; Sinkey and Greenawalt, 1991; Jimenez and Saurina, 2005; Iannotta et al., 2013): size, capital, profitability, loan growth and finally, the cost-to-income ratio as a proxy for bank efficiency.

To ascertain the effect on returns and costs, we look at other bank-level variables, which may be affected by the credit bureau such as the loan rate and deposit cost.

IV.2 Banking industry data

The banking industry variables such as three-bank asset concentration and the asset share of foreign banks are obtained from the World Bank (2013).

The crucial variable of interest is the details pertaining to the credit bureau. Employing manifold sources, including Shackmurove (2004), Credit Reporting Database (World Bank, 2013) and Madeddu (2013), we are able to pin down the year of operationalization of the credit bureau, either public or private, in these countries.

Table 2 provides a definition of the relevant variables, including data source and summary statistics. The level of non-performing loans is quite high, averaging 7.5%, with wide variability; the value at the 75th percentile is more than four times the number at the 25th percentile. This is consistent with our previous observation of high and significant variability in NPLs across countries. The natural log of assets translates into a book value of USD 117 billion, on average. Banks are quite profitable and cost efficient, with cost-to-income ratio of 45%, among the lowest globally (The Banker, 2013). Loan growth of banks has been modest, averaging less than 10%. A quarter of the banks in the sample are Islamic.

At the country level, a credit bureau has been in operation for 35% of the period; in case of credit registry, it is roughly double the number.

At the industry level, concentration levels are high with the three-bank asset concentration ratio being over 80% at the 75th percentile. The presence of foreign banks is also quite limited, averaging 18%.

The correlations in **Table 3** suggest a modest association among the relevant variables. For instance, the correlation between the NPL and credit bureau equals 3%, but is insignificant. NPLs bears a positive correlation with most other bank-specific variables, although in all cases, these are less than 40%. These raw correlations however, do not control for the economic environment or bank-level variables.

V. Credit bureaus and loan delinquency

We begin our analysis by investigating the relation between credit bureaus and NPLs. By employing the staggered establishment of credit bureaus that exploits inter-temporal variation across countries, we find that there was a dampening impact on loan delinquency.

V.1 Difference-in-differences analysis

To study the effects of credit bureau on bank NPLs, we employ regression for bank b in country k at time t of the following form:

$$NPL_{bkt} = \gamma_k + \eta_t + \upsilon_{bt} + \delta\, BUREAU_{kt-1} + X_{bkt-1}\theta' + \varepsilon_{bkt} \quad \textbf{(1)}$$

where *NPL* is the outcome variable of interest; γ_k and η_t are country and year effects to help control for differences in the timing and/or magnitude of shocks across countries and over time and ε_{bkt} is the error term.

Since the impaired loan ratio is a truncated variable (i.e., bounded between zero and one), we make a (natural) logarithmic transformation, so that it assumes values in the range ($-\infty$, $+\infty$). The new dependent variable (ignoring subscripts) is Ln (NPL/(1-NPL)).

BUREAU is the dummy variable which equals one if a country has a credit reporting institution (CB or CR) in the year. It is lagged one period, driven by the fact that its impact on NPLs is likely to occur with a lag. Our coefficient of interest is δ, which depicts the effect of BUREAU on NPLs. To the extent that credit reporting system reform leads to a reduction in loan delinquency, one would expect δ to be negative. Throughout, we double-cluster the standard errors at the country and year levels (Cameron et al, 2011).

Equation (1) also includes bank-specific fixed effects υ; this key feature allows us to control for any other unobservable bank characteristic not directly incorporated in the regressions.

$\mathbf{X}_{bkt}$ represents a matrix of lagged bank-level controls. These include size, profitability, capital, loan growth and cost-to-income ratio, which have been identified as important determinants of bank loan quality.

The impact of size on NPLs is ambiguous. The literature on financial intermediation advocates diversification as a way to minimize the risk of failure (Diamond, 1984; Ramakrishnan and Thakor, 1984). Large banks interact with a sizeable number of borrowers and have ample investment opportunities which enables them to contain risk. In a similar spirit, owing to economies of scale in screening and monitoring borrowers, large banks might have less risky loan portfolios. On the other hand, following from the corporate finance literature, the organizational complexity of large banks might make it difficult for them to monitor bad borrowers and thereby less likely to lead to a reduction in credit risk.

Bank performance might also influence the risk-taking behavior of managers. Profitable banks are less pressurized to generate revenues and as a result, less constrained to engage in risky lending (Godlewski, 2004).

One of the major reasons for prescribing capital adequacy ratios is to control excessive risk-taking by banks. Empirically, there is no consensus regarding the benefits of stringent capital regulations on bank risk. Sinkey and Greenwalt (1991) show that adequately capitalized US banks exhibit lower NPLs. On the other, higher capital levels might encourage banks to embark on riskier activities, engendering a riskier credit portfolio, as was evidenced in case of Swiss banks (Rime, 2001). In contrast, Das and Ghosh (2007) found no impact of capital on NPLs for Indian banks.

The credit policy of the bank plays a key role in determining the subsequent levels of NPLs. To maximize short-term benefits, managers seek to rapidly expand lending and might end up making less prudent credit decisions. The expansion in loan growth in order to garner market share is achieved by either lowering the interest rate charged to borrowers and/or by lowering credit assessment standards. This in turn, leads to a borrower pool of inferior quality, leading to an increase in impaired loans. Studies for both advanced (Kwan and Eisenbis, 1997; Keeton, 1999; Fernandez de Lis et al., 2000; Jimenez and Saurina, 2005) and other economies

(Fries et al., 2005; Das and Ghosh, 2007) show that rapid loan growth is a harbinger of problem loans.

More inefficient banks are likely to end up with a higher quantum of non-performing loans. According to Berger and DeYoung (1997), low efficiency is typically indicative of poor managerial performance. Such managers might not only fail to comply with standard loan monitoring procedures, but also could be less competent to assess the value of collateral and sanction a relatively high proportion of loans with negative or low net present value. This would suggest that the impact of inefficiency on delinquent loans would be positive.

Regression results are set out in **Table 4**. In column 1, we present the results without the controls. The coefficient on BUREAU is negative with a point estimate equal to -0.411 and is statistically significant at the 0.05 level. In other words, credit reporting systems are associated with a decline in non-performing loans. The magnitudes are quite large: as compared to a country not having a credit bureau, NPLs are, on average, 40% lower for a country with a credit bureau.

To understand its economic significance, consider the average NPLs (USD 213 million) of countries without credit reporting systems in 2008, just prior to the crisis. Had these countries had a credit reporting system, their NPLs would have on average, been lower by nearly USD 90 million, or close to USD 125 million. These findings are consistent with evidence which suggests that institutional reforms aimed at mitigating informational asymmetries in loan dispensation improves bank loan quality and eases the flow of private credit (Pagano and Jappelli, 1993; Djankov et al., 2007).

In column 2, we include the control variables and continue to find evidence in favor of the beneficial impact of credit reporting system on loan quality. The magnitude of the coefficient on BUREAU is larger (in absolute terms) and the explanatory power of the model is higher as well.

The next two columns focus on the ownership of the credit reporting system. As observed earlier, a CR is maintained by the public sector, whereas a CB is usually managed by the private sector. In theory, the two institutions should be perfect substitutes; the information supplied by these entities should be agnostic to the source. The evidence on the ground is however, different. For instance, Love and Mylenko (2003) show that credit registries had no impact on perceived financing

constraints. On the other hand, Djankov et al. (2007) find that in developing countries, credit registries are associated with higher ratios of private credit to GDP.

Consistent with Martinez Peria and Singh (2014), we find that credit bureau exerts a dampening impact on NPLs, whereas public credit registries are not much effective. In terms of magnitude, a credit bureau reform is associated with a reduction in NPLs by roughly 10%. With average NPLs in the sample equal to 7.5%, this is a non-negligible difference. More often than not, credit registries are employed for supervision purposes with high minimum loan limit, whereas bad loans might be small, numerous and geographically dispersed, information on which is not contained in the registry database. Additionally, to the extent they are run by the government, their data collation and processing mechanism might be less than ideal, compromising on their efficacy.

The control variables are mostly of the right sign. Thus, bigger banks have lower quantum of bad loans, hinting at their comparative advantages in processing and monitoring borrowers. The negative sign on ROA concurs with expectations that profitable banks are less pressurized to engage in risky lending. Contrary to expectations, the coefficient on loan growth is negative, suggesting that higher loan growth does not lead to higher NPLs. One possible way to view this result is that a sizeable proportion of the credit in these economies is given to the public sector, where loan impairment is negligible. Illustratively, during 2007-2011, credit to government firms as percent to GDP averaged over one-third in Egypt and Jordan and ranged from anywhere between 15-25% in several others such as Algeria, Bahrain, Morocco, Qatar and United Arab Emirates (Gray et al., 2014). As a result, notwithstanding the higher loan growth, credit impairment did not increase.

In column 6, we check for possible non-linearities by including its squared term of credit as an additional explanatory variable. Although the sign on this variable is positive, it is not statistically significant.

Across columns 1-6, the coefficient on CRAR is statistically insignificant. To investigate this further, we re-estimate equation 1 to test the moral hazard hypothesis only for a sub-sample of banks with capital below the median level. If this hypothesis were to be valid, we would expect banks with relatively low capital to undertake more risky lending, thereby engendering higher NPLs. As earlier, we find that the coefficient on CRAR is statistically insignificant, providing limited support to the moral hazard hypothesis.

In column 8, we test the skimping hypothesis. The hypothesis suggests that high cost efficiency might be a reflection of the fact that limited resources are allocated towards monitoring lending risks which could actually end up raising NPLs in the future. Therefore, we estimate equation 1 for a sub-sample of banks with cost-income ratio above its median value. Banks that engage in skimping behavior should exhibit a rise in non-performing loans. We find that the coefficient on CIR is positive and only weakly significant, so that exogenous increase in cost efficiency leads to an increase in NPLs. The finding is consistent with evidence obtaining from banks in transition economies during 1995-2002 (Rossi et al., 2005).

Summing up, the key takeaway is that it is credit bureau that contribute to the decline in NPLs.

V.2 Credit reporting systems, bank business model and NPLs

A related concern is the impact of credit bureaus across bank business models. As is well-known, several of these countries have a significant presence of Islamic banks whose business model and capital structure are different from those of their conventional counterparts (Beck et al., 2013). Given the nature of their banking transactions which are typically asset-backed or asset-based with limited diversification opportunities and risk concentration, a significant proportion of their loans are towards real estate and related activities. It therefore appears likely that credit reporting system will have a significant impact on the NPLs of these banks. We thus expect to observe a lower negative correlation between credit reporting system and NPLs for Islamic banks.

To test this prediction, we estimate the following specification:

$$NPL_{bkt} = \gamma_k + \eta_t + \nu_{bt} + \delta\, BUREAU_{kt-1} + \lambda\,(BUREAU_{kt-1} * Islamic_{bkt}) + X_{bkt-1}\varphi' + \xi_{bkt} \quad \textbf{(2)}$$

Here *Islamic* is a dummy for Islamic banks and the coefficient of interest is λ. All the other variables and subscripts are defined as earlier. The specification represents a difference-in-difference-in-differences (DIDID) analysis: it controls for country-specific shocks by incorporating a fixed effect across countries and across years.

The results in **Table 5** show that there exists a differential effect of credit registry on the NPLs of Islamic banks. In particular, NPLs decline by 8.4 percentage points more for Islamic banks when a credit registry is in place. We also estimate

these regressions, separately for countries having high- and low-NPLs. A country is defined as having high NPL if in any bank-year, the NPL is higher than the sample median, else it is categorized as having low NPL. The finding show that the effect is manifest in countries with both high- and low levels of NPLs and the magnitudes in both cases are roughly similar. These findings emphasize a 'role for government in facilitating information sharing' (Djankov et al., 2007), especially in countries with Islamic banking presence.

V.3 Credit bureau – Depth and coverage

A natural question to ask is whether the results differ across countries with varying degrees of depth and coverage. Accordingly, we estimate regressions similar to equation 2, except that we include an interaction term of CR*DEPTH, where DEPTH represents the depth of credit information. In separate regression, we include the interaction of CR*COVERAGE, where COVERAGE denotes the coverage of credit information. We run similar regression for credit bureau, including its interaction with depth and coverage of credit information, respectively. **Table 6** reports the regression results.

The table shows that in high NPL countries, loan delinquency declines by 8% points when a credit registry is introduced with a one percentage point higher depth. To understand the impact, we look at a change in depth from the 50th to the 75th percentile of countries. The estimates indicate that such a change in depth leads to an additional 17% percentage point reduction in NPLs. On the contrary, there is no impact for low NPL countries. This supports the fact that, since credit registries have high minimum threshold loan limits because they are typically employed for supervisory purposes, greater depth of credit information is actually beneficial in countries having high NPLs. In contrast, there is no discernible impact of coverage of credit information on NPLs, either for credit bureaus or credit registries. The fact that coverage of credit reporting systems is less effective as compared with its depth has also been highlighted by Martinez Peria and Singh (2014).

V.4 Credit reporting systems, banking structure and NPLs

It is intuitive that the impact of credit reporting system on bank NPLs would be higher for banks that are in danger of over-extension. However, it is not

altogether clear whether credit reporting systems exerted an asymmetric impact on banks across countries with different banking structure. Bruhn et al. (2013) proffer evidence that bank concentration is negatively associated with the probability of emergence of a credit bureau. We would thus expect to observe a negative correlation between credit bureaus and NPLs in countries with concentrated banking systems.

It is also possible to argue that credit reporting systems would be more effective in countries with a higher presence of foreign banks. To the extent that foreign banks rely on 'hard information' in their credit decision-making which is typically available with credit bureaus, it appears that these entities will be relatively more effective in containing NPLs in countries with higher foreign bank presence.

To test these predictions, we estimate the following specification:

$$NPL_{bkt} = \gamma_k + \eta_t + \nu_{bt} + \delta\, BUREAU_{kt-1} + \lambda(BUREAU_{kt-1} * BSC_{kt}) + X_{bkt-1}\varphi' + \xi_{bkt} \quad \textbf{(3)}$$

Here *BSC* indicates the banking structure in the country and the coefficient of interest is λ. We consider two measures of banking structure: first, the three-bank concentration ratio and second, the asset share of foreign banks. All the other variables and subscripts are defined as earlier.

The results in **Table 7** show that the direct effect (coefficient δ in equation 3) is negative and statistically significant in column 2, but positive in column 10, indicating that credit registries are not very effective in countries where NPL levels are low, although on average, they exert a dampening effect on NPLs.

As compared to this, we find that the differential effect of credit bureau is manifest primarily in countries with high NPLs having significant foreign bank presence. Based on the estimates in column 8, we can show that an increase in foreign bank presence by nearly 40% - equal to a move from the median to the 75th percentile of the distribution – would lead to a reduction in NPLs by an additional 18 percentage points. In contrast, in countries with low NPLs, credit registries are actually detrimental to the containment of NPLs. Employing similar numbers as above, we find from column 10 that the overall effect is a rise in NPLs by an additional 71 percentage points. Without loss of generality, countries with low NPLs are the oil-exporting GCC nations where foreign banks typically focus on retail and high net worth individuals and families, who less likely to be captured in the nascent

credit registry database. As a consequence, notwithstanding the presence of credit registry, higher foreign banks presence ends up raising bank NPLs.

V.5 Dynamics of credit reporting system

Third, akin to Bertrand and Mullainathan (2003), we decompose the institution of credit reporting system into separate time periods. We replace the BUREAU indicator with two variables: BUREAU (-2, 0) captures any effect from two years before to the year of establishment of the entity, while BUREAU is the contemporaneous value.[4] We estimate specifications similar to earlier, controlling for all usual determinants of NPLs as well as country, year and bank fixed effects. A positive and significant coefficient on BUREAU(-2, 0) would be symptomatic of reverse causation.

We find limited evidence of any contemporaneous impact on bank impaired loans: the coefficient on BUREAU is insignificant across all columns (**Table 8**). In contrast, the coefficient on BUREAU(-2,0) is negative and statistically significant (at the 0.10 level) for high NPL countries.

V.6 Returns and cost

In this section, we examine the effect of credit reporting systems on bank returns and costs. Contextually, we also examine the relevance of banking structure. **Table 9** presents the results of a DID analysis, which examines the effect of credit reporting system on lending rate, measured as interest income on loans to total loans (Panel A) and deposit rate, measured as interest expended on deposits to total customer deposits (Panel B).[5] The coefficient of interest is the interaction term BUREAU*BSC, where both these terms are as defined earlier. All regressions include the full set of controls, including fixed effects, but these are not reported for brevity.

In columns 1-4 (Panel A), we find that, in concentrated banking systems, the presence of credit registry raises loan rate by over 500 basis points. To glean the impact, we look at the change in concentration from the 25th to the 75th percentile of countries (55%). Such a change in concentration leads to an increase in loan rate

[4] Since the establishment of a credit reporting system is an event which equals one beginning from the year in which it is established, it is not possible to include lead value of the variable.

[5] We also examine the differential impact of credit reporting system on NPLs for Islamic banks, but these effects are not significant.

by an additional 290 (=55*0.053*100) basis points. Martinez Peria and Singh (2014) also show that although credit registry reforms raises the loan interest rate for firms, it was not statistically significant in their framework. Our results suggest that in concentrated banking systems, lenders tend to extract monopoly rents which keeps NPLs high, notwithstanding a credit registry (Bruhn et al., 2013).

Across columns, we find that the adverse impact on NPLs is manifest primarily for low NPL countries. The point estimates are extremely large and suggests that concentrated banking systems in countries with credit registries are detrimental to the resolution of NPLs.

We also find that countries with high share of foreign banks have high NPLs, notwithstanding the presence of credit bureau. This is true especially for countries with high NPLs. A move from the 25th to the 75th percentile of countries in terms of foreign bank assets would lead to NPLs being higher by 40 percentage points. The findings are consistent with the cherry picking hypothesis and shows that higher foreign bank presence worsens the remaining credit pool significantly, leading to a rise in NPLs (Detragiache et al., 2008).

Finally, when we look at deposit cost, we observe that, even with high bank concentration, credit bureaus exert a salutary impact by dampening deposit rates. The magnitudes are however, small: a move from the 25th to the 75th percentile of the distribution would lower deposit rates by just over 100 basis points.

To encapsulate, the findings suggest that credit reporting systems do affect bank loan and deposit rates across countries with different banking structures.

VI. Concluding remarks

Several studies have analyzed the bank-specific and macroeconomic determinants of non-performing loans, both at the cross-country level as also within countries. However, an area that has not been adequately explored has been the impact of credit reporting systems on bank loan delinquency. Using information on an extended sample of MENA banks during 2000-2012 that subsumes credit reporting system reforms, the article investigates its impact on impaired loans. Employing a difference-in-differences methodology, the analysis indicates that NPLs are lower in countries with private credit bureaus. Our results are therefore consistent with evidence which highlights the beneficial impact of credit reporting

system on problem loans. To be more specific, we find that credit bureau plays an important role in mitigating the problem loans for banks.

The evidence also points to a differential impact across bank business model. In other words, credit registries play a useful role in countries that have Islamic banking presence. These findings are in line with evidence which documents a key role for the government in facilitating information sharing when other avenues for specialized assessment of risk are limited (Jappelli and Pagano, 2002; Djankov et al., 2007).

Finally, our findings also suggest that the structure of the banking system exerts a discernible impact on NPLs in the presence of credit reporting systems. We find that foreign banks presence can actually mitigate impaired loans in the presence of credit bureaus, especially for countries having high NPLs. While concentration does not appear to influence NPLs, it does appear to raise borrowing costs, especially for countries with credit registries. Our analysis thus contributes to the evidence that uncovers the beneficial effects of foreign banks (Claessens et al., 2001) and the adverse effects of bank concentration (Bruhn et al., 2013).

To sum up, the overall conclusion is that neither credit bureaus nor credit registries offer unmitigated benefits. The reform of credit reporting system needs to carefully balance the advantages of mitigating informational asymmetries, while avoiding the pitfalls of nurturing an unwieldy banking structure wherein the advantages emanating from institutionalising credit reporting reforms are largely negated. Addressing this trade-off while harnessing the benefits to the maximum extent possible remains a key challenge for policymakers.

References

Abid, L., Ouertani, M.N and Zouari-Ghorbel, S. (2014). Macroeconomic and bank-specific determinants of household's non-performing loans in Tunisia: A dynamic panel data approach. Procedia Economics and Finance 3, 58-68.

Al-Hassan, A., Khamis, M.Y and Nada, O. (2010). The GCC banking sector: Topography and analysis. IMF Working Paper 87. IMF: Washington DC.

Arab Monetary Fund (2015). *Arab Credit Reporting Guide*. AMF and World Bank.

Barron, J. M. and Staten, M.E. (2003). The value of comprehensive credit reports: Lessons from the U.S. experience. In M. Miller (Ed.). *Credit Reporting Systems and the International Economy*. Cambridge, MA: MIT Press, pp 273-310.

Barth, J.R., Lin, C., Lin, P. and Song, F. (2009). Corruption in bank lending to firms: Cross-country micro evidence on the beneficial role of competition and information sharing. Journal of Financial Economics 91, 361–388.

Beck, T., Demirgüç-Kunt, A. and Merrouche, O. (2013). Islamic vs. conventional banking: Business model, efficiency and stability. Journal of Banking and Finance 37, 433-447.

Bennardo, A., Pagano, M. and Piccolo, S. (2007). Multiple-bank lending, creditor rights and information sharing. University of Salerno (mimeo).

Berger, A.N. and DeYoung, R. (1997). Problem loans and cost efficiency in commercial banks. Journal of Banking and Finance 21, 849-870.

Berger, A.N. and G.Udell (2004). The institutional memory hypothesis and the pro-cyclicality of bank lending behavior. *Journal of Financial Intermediation*, 13, 458-95.

Bertrand, M. and Mullainathan, S. (2003). Enjoying the quiet life? Corporate governance and managerial preferences. Journal of Political Economy 111, 1043-1075.

Brown, M and Zehnder, C. (2007). Credit reporting, relationship banking and loan repayment. Journal of Money, Credit and Banking 39, 1883-1918.

Brown, M., Jappelli, T and Pagano, M. (2009). Information sharing and credit: Firm-level evidence from transition countries. Journal of Financial Intermediation 18, 151-172.

Bruhn, M., Farazi, S. and Kanz, M. (2013). Bank competition, concentration and credit reporting. Policy Research Working Paper No. 6442. The World Bank: Washington DC.

Cameron, C.A., Gelbach, J. and Miller, D.L. (2011). Robust inference with multi-way clustering. Journal of Business and Economics Statistics 29, 238-49.

Chaibi, H and Ftiti, Z. (2015). Credit risk determinants: Evidence from a cross-country study. Research in International Business and Finance 33, 1-16.

Claessens, S. and van Horen, N. (2014). The impact of the global financial crisis on banking globalization. IMF Working Paper 197. IMF: Washington DC.

Claessens, S., Demirguc-Kunt, A. and Huizinga, H. (2001). How does foreign entry affect domestic banking markets? −Journal of Banking and Finance, 25, 891–911.

Das, A., and Ghosh S. (2007). Determinants of credit risk in Indian state-owned banks: An empirical investigation. Economic Issues 12, 48-66.

de Lis, F., Jorge, J., Pagés, M. and Saurina, J. (2000). Credit growth, problem loans and credit risk provisioning in Spain. Working Paper 18, Banco de España: Madrid.

Dell'Ariccia, G. and Marquez, R. (2006). Lending booms and lending standards. Journal of Finance 61, 2511-46.

Detragiache, E., Tressel, T., and Gupta, P. (2008). Foreign banks in poor countries: Theory and evidence. Journal of Finance 63, 2123-2160.

Diamond, D. (1984). Financial intermediation and delegated monitoring. Review of Economic Studies 51, 393-414.

Dinc, I.S. (2005). Politicians and banks: Political influences on government-owned banks in emerging economies. Journal of Financial Economics 77, 453-459.

Djankov, S., McLeisha, C and Shleifer, A. (2007). Private credit in 129 countries. Journal of Financial Economics 84, 299-329.

Doblas-Madrid, A and Minetti, R. (2013). Sharing information in the credit market: Contract level evidence from US firms. Journal of Financial Economics 109, 198-223.

Espinosa, R and Prasad, A. (2010). Non-performing loans in the GCC banking system and their macroeconomic effects. IMF Working Paper 224. IMF: Washington DC.

Fiordelisi, F., Marquez-Ibanez, D., and Molyneux, P. (2011). Efficiency and risk in European banking. Journal of Banking and Finance 35, 1315-1326.

Fries, S., Neven, D., Seabrigh, P and Taci, A. (2006). Market entry, privatization and bank performance in transition. Economics of Transition 14, 579-610.

Gabriel, J.Z., Salas, V. and Saurina, J. (2006). Determinants of collateral. *Journal of Financial Economics* 81, 255-81.

Galindo, A and Miller, M. (2001). Can credit registries reduce credit constraints? Empirical evidence on the role of credit registries in firm investment decisions. In M. Miller (Ed.). *Credit Reporting Systems and the International Economy*. Cambridge, MA: MIT Press, pp 1-26.

Garrido, J., Kopp, E. and Weber, A. (2016). Cleaning-up bank balance sheets: Economic, legal, and supervisory measures for Italy. IMF Working Paper 135. IMF: Washington DC.

Gehrig, T and Stenbacka, R. (2007). Information sharing and lending market competition with switching costs and poaching. European Economic Review 51, 77-99.

Godlewski, C.J, (2004), Bank capital and credit risk taking in emerging market economies, Journal of Banking Regulation 6, 128-145.

Gray, S., Karam, P and Turk, R. (2014). Are banks really lazy? Evidence from Middle East and North Africa. IMF Working Paper 86. IMF: Washington DC.

Houston, J., Lin, C., Lin, P. and Ma, Y. (2010). Creditor rights, information sharing, and bank risk taking. Journal of Financial Economics 96, 485-512.

Hu, J-L, Li, Y and Chiu, Y-H (2004). Ownership and non-performing loans: Evidence from Taiwan's banks. Developing Economies 42, 405-420.

Iannotta G., Nocera G. and Resti A., (2013). Do investors care about credit ratings? An analysis through the cycle", Journal of Financial Stability 9, 545-555.

International Monetary Fund (2012). *Regional Economic Outlook (Middle East and Central Asia)*. IMF: Washington DC.

International Monetary Fund (2015). *Global Financial Stability Report*. IMF: Washington DC.

Islamic Financial Services Board (2016). *Islamic Financial Services Industry Stability Report 2016*. IFSB: Kuala Lampur, Malaysia.

Jappelli, T., and Pagano, M. (2002). Information sharing, lending and defaults: Cross-countries evidence. Journal of Banking and Finance 26, 2017-2045.

Jappelli, T. and Pagano, M. (2003). Public credit information: A European perspective. In M.J. Miller (Eds.) *Credit Reporting Systems and the International Economy*. Cambridge, MA: MIT Press, pp.81-114.

Jimenez, G and Saurina, J. (2006). Credit cycles, credit risk and prudential regulation. International Journal of Central Banking 2, 65-98.

Jimenez, G., Lopez, J.A. and Saurina, J. (2013). How does competition affect bank risk-taking? Journal of Financial Economics 9, 185-195.

Kallberg, J.G. and Udell, G.F. (2003). The value of private business credit information sharing: The US case. Journal of Banking and Finance 27, 449-469.

Keeton, William R. (1999). Does faster loan growth lead to higher loan losses?. Federal Reserve Bank of Kansas City Economic Review (Second Quarter), 57-75.

Kwan, S. and Eisenbis, R.A. (1997). Bank risk, capitalization and operating efficiency. Journal of Financial Services Research 12, 117-131.

Love, I and Mylenko, N. (2003). Credit reporting and financing constraints. Policy Research Working Paper No.3142. The World Bank: Washington DC.

Madeddu, O. (2012). The status of information sharing and credit reporting infrastructure in the Middle East and North Africa region. Financial Flagship Report. The World Bank: Washington DC.

Martinez Peria, M.S. and Singh, S. (2014). The impact of credit information sharing reforms on firm financing. Policy Research Working Paper 7013. The World Bank: Washington DC.

Naceur, S.B. and Kandil, M. (2013). Has the Basel capital requirement caused credit crunch in the MENA region? Middle East Development Journal 5, 135-141.

Naceur, S.B. and Omran, M. (2011).The effects of bank regulations, competition, and financial reforms on banks' performance. Emerging Markets Review 12, 1–20.

Padilla, A. and Pagano, M. (2000). Sharing default information as a borrower discipline device. European Economic Review 12, 1951-1980.

Pagano, M., and Jappelli, T. (1993). Information sharing in consumer credit market. Journal of Finance 43, 1693-1718.

Podpiera, J. and Weill, L. (2008). Bad luck or bad management? Emerging banking market experience. Journal of Financial Stability 2008, 135-148.

Powell, A., Mylenko, N., Miller, M. and Majnoni, G. (2004). Improving credit information, bank regulation and supervision: On the role and design of public credit registries. Policy Research Working Paper No. 3443. The World Bank: Washington DC.

Rajan, R.G. (1994): Why banks credit policies fluctuate? A theory and some evidence. Quarterly Journal of Economics 109, 399-441.

Ramakrishnan, R.T.S. and Thakor, A.V. (1984). Information reliability and a theory of financial intermediation. Review of Economic Studies 51, 415-432.

Rime, B. (2001). Capital requirements and bank behavior: Empirical evidence for Switzerland. Journal of Banking and Finance 25, 789-805.

Rossi, S., Schwaiger, M. and Winkler, G. (2005). Managerial behavior and cost/profit efficiency in the banking sectors of Central and Eastern European countries. Working Paper No. 96, Austrian National Bank: Vienna.

Salas, V and Saurina, J. (2002). Credit risk in two institutional regimes: Spanish commercial versus savings banks. Journal of Financial Services Research 22, 203-224.

Shackmurove, Y. (2004). Economic development in the Middle East. Penn Institute of Economic Research Working Paper No. 22. University of Pennsylvania: USA.

Sharpe, S. (1990), Asymmetric information, bank lending and implicit contracts: A stylized model of customer relationships. Journal of Finance 45, 1069-87.

Singh, R.J., Kpodar, K. and Ghura, D. (2009). Financial deepening in the CFA zone: the role of institutions. IMF Working Paper 113. IMF: Washington DC.

Sinkey, J.F. and Greenawalt, M.B. (1991). Loan loss experience and risk-taking behavior at large commercial banks. Journal of Financial Services Research 5, 43-59.

The Banker (2013). The World's Top 1000 Banks. The Banker: UK.

Von Thadden, E-L (2004). Asymmetric information, bank lending and implicit contracts: the winner's curse. Finance Research Letters 1, 11-23.

World Bank (2013). Credit Reporting Database. Accessed on January 16 and available at http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTGLOBALFINREPORT/.

World Bank (2014). Financial Structure Database (Updated November 2013). The World Bank, Washington DC.

Table 1: Composition of banks by country

Country	N.banks	of which: Islamic	Avg. number of years of observations	Total observations
Algeria	5	0	11.8	59
Bahrain	8	1	12.9	103
Egypt	10	1	12.6	126
Jordan	4	1	13.0	52
Kuwait	9	2	13.0	117
Lebanon	12	0	12.6	151
Morocco	9	0	12.4	112
Oman	3	0	13.0	39
Qatar	10	4	12.8	128
Saudi Arabia	13	10	12.9	168
Tunisia	3	0	12.0	36
UAE	16	7	12.9	206
Total	**102**	**26**	**12.7**	**1297**

*Conventional retail banks

** Including 6 off-shore banks

Table 2: Variable definitions and data sources

Variable	Unit	Empirical definition	Data source	N	Mean (SD)	p.25 (p.75)
NPL	Ratio	Non-performing loans/Gross loans	BankScope	835	0.075 (0.086)	0.022 (0.098)
LTA	Number	Ln (Bank asset/CPI)	BankScope	1083	15.663 (1.018)	14.999 (16.452)
ROA	%	Net profit/Total asset	As above	1082	1.611 (1.439)	0.921 (2.260)
CRAR	%	Total capital/Risk weighted asset	As above	807	18.983 (8.649)	14.522 (21.901)
GR_LOAN	%	Loan growth rate, defined following Dinc (2005) as Loan(t) – Loan (t-1)/Asset(t-1)	As above	980	8.678 (14.753)	1.364 (13.499)
CIR	Ratio	Operating expense/(Total income – interest cost)	As above	1066	0.454 (0.270)	0.330 (0.528)
Islamic	Number	Dummy=1 if a bank is Islamic, else zero	As above	1297	0.256 (0.437)	…
BUREAU	Number	Dummy=1 if a country has a credit reporting system (credit bureau or credit registry) in a given year, else zero	World Bank/ /Madeddu (2010)/ Shackmurove (2004)	1297	0.786 (0.411)	…
CB	Number	Dummy=1 if a country has a credit bureau in a given year, else zero	As above	1297	0.346 (0.476)	…
				1297	0.637 (0.481)	…
CR	Number	Dummy=1 if a country has a credit registry in a given year, else zero	As above	1297	0.346 (0.476)	…
DEPTH	Number	Coverage and scope of credit information in the credit reporting system, on a scale of 0 (minimum) to 6 (maximum)	World Bank	783	2.489 (2.454)	0 (5)
COVER_CB	%	Number of individuals and firms listed in the credit bureau to the adult population	World Bank	652	4.791 (5.858)	2 (8.4)
COVER_CR	%	Number of individuals and firms listed in the credit registry to the adult population	World Bank	483	11.639 (10.259)	0 (17.7)
CONC	Ratio	3-bank asset concentration ratio	World Bank, FSD	1297	0.651 (0.159)	0.518 (0.802)
FBSHARE	Ratio	Foreign bank asset/ Total banking asset	Claessens and van Horen (2014)	1255	0.179 (0.172)	0.022 (0.250)

FSD = Financial Structure Database

Table 3: Correlation matrix

	1	2	3	4	5	6	7
1.NPL							
2.BUREAU	-0.031						
3. LTA	-0.298***	0.224***					
4.ROA	-0.359***	-0.076***	0.007				
5.CRAR	-0.006	-0.004	-0.208***	0.187***			
6.GR_LOAN	-0.304***	-0.126***	-0.043	0.228***	0.079**		
7.CIR	0.238***	0.046	-0.205***	-0.452***	0.024	-0.107***	

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

Table 4: Impact of credit bureau on NPLs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BUREAU	-0.411**	-0.473**				-0.475**	-0.484***	-0.335*
	(0.194)	(0.235)				(0.236)	(0.186)	(0.186)
CR			-0.154		-0.209			
			(0.139)		(0.184)			
CB				-0.097***	-0.133			
				(0.023)	(0.253)			
LTA		-0.163***	-0.172**	-0.174***	-0.160**	-0.162***	-0.208	-0.185
		(0.030)	(0.083)	(0.071)	(0.078)	(0.059)	(0.135)	(0.183)
ROA		-0.142***	-0.138**	-0.140**	-0.138**	-0.141***	-0.211*	-0.162***
		(0.057)	(0.063)	(0.059)	(0.061)	(0.057)	(0.118)	(0.034)
CRAR		0.019	0.020	0.021	0.020	0.019	0.050	0.026
		(0.015)	(0.054)	(0.014)	(0.014)	(0.015)	(0.043)	(0.017)
GR_LOAN		-0.015***	-0.014***	-0.014***	-0.014***	-0.016***	-0.009*	-0.012***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.003)
Sq.(GR_LOAN)						0.0001		
						(0.0003)		
CIR		0.030	0.066	0.066	0.077	0.026	0.023	0.044*
		(0.078)	(0.105)	(0.095)	(0.099)	(0.073)	(0.122)	(0.026)
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
N.Obs.	829	677	679	677	677	677	335	283
R-sq.	0.7003	0.7356	0.7285	0.7284	0.7295	0.7357	0.7503	0.7433

Standard errors (clustered by country and year) in brackets

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

Table 5: Differential impact of credit bureau for Islamic banks

	All countries		High NPL countries		Low NPL countries	
	(1)	(2)	(3)	(4)	(5)	(6)
CR	-0.048		0.161***		-0.029	
	(0.154)		(0.053)		(0.133)	
CB		-0.095		-0.119		-0.241
		(0.228)		(0.196)		(0.184)
CR* Islamic	-0.476***		-0.324*		-0.302***	
	(0.109)		(0.184)		(0.030)	
CB*Islamic		-0.012		0.206		0.006
		(0.314)		(0.228)		(0.339)
Controls	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
N.Obs.	677	677	320	320	357	357
R-sq.	0.7295	0.7285	0.7573	0.7578	0.6900	0.6941

Standard errors (clustered by country and year) in brackets

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

Table 6: Impact of depth and coverage of credit bureau – High vs. low NPL country-banks

	High NPL countries				Low NPL countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CR	-0.409	-0.273			-0.126	2.223***		
	(0.493)	(0.188)			(0.105)	(0.856)		
CB			0.021	-0.049			-0.311**	-0.668***
			(0.152)	(0.094)			(0.134)	(0.180)
CR* DEPTH	-0.084***				-0.007			
	(0.024)				(0.015)			
CR*COVERAGE		0.011				0.009		
		(0.012)				(0.007)		
CB* DEPTH			-0.018				0.031	
			(0.019)				(0.032)	
CB* COVERAGE				0.008				0.028
				(0.022)				(0.022)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
N.Obs.	186	108	186	168	276	190	276	231
R-sq.	0.8493	0.8766	0.8388	0.8353	0.7565	0.7186	0.7611	0.7448

Standard errors (clustered by country and year) in brackets

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

Table 7: Impact of bank risk on NPLs – Robustness

	All countries				High NPL countries				Low NPL countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CR	-0.226	-0.352**			0.461	-0.032			-1.176	0.293*		
	(1.423)	(0.158)			(0.843)	(0.250)			(0.889)	(0.154)		
CB			-0.150	0.022			0.016	0.008			-0.508	-0.196
			(0.701)	(0.243)			(0.464)	(0.211)			(0.524)	(0.124)
CR*CONC	0.095				-0.458				1.263			
	(1.689)				(1.207)				(1.083)			
CR*FBSHARE		1.175				0.773				1.832***		
		(0.846)				(1.019)				(0.289)		
CB*CONC			0.084				-0.157				0.447	
			(1.026)				(0.717)				(0.809)	
CB*FBSHARE				-0.568				-0.464***				-0.249
				(0.616)				(0.125)				(0.387)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N.Obs	677	660	677	660	320	303	320	303	357	357	357	357
R-sq.	0.7285	0.7287	0.7288	0.7275	0.7574	0.7665	0.7570	0.7651	0.6904	0.6959	0.6947	0.6944

Standard errors (clustered by country and year) in brackets
***, ** and * denote statistical significance at the 1, 5 and 10%, respectively

Table 8. Dynamics of credit bureau

	All countries	High NPL countries	Low NPL countries
	(1)	(2)	(3)
BUREAU	-0.408	-0.115	-0.250
	(0.295)	(0.163)	(0.165)
BUREAU (-2, 0)	-0.131	-0.083*	-0.034
	(0.089)	(0.043)	(0.103)
Controls	YES	YES	YES
Bank FE	YES	YES	YES
Year FE	YES	YES	YES
Country FE	YES	YES	YES
N.Obs	677	320	357
Adj- R^2	0.7346	0.7577	0.6295

Standard errors (clustered by country and year) in brackets
***, ** and * denote statistical significance at the 1, 5 and 10%, respectively

Table 9: Impact of credit bureau on return and costs

	All countries				High NPL countries				Low NPL countries			
Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dep. var.= Loan rate												
CR	-0.041**	-0.005			-0.022	-0.009			-0.227***	-0.002		
	(0.018)	(0.004)			(0.032)	(0.014)			(0.039)	(0.004)		
CB			0.005	-0.005			0.0003	-0.014**			-0.005	0.0003
			(0.019)	(0.003)			(0.028)	(0.006)			(0.038)	(0.011)
CR*CONC	0.053***				0.033				0.274***			
	(0.021)				(0.049)				(0.044)			
CR*FBSHARE		0.004				0.021				0.008		
		(0.020)				(0.034)				(0.074)		
CB*CONC			-0.010				-0.009				0.015	
			(0.028)				(0.044)				(0.058)	
CB*FBSHARE				0.021				0.039**				0.019
				(0.016)				(0.017)				(0.037)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N.Obs.	460	451	460	451	243	234	234	234	217	217	217	217
R-sq.	0.3200	0.3180	0.3141	0.3212	0.4970	0.5053	0.4981	0.5137	0.4443	0.3920	0.3935	0.3951
Panel B												
Dep. var. = Deposit rate												
CR	0.012*	-0.006			0.014	-0.009			-0.073	-0.015***		
	(0.007)	(0.005)			(0.015)	(0.007)			(0.047)	(0.006)		
CB			0.0001	0.0008			-0.017*	-0.0006			0.002	-0.005
			(0.005)	(0.004)			(0.009)	(0.005)			(0.022)	(0.008)
CR*CONC	-0.020***				-0.027				0.073			
	(0.008)				(0.025)				(0.057)			
CR*FBSHARE		0.018				0.021				0.044		
		(0.015)				(0.020)				(0.028)		
CB*CONC			-0.002				0.016				-0.012	
			(0.009)				(0.013)				(0.031)	
CB*FBSHARE				-0.012				-0.025				0.003
				(0.010)				(0.016)				(0.024)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N.Obs.	561	551	561	551	288	278	288	278	273	273	273	273
R-sq.	0.2351	0.2392	0.2326	0.2382	0.3533	0.3722	0.3566	0.3781	0.3051	0.3047	0.2950	0.2944

Standard errors (clustered by country and year) in brackets

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