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ORIGINAL ARTICLE

Corruption and Non-Performing Loans

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Abstract

This article empirically evaluates the impact of corruption on the level of non-performing loans (NPLs) using the international bank-level data, spanning over the period 2000−2016 and across 140 countries. We find a positive and statistically significant relationship between corruption and NPLs. We also analyze the channels through which corruption affects NPLs. We find that the relationship between corruption and NPLs becomes more pronounced during and after the global financial crisis and is more pronounced for smaller banks. The association between corruption and NPLs is stronger in countries characterized by a high level of collectivism. The link between corruption and NPLs is higher where the legal environment is weak and where economies are market-based.

Keywords: Bank lending, Non-performing loans, Financial crisis, Corruption perception index, Economic development

JEL classification: G20, D73, O40

Introduction

The 2008−2010 global financial crisis pressured the regulators, policymakers, and academics in a meticulous search for its drivers. In an extensive review of the evidence, Thakor (2018) concludes that insolvency risk was the main cause for the crisis. Bank balance-sheets deteriorated due to financial market's related losses but also due to increasing levels of non-performing loans (NPLs). In the U.S., the average proportion of NPLs per total gross loans increased from 1.4 percent in 2007 to 4.96 percent in 2009. In the EU, the level of NPLs increased from 2.4 percent in 2007 to 6.6 percent of total assets in 2016.[1] At the same time, several financial scandals caught public attention and called for further scrutiny of unsound practices in banking. In a 2015 survey, 47 percent of 1200 financial services professionals in the U.K. and the U.S. claimed that it is necessary to engage in an illegal or unethical activity at least one time to succeed and to gain an edge in the market.[2]

Excessive risk taking and failed management and board control functions were cited as causes of failure of the U.K. bank HBOS that led to its acquisition by Lloyds and government bailout (FCA & PRA, 2015). The regulator investigated the wider allegation of corruption following a criminal investigation in which two former HBOS bankers and four business associates were found guilty of corruption, money laundering, and fraud. In particular, the lead director of HBOS's impaired assets division was taking advantage of small businesses in threatening to terminate loans unless a bribe was being paid to the restructuring consultancy company led by his accomplices. This compelled HBOS to write off £266 m in loans.[3] Other examples point to the anecdotal evidence between corruption and bad loans, including the arrest by the Indian Central Bureau of Investigation (CBI) in 2019 of eight senior executives from different financial institutions for

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[1] These data are available at: World Bank, IMF Financial Soundness Indicators, and ECB.
[2] University of Notre Dame's Mendoza College of Business and Labaton Sucharow LLP. Available at: https://www.corporatecomplianceinsights.com/historic-survey-of-financial-services-professionals-reveals-widespread-disregard-for-ethics/.
[3] Jane Croft, HBOS bankers bribed with sex parties guilty of corruption, *Financial Times*, 30 January 2017. The article is available at: https://www.ft.com/content/4149dcd6-e70b-11e6-967b-c88452263daf.

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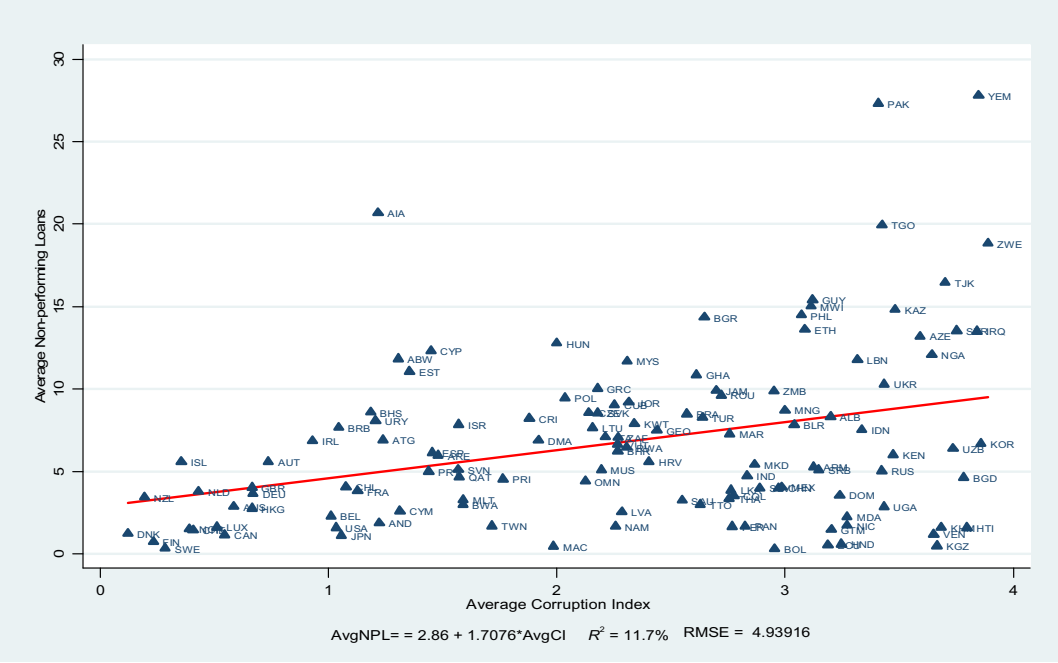

Fig. 1. Plot of the average corruption index and NPLs. Note: We use standard regression equation as an estimation method. The horizontal axis on the graph represents the average corruption index (AvgCI) and the vertical axis (AvgNPL) represents the average NPLs where the average is computed for different countries. Source: World Bank and Fitch Connect.

taking bribes for a loan.[4] An older example is the bankruptcy of Hanbo Steel Industry Co. in South Korea where its founder was arrested for corruption offences, including bribing bankers and high-ranking politicians to keep granting loans to the second largest steelmaker in South Korea.[5]

The above examples indicate that the level of corruption can be intrinsically related to the proliferation of NPLs in banking. If corruption is widespread, corrupted bank officers might grant loans even to companies that do not fulfill loan requirements, with a subsequent decrease in loan portfolio quality. In a cross-country setting, the level of corruption in a particularly country could be seen as a potential factor contributing to the surge of NPLs (Park, 2012).

To address this issue, we combine the bank financial data across 140 countries and 7773 banks with a corruption index from Transparency International (2017) and several macroeconomic and institutional variables. We focus on the period 2000–2016, which comprises of the pre-financial crisis, financial crisis period, and post-financial crisis period.

As a preliminary investigation, we plot the countries' mean values of the corruption index and mean values of NPLs for the period 2000 to 2016 in Fig. 1. Fig. 1 indicates that there exists a positive relationship between the corruption index and the level of non-performing loans.

We investigate whether higher corruption leads to the lower loan quality measured by the level of NPLs. We find robust support that higher corruption is associated with higher levels of NPLs. This finding is statistically significant across several econometric specifications and robustness tests. The result is also economically significant. In particular, an increase in corruption for one standard deviation would lead to an expected increase in NPLs for 0.111 standard deviations.

Our article is closely related to the contribution by Goel and Hasan (2011), which shows that corruption is positively related to the level of NPLs. Whereas Goel and Hasan (2011) use cross-country data, we employ bank-level data in order to determine the channels through which corruption affects the level of NPLs.

[4] Sangita Mehta, Bribe-for-loan scam: Time for more transparency, *The Economic Times*, updated 09 July 2019. The article is available at: https://economictimes.indiatimes.com/industry/banking/finance/banking/bribe-for-loan-scam-time-for-more-transparency/articleshow/7062623.cms.

[5] Reuters, Hanbo Steel Founder Given 15 Years in Korean Scandal, *The New York Times*, 2 June 1997. The article is available at: https://www.nytimes.com/1997/06/02/business/hanbo-steel-founder-given-15-years-in-korean-scandal.html

When analyzing the channels through which the corruption affects the level of NPLs, we find some evidence that the effect of corruption on NPLs is bigger for smaller banks than for larger banks. This is consistent with the explanation that smaller banks are less hierarchical and transfer bigger decision-making powers to bank officers. An additional discretion then leads to a stronger link between the corruption index and NPLs.

We also find some evidence that the impact of corruption on NPLs is less pronounced for banks that are high profitable. A potential reason for this result is that more profitable banks have more prudent lending policy and more effectively allocate funds and, consequently, can overcome high levels of corruption.

Our evidence shows that the impact of corruption on the level of NPLs is stronger for high-collectivist countries. This indicates that the impact of corruption on the level of NPLs is stronger for countries where people tend to have less interdependent self-construal.

Our findings confirm the importance of the quality of legal and institutional environment. We find that the well-functioning legal environment, evident in the strong rule of law in a given country, weakens the link between corruption and NPLs.

We investigate the effect of corruption on NPLs, before the crisis, during the crisis, and after the crisis. We show that the effect of corruption on the NPLs becomes more pronounced during the crisis period and in the post-crisis period. This is aligned with the view that during the financial crisis when the survival is at stake the impact of corruption on bank lending is more pronounced, causing a deterioration of bank asset quality.

Hanousek et al. (2019) show that corruption negatively affects firm efficiency but the negative effect is less pronounced for foreign controlled firms and for firms run by female CEOs. Wellalage et al. (2018) find that corruption leads to increased credit constraints for small and medium enterprises in South Asia. They find that the effect of corruption varies across the male and female owners highlighting gender differences in the relationship between corruption and lending. Van Vu et al. (2018) find that various forms of corruption differently affect firm performance. Our findings complement their research by pointing to the mitigating role of firm size and the institutional environment complementing the literature that discusses how ethical behavior is implemented in organizations (Batten et al., 2017, 2018).

Overall, our findings provide some relevant policy implications for the role of corruption as a potential factor that affects loan quality in the banking system. The results of our paper indicate that measures taken against corruption have implications for financial stability.

The paper is organized as follows. Section 1 provides the theoretical framework and hypothesis development. The data and research method are described in Section 2. Section 3 presents and discusses the results of the empirical analysis. Section 4 provides robustness checks. Section 5 concludes the article.

1 Theoretical framework and hypothesis development

The relationship between the legal environment and finance has gained prominence following the seminal article by La Porta et al. (1997) which analyzes how the quality of the legal and institutional framework affects financial systems. Several articles find that corruption is negatively related to the economic growth (see Mo, 2001; Lizal & Kocenda, 2001; Mauro, 1998) and that economic growth and firm failures are negatively related (Ali & Daly, 2010; Ghosh, 2015). Corruption can contribute to a reduction in growth, investments, and firm productivity in developed and developing countries (Mauro, 1995; Méon & Weill, 2010). Qi and Ongena (2019) show that firms engaged in bribery practices lose access to bank credit which impedes firm growth (see also Beck et al., 2013; Ghosh, 2015; Klein, 2013; Mohaddes et al., 2017; Vithessonthi, 2016). Fan et al. (2009) and Treisman (2000) show that highly developed countries have lower levels of corruption compared to developing countries. Corruption leads to weaker and less efficient banking systems (Chen et al., 2015; Goel & Hasan, 2011; Park, 2012).

In most countries that are greatly affected by corruption, even uncreditworthy firms could get a bank loan (for example, by bribing credit loans officers; Fungáčová et al., 2015),[6] which can subsequently lead to excessive corporate leverage (Jõeveer, 2013; Weill, 2011a) and loan delinquencies. Using cross-country data, Goel and Hasan (2011) find that countries with higher corruption are associated with a higher level of NPLs. Park (2012) finds that corruption aggravates the problems of bad loans in the banking sector. Similarly, findings

[6] Chen et al. (2013) find that bribery determines the access of private firms to bank credit in China (see also Weill (2011b)).

in Bougatef (2015) confirm the positive link between corruption and NPLs in the Islamic banking system. Chen et al. (2015) analyze the impact of corruption on bank risk-taking behavior in 35 emerging economies during the period 2000–2012. They show that an increase in corruption is associated with more pronounced risk-taking behavior of banks.

Whereas the studies above provide an argument for the positive relationship between corruption and NPLs, it might be possible to construe an alternative explanation. If good borrowers do not receive the credit needed from banks or financial institutions due to the market frictions, they might resort to corruptive practices. To avoid adverse selection issues, good firms may bribe to signal their quality to lenders, enabling good borrowers[7] to receive the credit needed and improving the efficiency of credit allocation. In this alternative explanation, corruption would reduce the level of NPLs. This leads to the following hypothesis:

H1. *Corruption affects the level of NPLs.*

Various determinants affect the quality of bank lending, as reflected in the level of NPLs. The internal determinants consist of bank size, management quality and efficiency, and bank capitalization (Dimitrios et al., 2016a, b; Louzis et al., 2012; Espinoza & Prasad, 2010; Hasan & Wall, 2004; Salas & Saurina, 2002; Berger & DeYoung, 1997). The external determinants consist of bank regulations and supervision (Barth et al., 2004; Godlewski, 2004), law of enforcement (Barth et al., 2004; Boudriga et al., 2009), and national culture (Dheera-aumpon, 2019; El Ghoul et al., 2016; Zheng et al., 2013). Our aim is to analyze how the internal and external determinants affect the link between corruption and NPLs.

The literature related to the organizational structure of banks emphasizes that large banks with more centralized and hierarchical structures can perform better when information can be hardened and easily transmitted across the hierarchical lines.[8] Whereas small banks have an advantage in soft information processing where discretion of a loan officer is of paramount importance (see Stein, 2002),[9] the problem is that discretion might be abused in environments with high levels of corruption. Skrastins and Vig (2015) show that more hierarchical organizations operated better in environments with high levels of corruption, showing that hierarchy can restrain rent-seeking activities. This leads to the following hypothesis:

H2. *The link between corruption and bank size is less pronounced for larger banks.*

The related issue refers to the role of bank capital for the relationship between corruption and NPLs. One of the main roles of bank capital is to provide proper incentives to banks to internalize their risk taking strategy (see Admati & Hellwig, 2013). Thinking along these lines would posit that weakly capitalized banks have little incentive to engage in safe lending practices and would be prone to corruption. However, an alternative view is also possible. Weakly capitalized banks are exposed to intensive scrutiny from the bank supervisor. Anticipating heavy supervision, weakly capitalized banks could restrain from corruption.

H3. *The link between corruption and NPLs is influenced by bank capital.*

The effect of corruption on NPLs is likely to be less pronounced for countries with a healthy legal environment and efficient regulatory systems (Danisman & Demirel, 2018). These countries are less likely to be adversely affected when the rules are better and efficiently enforced. La Porta et al. (1998) and Levine (1998) show that countries with weaker legal structure to protect borrowers have a smaller number of performing banks in their economy. Moreover, Barth et al. (2009) find that ownership of banks and firms, legal environment, and firm competition significantly reduce lending corruption. We analyze how the link between corruption and NPLs interacts with the quality of the legal and regulatory framework. This leads to the following hypothesis:

H4. *The link between corruption and NPLs is weaker in countries with a strong legal environment.*

Corruption alters the effectiveness of the banking system. Beck et al. (2006b) show that the most efficient strategy to reduce corruption in bank lending is to expose banks to private monitoring and discipline by the disclosure of accurate information. According to this view, banks would have to behave

[7] Even though the firm fulfills the required conditions to obtain a loan, it might occur that a loan officer might require a bribe as an incentive to process the client's loan file, in the condition that his base salary is reduced due to volatile banks' operating income. Consequently, this bribery would increase the cost of the loan and the burden is borne solely by the borrower (see Beck et al., 2006a).

[8] Larger banks have better-defined procedures and possess sophisticated capabilities for loan assessment (Hu et al., 2004; Lis et al., 2000).

[9] Canales and Nanda (2012) show that bank managers in a decentralized organizational structure are better at bank lending to small firms and firms with a plethora of soft information.

more cautiously and avoid bad practices in lending. In addition, countries with high-powered supervisory agencies tend to have lower levels of corruption (Beck et al., 2006b; Demirguc-Kunt et al., 2004). Akins et al. (2017) find that timely loan loss recognition by banks reduces the level of corruption in lending. Awartani et al. (2016) show that better institution quality leads to longer maturity of corporate debt. We hypothesize that corruption also makes the regulatory framework less effective.

H5. *Corruption reduces the effectiveness of bank regulation in lowering the level of NPLs.*

The relationship between corruption and NPLs might be driven by the national cultural dimensions (i.e. individualism/collectivism, uncertainty avoidance, masculinity/femininity, and power distance), as construed by Hofstede (2001) and Hofstede (1983). In the extant literature, Zheng et al. (2013) analyze the association between national culture and corruption in bank lending. They argue that compared to other cultural dimensions, the role of national culture and collectivism in particular is an important factor affecting the corruption of the bank officials. They confirm a positive and significant association between the level of collectivism and corruption of bank officials. El Ghoul et al. (2016) document that corruption is associated with collectivistic culture affecting bank lending, and Haider et al. (2018) report that corruption impacts the relation between financial constraints and firm performance. Triandis (2001) highlights individualism/collectivism as the most significant driver of cultural differences across countries.

H6. *The association between corruption and NPLs is stronger in countries characterized by a high level of collectivism.*

2 Data and methodology

2.1 Data description

The annual bank-level financial data are retrieved from the Fitch Connect database. We consider consolidated data.[10] Our final unbalanced panel data sample includes 7773 banks from 140 countries over the period 2000–2016. We include in the database commercial, savings, and co-operative banks. Our bank and macroeconomic variables are 'winsorized' at a 1% interval to mitigate the impact of extreme values and to exclude potential outliers.[11] We combine bank-level data, macroeconomic indicators, and institutional data from various sources. Macroeconomic data are obtained from World Bank. Two indices of corruption are obtained from the Transparency International Corruption Perception Index and the World Bank. Table A1 in Appendix A reports the definitions and the data sources of the variables used.

2.2 Empirical model

To analyze the effect of corruption on NPLs, we estimate the following regression model:

$$NPL_{i,c,t} = \alpha + \beta NPL_{i,c,t-1} + \gamma CI_{c,t-1} + \delta Bank_{i,c,t-1} + \vartheta Macro_{c,t-1} + \kappa Institutional_{c,t-1} + \mu Year_t + \epsilon_{i,c,t} \quad (1)$$

where the dependent variable is non-performing loans ratio $NPL_{i,c,t}$ measured by the loans and advances that are more than 90 days overdue divided by total loans for bank *i*, located in country *c*, at year *t*. We use $NPL_{i,c,t}$ as a proxy for banks' loan quality (Chaibi & Ftiti, 2015; Ghosh, 2015; Tarchouna et al., 2017; Vithessonthi, 2016).

Our main explanatory variable is corruption index $CI_{c,t-1}$, which indicates the level of corruption in country *c*, in year *t-1*. We employ two alternative corruption indexes, the corruption perception index ($CPI_{c,t}$), obtained from the Transparency International Corruption Perception Index and the control of corruption of the World Bank. First, the score of the *CPI* ranges on a scale from 0 to 10. The higher the corruption in the country is, the lower the *CPI* score the country gets. For interpretation reasons, we define a new index Control of corruption, $CI_{c,t}$, where $CI_{c,t} = 10\text{-}CPI_{c,t}$. Higher values of *CI* indicate higher levels of corruption. For example, the highest value of *CI* is 8.43 points for Bangladesh and the lowest is 0.61 points for Denmark. Second, we employ control of corruption (hereinafter CC) from the World Bank – Worldwide Governance Indicator. CC is widely used in related literature (Kaufmann et al., 2010). The index ranges from the lowest value of −2.5 to the highest value of +2.5. The lower value represents the highest level of corruption and

[10] For a standardized research on corruption, the inclusion of subsidiaries provides a better measure of the firm's propensity to corruption (Pantzalis et al., 2008; Zeume, 2017). We have also performed the analysis on the unconsolidated data, obtaining qualitatively similar results.
[11] We removed negative values for non-performing loans, total assets, and loans to customer deposits.

vice versa.[12] We follow Park (2012) and Goel and Hasan (2011) and compute WBCI as $WBCI_{c,t}$=(5-($CC_{c,t}$+2.5)) where $CC_{c,t}$ is control of corruption at time *t* four country *c*. This adjustment is employed for interpretation reasons such that higher values of WBCI are associated with lower values of control of corruption and higher values of corruption.[13] The highest value of WBCI was 3.98 points for Libya and the lowest for Denmark with 0.12 points. The average values of WBCI per each country are shown in Table A2 in Appendix A.

We include the following bank-specific variables as control variables. Bank $size_{i,c,t-1}$ is computed as the natural logarithm of total assets for bank *i*, located in country *c*, in year *t-1*.[14] $LTCD_{i,c,t-1}$ represents the ratio of total loans divided by total customer deposits for each bank *i*, located in country *c*, in year *t-1*.[15] $ROAA_{i,c,t-1}$ represents the ratio of the return on average assets for each bank *i*, located in country *c*, in year *t-1*.[16] The capitalization ratio, $Capitalization_{i,c,t-1}$, is the ratio of total equity divided by total assets for bank *i*, located in country *c*, in year *t-1*, as in Makri et al. (2014), Klein (2013), and Louzis et al. (2012),[17] where $LLP_{i,c,t}$ represents the ratio of the loan loss provisions divided by gross loans for each bank *i*, located in country *c*, in year *t*.[18]

We also include several macroeconomic indicators as controls. GDP $growth_{c,t-1}$ denotes the annual percentage growth rate of GDP in country *c*, at time *t-1*.[19] $UNEMP_{c,t-1}$ indicates the unemployment rate for a country *c*, at time *t-1*[20], and $GCF_{c,t-1}$ is computed as the growth capital formation as percentage of GDP in country *c*, at time *t-1*. $RIR_{c,t-1}$ presents the real interest rate in a country *c*, at time *t-1*.[21]

We also include several institutional and regulatory variables as controls. $RoL_{c,t-1}$ represents the rule of law in country *c*, at time *t-1*, and serves as a proxy for the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence (Kaufmann et al., 2010). $Cap\_Str_{c,t-1}$ denotes capital stringency from Barth et al. (2013) in country *c*, at time *t-1*. $Year_t$ is the yearly dummy variable and is included in the model to control for the time-specific effects (Petersen, 2009). $\epsilon_{i,c,t}$ denotes the white noise error term. Hereinafter, we suppress the subscript in the variables.

To test our second, third, and sixth hypotheses about the channels through which corruption might affect the level of non-performing loans, we estimate equation (2):

$$\begin{aligned} NPL_{i,c,t} = {} & \alpha + \beta NPL_{i,c,t-1} + \gamma CI_{c,t-1} + \delta Bank_{i,c,t-1} \\ & + \vartheta Macro_{c,t-1} + \propto CI_{c,t-1}{*}Bank\ Size_{i,c,t-1} \\ & + \tau CI_{c,t-1}{*}Capitalization_{i,c,t-1} \\ & + \omega CI_{c,t-1}{*}ROAA_{i,c,t-1} + \rho CI_{c,t-1}{*}CLT_{c,t-1} \\ & + \mu Year_t + \epsilon_{i,c,t} \end{aligned} \tag{2}$$

where the control variables are the same as in equation (1). CI*Bank Size denotes the interaction term between corruption and the natural logarithm of total assets for bank *i*, located in country *c*, in year *t-1*. CI*Capitalization denotes the interaction term between corruption and the ratio of total equity divided by total assets for bank *i*, located in country *c*, in year *t-1*. CI*ROAA denotes the interaction term between corruption and return on average assets for each bank *i*, located in country *c*, in year *t-1*. CI*CLT denotes the interaction term between corruption and the level of collectivism (CLT) in a country *c*.

[12] For further detailed methodology on how the indicator is constructed, see Kaufmann et al. (2010).
[13] Whereas the corruption index described above presents the overall corruption in a country and is not specifically tight to the banking sector corruption, it is widely accepted that the corruption in the banking sector is highly correlated with the overall corruption in the economy; see Park (2012), Chen et al. (2015) and Goel and Hasan (2011).
[14] In the extant literature, the effect of bank size on the level of NPLs is ambiguous. On the one hand, Ranjan and Dhal (2003) and Salas and Saurina (2002) show that larger banks have more diversification possibilities which leads to lower NPLs. On the other hand, Chaibi and Ftiti (2015), Louzis et al. (2012), and Brei and Gadanecz (2012) argue that large banks may take excessive risks which can result in higher NPLs.
[15] The higher ratio of loans with respect to deposits indicates more aggressive lending practices of a bank resulting in easier loan granting and, therefore, a higher likelihood of establishing NPLs (Dimitrios et al., 2016b). It indicates an increased risk appetite of banks with a potential for higher levels of non-performing loans.
[16] Return of average assets is used as a proxy for management's efficiency. We anticipate that the relationship between the return on average assets and non-performing loans is negative (see Dimitrios et al., 2016a; Vithessonthi, 2016).
[17] We anticipate that a higher level of capitalization pressures banks to avoid risky lending practices and subsequently negatively effects the level of NPLs. Makri et al. (2014), Salas and Saurina (2002), and Keeton and Morris (1987) show that the level of capital negatively affects the level of NPLs.
[18] We anticipate that the relationship between loan loss provisions and NPLs is positive, since banks use higher levels of provisioning when they predict loan defaults (Boudriga et al., 2009; Chaibi & Ftiti, 2015).
[19] Love and Turk Ariss (2014), Ghosh (2015), Ali and Daly (2010), and Treisman (2000) find that the GPD growth is negatively related to NPLs.
[20] A higher unemployment rate affects the borrowers' incomes and, hence, affects the delinquency rates (Al-Marhubi, 2000; Dimitrios et al., 2016a; Klein, 2013; Saha & Ben Ali, 2017; Rinaldi & Sanchis-Arellano, 2006).
[21] Chaibi and Ftiti (2015) and Castro (2013) find a positive influence of real interest rate on the NPLs.

To test our fourth and fifth hypotheses, we estimate the following equation:

$$NPL_{i,c,t} = \alpha + \gamma CI_{c,t-1} + \delta Bank_{i,c,t-1} + \vartheta Macro_{c,t-1} + \varphi RoL_{c,t-1} + \omega CI_{c,t-1}{*}RoL_{c,t-1} + \tau Cap_{Str_{c,t-1}} + \rho CI_{c,t-1}{*}Cap_{Str_{c,t-1}} + \mu Year_t + \epsilon_{i,c,t} \quad (3)$$

where CI*RoL represents the interaction term between the corruption index and the rule of law, located in country *c*, in year *t-1*. Cap_Str, and the interaction term between the corruption index and a measure of capital stringency, located in country *c*, in year *t-1* and all other control variables are the same as in equation (1).

We apply different panel data estimation approaches. First, to account for the unobserved heterogeneity across banks, we setup the fixed effects and random effects (hereinafter, FE and RE) panel regression models with robust standard errors (Carlson et al., 2013; Košak et al., 2015; Micco & Panizza, 2006).[22] Second, to take into consideration the time presence of NPLs, we include $NPL_{i,c,t-1}$ as the independent variable of NPL of bank *i*, located in country *c*, in year *t-1*, and use the system GMM estimation to achieve consistent and efficient estimates (Blundell & Bond, 1998).

In Table 1, we present the descriptive statistics, including the mean, standard deviation, and minimum and maximum values.

In the first part of the table, we present bank-specific variables. We observe a large disparity in the NPL rate between banks with minimum of 0 percent and a maximum of 29.3 percent, and the standard deviation of the NPL rate is 3.196 percent. We observe a high variation in the mean ratio of loans to customer deposits of 80.61 percent. Regarding the management efficiency, ROAA ranges from a minimum of −6.0 percent to a maximum of 8.4 with a mean value of 1.11 percent during the period 2000–2016, whereas the standard deviation equals 1.35 percent, indicating that on average banks in our data are profitable but some banks have financial difficulties. The mean value of capitalization and NPL equals 11.66 percent and 1.81 percent respectively. Loan loss provisions divided by total loans, LLP, has a mean of 0.49 percent.

In the second part of Table 1, we present the results for macroeconomic indicators: growth rate of GDP, unemployment ratio, gross capital formation, and real interest rates. The mean annual percentage growth rate of GDP is 2.04 percent. We note that some countries have a negative GDP growth rate with a minimum value of −5.62 percent. The mean unemployment rate is 6.35 percent, the mean gross capital formation is 22.1 percent, and the mean real interest rate is 2.91 percent. In the third panel, we present the corruption index measured by the World Bank, Transparency International, and International Country Risk Guide. In our sample, the mean of WBCI is 1.11, the mean of CI is 2.74, and the mean of ICRG is 1.95. The last column of Table 1 presents the maximum of a corruption index per

Table 1. Descriptive statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Dependent variable					
NPL (%)	105,708	1.809	3.195	0.000	29.300
Bank specific variables					
Bank size (log)	109,178	5.422	1.905	2.229	14.319
Capitalization (%)	109,178	11.662	6.889	1.480	74.240
LTCD	108,156	80.606	46.020	5.900	864.97
ROAA (%)	108,429	1.107	1.349	−6.000	8.370
LLPGL (%)	106,431	0.490	0.955	−1.500	8.570
Crisis	109,178	0.182	0.386	0.000	1.000
Macroeconomic indicators					
GDP growth (%)	108,854	2.037	1.829	−5.619	10.636
Unemployment (%)	107,958	6.346	1.953	2.500	19.900
GCF (%)	108,697	21.074	2.513	14.428	42.894
RIR (%)	106,804	2.907	2.324	−9.633	29.120
Corruption perception index					
CI	108,653	2.736	0.862	0.000	9.600
WBCI	103,079	1.108	0.447	0.030	4.222
ICRG	108,522	1.953	0.569	0.000	5.500
Institutional controls					
CLT	106,462	11.202	10.819	9.000	94.000
Overall capital stringency	19,147	4.980	1.649	1.000	7.000
RoL	103,084	0.994	0.419	0.400	4.678
Economies classification	105,392	0.022	0.148	0.000	1.000

Note: The sample covers the period from 2000 to 2016. The bank variables are NPL - non-performing loans; Bank size - natural logarithm of total assets; Capitalization - total equity as a proportion of total assets; LTCD - total loans as a proportion of total customer deposits; ROAA - return on average assets; LLP - loan loss provision divided by gross loans. The macroeconomic indicators are: GFC - global financial crisis; GDP growth ratio; Unemployment ratio; GCF - gross capital formation as a percentage of GDP; RIR - real interest rate; CI - corruption perception index from Transparency International; WBCI - corruption perception index from World Bank; CI-ICRG - International Country Risk Guide; CLT - an index of collectivism by using Hofstede data; Cap_Str - capital stringency; RoL - rule of law; Economies classification - a dummy variable equal to 1 if the financial system is a bank-based financial system or 0 if the financial system is a market-based financial system. Source: Fitch Connect, World Bank - World Development Indicators, and Transparency International.

[22] When using fixed and random effects panel regression methods, we drop the contemporaneous NPL variable from the regression equation in (1). We use the bank fixed effects model with robust standard errors, clustered at the country level.

Table 2. Pearson's correlation matrix.

	NPL	CI	Bank Size	LTCD	ROAA	Capitaliz.	GDP growth	Unemp.	GCF	RIR
NPL	1									
CI	0.333***	1								
Bank Size	0.221***	0.415***	1							
LTCD	0.0672***	0.130***	0.230***	1						
ROAA	−0.240***	0.104***	0.142***	0.0513***	1					
Capitaliz.	0.00699*	0.106***	−0.0909***	0.0608***	0.0891***	1				
GDP growth	−0.0417***	0.263***	0.112***	0.0264***	0.198***	0.0390***	1			
Unemp.	0.325***	0.245***	0.129***	0.0112***	−0.116***	−0.00766*	−0.294***	1		
GCF	−0.150***	0.227***	0.146***	0.0819***	0.165***	0.0399***	0.543***	−0.524***	1	
RIR	−0.0171***	0.112***	0.00821**	0.0669***	0.0568***	0.0497***	0.0530***	−0.283***	0.319***	1

Note: The sample covers the period from 2000 to 2016. The table reports the correlation matrix between the key variables which are used in the model. NPL - non-performing loans; CI - corruption perception index from Transparency International; Bank size - natural logarithm of total assets; LTCD - total loans as a proportion of total customer deposits; ROAA - return on average assets; Capitalization - total equity as a proportion of total assets; GDP growth ratio; Unemp - unemployment ratio; GCF - gross capital formation as a percentage of GDP; RIR - real interest rate. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Source: Our own calculations.

each corruption measure. Higher values of these indexes indicate that various countries are suffering from severe corruption issues. The standard deviation of the corruption index measured by the World Bank is near to the one documented in Chen et al. (2015) with the mean value of 0.704. In the fourth part of Table 1, we include institutional variables. The mean values of the index of the overall capital stringency, rule of law, regulatory quality, and the level of collectivism are 4.98, 0.99, 1.09, and 11.2 respectively.

In Table 2, we present the correlations between our variables. In line with our empirical model, we find that NPL is positively and significantly correlated with corruption but negatively and significantly correlated with bank size and return on average assets (at the 1 percent significance level). The correlation between NPL and capitalization is positive and significant. Furthermore, variable NPL is negatively and significantly correlated with GDP growth and gross capital formation as a percentage of GDP but positively and statistically significantly correlated with unemployment rate.

3 Empirical results

3.1 Baseline results

We begin by estimating the regression in (1) using the fixed effects regression model (see Table 3).[23] The estimated regression coefficient between the level of corruption and NPL is positive and statistically significant. This supports Hypothesis 1 and is consistent with the previous findings that corruption negatively affects loan quality measured by the NPL (Bougatef, 2015; Goel & Hasan, 2011; Park, 2012). The result is also economically significant. That is, an increase in corruption for one standard deviation would lead to an expected increase in NPL for 0.111 standard deviations (where 0.111 is computed as the estimated regression coefficient, associated with the level of corruption CI, 0.413, multiplied by the standard deviation of CI, 0.862, and divided by the standard deviation of NPL, 3.195).

The regression coefficients of control variables have the anticipated signs. The bank size is significantly and positively related to NPL. This implies that larger banks take larger risks potentially due to the associated government guarantees due to their too-big-to-fail status, which leads to higher levels of NPLs. Our empirical evidence is consistent with the finding of Chaibi and Ftiti (2015) and Louzis et al. (2012). That the return on average assets is negatively associated with NPL is consistent with the explanation and findings of Dimitrios et al. (2016a), Dimitrios et al. (2016b), and Baselga-Pascual et al. (2015). Additionally, capitalization is negatively and significantly related to NPL. The GDP growth is negatively but not significantly related to NPL whereas the unemployment rate is positively related to NPL. The GCF is negative but not significantly related to NPL. We also find that real interest rate is positively and statistically significantly related to NPL.

We use the Hausman test (Hausman, 1978) to choose between the FE or RE estimator. From the chi-squared test statistics, we conclude that the random effects model is rejected (with

[23] To mitigate the reverse causality, we use one-year lag of each of the bank and macroeconomic variables.

Table 3. The relationship between corruption index and NPLs: the total sample with different estimation methods.

Dependent variable: NPL	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	−0.620	−1.535		−0.392	−1.310	
	(-0.38)	(-1.63)		(-0.26)	(-1.41)	
Corruption level						
CI	0.413***	0.634***	0.992**			
	(3.21)	(6.76)	(2.52)			
WBCI				0.369***	0.771***	4.101***
				(3.78)	(2.88)	(2.71)
Bank-specific variables						
Lagged NPL			0.788***			0.746***
			(27.10)			(15.03)
Bank Size	0.186***	0.197***	0.105***	0.185***	0.213***	0.0507
	(6.28)	(13.17)	(2.59)	(5.64)	(11.13)	(0.77)
LTCD	0.00248	0.00270*	0.00339**	0.00259*	0.00293**	0.00240
	(1.62)	(1.89)	(2.19)	(1.76)	(2.12)	(1.23)
ROAA	−0.429***	−0.430***	−0.251***	−0.435***	−0.436***	−0.505**
	(-37.77)	(-36.24)	(-4.45)	(-35.63)	(-33.54)	(-2.08)
Capitalization	−0.0352***	−0.0317***	−0.0381**	−0.0351***	−0.0306***	0.0274
	(-21.60)	(-9.90)	(-2.03)	(-22.47)	(-9.76)	(0.43)
Macroeconomic indicators						
GDP growth	0.000390	0.000753	−0.616	0.00714	0.0167*	−1.121**
	(0.03)	(0.06)	(-1.32)	(0.50)	(1.74)	(-2.19)
Unemployment	0.219***	0.223***	1.101**	0.242***	0.253***	0.740**
	(5.26)	(6.71)	(2.40)	(5.09)	(7.11)	(2.05)
GCF	−0.0535	−0.0412	0.000751	−0.0354	−0.0193	0.282
	(-1.07)	(-1.17)	(0.00)	(-0.69)	(-0.50)	(0.87)
RIR	0.0979***	0.101***	−0.902***	0.0852***	0.0784***	−0.634***
	(3.57)	(4.28)	(-3.85)	(3.29)	(3.52)	(-3.22)
Coefficient Estimates	FE	RE	GMM	FE	RE	GMM
No. Obs.	102,905	102,905	102,420	97,314	97,314	96,850
Dummies Year	Yes	Yes	Yes	Yes	Yes	Yes
R-squared within	0.2004	0.1998		0.1983	0.1973	
Hansen J statistic (p-value)			21.08 (0.576)			22.13 (0.452)
AB test AR(2) (p-value)			−0.10 (0.923)			−0.67 (0.501)

Note: The sample covers the period from 2000 to 2016. The dependent variable is non-performing loans (NPL). The estimation methods are FE, RE and the twostep Arellano-Bond system GMM. CI - corruption perception index; WBCI - corruption perception index from World Bank; Bank size - natural logarithm of bank assets; LTCD - total loans as a proportion of total customer deposits; ROAA - return on average assets; Capitalization - total equity as a proportion of total assets. The macroeconomic indicators are: GDP growth ratio; Unemployment ratio; GCF - gross capital formation as a percentage of GDP; RIR - real interest rate. The regressions include Year dummies. AR(2) reports the p-values for the null hypothesis that the errors in the first regression exhibit no second-order serial correlation. The independent variables are lagged one period. Robust-standard errors in parenthesis are clustered at the level of country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Prob > chi2(9) = 0.0000 < 0.05). Hence, the FEs model should be employed rather than the RE model. In addition, we test for the time-fixed effects in the data and confirm that year dummies should be included in the model (the Breuch − Pagan LM test shows the existence of the panel effect in the data for random effects). We estimate standard errors that are robust to heteroskedasticity.

The fixed effects model is prone to the endogeneity problem. The alternative explanation of our findings might be that a high level of NPLs creates a fertile ground for corruption to spread within the financial institution. For example, corrupt loan officers can exclude the defaulted borrowers from the aberration of penalties (Boerner & Hainz, 2004). The presence of endogeneity in the model can lead to inconsistent and biased estimators. To address the endogeneity problem, we use the dynamic panel-data setup to account for potential endogeneity of our dependent variable $NPL_{i,c,t}$. We include the lagged variable $NPL_{i,c,t-1}$ as an independent variable, as in regression in (1) (see Arellano & Bond, 1991; Baum, 2006; Chaibi & Ftiti, 2015; Tarchouna et al., 2017). Furthermore, Blundell and Bond (1998) suggest to rely on the system generalized method of moments (GMM) estimator for dynamic panel data. This method provides unbiased and efficient estimates. As endogenous instrument, we consider the lagged dependent variable $NPL_{i,c,t-1}$. All other variables are treated as exogenous instruments.

Moreover, we use the set of lags from 2 to 5 to mitigate the over-identification problem of endogenous instruments.

Furthermore, to account for appropriate instruments, the relevance condition states that the excluded instruments have to fulfill two conditions. They have to be correlated with the dependent variable (in our case NPL) and they have to be uncorrelated with the residuals (Baum et al., 2003). We also test for the over-identification restrictions by using Hansen's J statistic, as well as the presence of the first order autocorrelation AR(1) and the second order autocorrelation AR(2) of the residuals in the dynamic model. We confirm the validity of the instruments chosen and no presence of the second order autocorrelation. This indicates that our GMM estimate is consistent. The regression coefficient of the first lag of NPLs is positive and significant (see column 3 of Table 3). The positive relationship indicates that NPLs are expected to increase when they moved up the year before, as in Chaibi and Ftiti (2015).

The results reported in column 4 and 6 of Table 3 indicate that the level of corruption is significantly and positively related to the NPLs even when we use an alternative corruption perception index from the World Bank. This confirms Hypothesis 1.

3.2 Channels through which corruption affects NPLs

Having identified the main determinants of NPLs, we analyze the interaction terms between the corruption index and bank-specific variables in order to investigate the channels through which corruption impacts the level of NPLs. We introduce four interaction terms: corruption and bank size, corruption and bank capitalization, corruption and ROAA, and corruption and collectivism. The results are presented in Table 4. As before, the level of corruption is positively and statistically significantly related to the level of NPLs.[24]

The interaction term between the corruption index and bank size[25] is negatively and significantly (for GMM estimation but not for FE estimation) related to the level of NPLs. We find that a one-unit increase in CI*Bank size leads to reduction of NPLs by 0.0191 units. This indicates that the effect of corruption on the level of NPLs is less pronounced for larger banks than for smaller banks, providing some support for Hypothesis 2. The explanation may derive from more hierarchical structures of larger banks that preclude corruptive bank practices, resulting in a weaker link between corruption and NPLs. The interaction term between corruption and capitalization has no significant effect on the level of NPLs. This indicates that the third hypothesis is not confirmed.

The interaction term between corruption and ROAA is negatively and significantly (for GMM estimation but not for FE estimation) related to the level of NPLs. We show that a one-unit increase in CI*ROAA leads to a decrease of NPLs by 0.276 units. This implies that the effect of corruption on the level of NPLs is less pronounced for banks with high profitability. A potential explanation might be that as most profitable banks are less concerned with their revenue creation, they do not engage themselves toward risky lending, causing a cutback in the level of NPLs.

We also analyze the association between corruption and NPLs by using a specific dimension of culture, namely collectivism to control for heterogeneity in national cultures across countries.[26] The interaction term between corruption and the level of collectivism (CLT) is positively and significantly (for FE estimation but not for GMM estimation) related to the level of NPLs. We find that a one-unit increase in CI*CLT leads to an increase of NPLs by 0.0433 units. This indicates that the impact of corruption on the level of NPLs is stringer for countries where people tend to have less interdependent self-construal. This provides some support for our Hypothesis 6.

3.3 Corruption and NPLs during and after the global financial crisis

We now evaluate how the global financial crisis affects the relationship between the corruption index and NPLs. We add the interaction terms of the corruption index with dummy variables that equal 1 during the three sub-periods: before the crisis (2000–2007), during the crisis (2008–2010), and the post-crisis (2011–2016), with 0 otherwise (see Allen et al., 2017). The estimation results in Table 5 show that the interaction term of corruption with before the crisis, CI*BEFORE GFC, is negatively and significantly associated with NPLs. This suggests

[24] The p-values of Hansen's J statistics in Table 4 imply that the instruments satisfy the orthogonality conditions for all GMM regressions.
[25] Skrastins and Vig (2015) approach to test the influence of bank size on the relation between corruption and NPLs. In their paper, the organizational hierarchy is measured by the managerial levels. We use the logarithm of total bank assets to test the impact.
[26] Hofstede (2001) and Hofstede (1983) constructed four cultural dimensions: individualism/collectivism (IDV), uncertainty avoidance (UAI), masculinity/femininity (MAS), and power distance (PDI).

Table 4. Channels through which corruption affects NPL.

Dependent variable NPL	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	−0.920		−0.711		−0.747		−2.714***	
	(-0.63)		(-0.41)		(-0.43)		(-4.81)	
Corruption level								
CI	0.517**	7.707***	0.444**	1.098***	0.441***	1.964***	0.295***	1.270
	(2.41)	(3.16)	(2.18)	(2.89)	(2.89)	(3.79)	(4.62)	(0.79)
Bank-specific variables								
Lagged NPL		0.752***		0.792***		0.774***		0.752***
		(25.32)		(30.27)		(26.69)		(35.18)
Bank Size	0.229**	2.008***	0.185***	0.0820**	0.183***	0.146**	0.178***	0.101**
	(2.30)	(2.95)	(6.37)	(2.13)	(6.34)	(2.15)	(7.40)	(2.38)
LTCD	0.00246	0.00353**	0.00250*	0.00422**	0.00247	0.00261	0.00169**	0.00235**
	(1.62)	(2.31)	(1.67)	(2.45)	(1.60)	(1.54)	(2.52)	(2.39)
ROAA	−0.429***	−0.295***	−0.428***	−0.247***	−0.362***	0.540*	−0.424***	−0.249***
	(-39.10)	(-4.96)	(-39.76)	(-4.83)	(-3.87)	(1.76)	(-22.34)	(-5.98)
Capitalization	−0.0352***	−0.0215	−0.0284	0.0570	−0.0348***	−0.0640**	−0.0343***	−0.0404**
	(-21.45)	(-1.11)	(-1.26)	(0.36)	(-25.40)	(-2.12)	(-9.35)	(-2.29)
Macroeconomic indicators								
GDP growth	−0.000325	−1.234**	0.000249	−0.525	−0.000294	−0.564	0.00174	−0.267
	(-0.02)	(-2.16)	(0.02)	(-1.09)	(-0.02)	(-0.74)	(0.24)	(-0.40)
Unemployment	0.219***	1.088**	0.220***	1.076**	0.220***	1.131**	0.236***	0.810
	(5.11)	(2.39)	(5.24)	(2.38)	(5.22)	(2.02)	(13.42)	(1.27)
GCF	−0.0522	0.457	−0.0532	0.171	−0.0510	−0.492	−0.00684	0.0615
	(-1.07)	(1.24)	(-1.06)	(0.53)	(-0.99)	(-0.74)	(-0.30)	(0.15)
RIR	0.0976***	−1.023***	0.0979***	−0.712**	0.0968***	−1.253***	0.109***	−0.610***
	(3.52)	(-3.61)	(3.56)	(-1.99)	(3.60)	(-2.76)	(14.10)	(-2.64)
Interaction terms								
CI*Bank Size	−0.0156	−0.698***						
	(-0.38)	(-2.77)						
CI*Capitalization			−0.00255	−0.0313				
			(-0.29)	(-0.61)				
CI*ROAA					−0.0231	−0.276**		
					(-0.63)	(-2.41)		
CI*CLT							0.0433***	−0.00924
							(6.06)	(-0.50)
Coefficient Estimates	FE	GMM	FE	GMM	FE	GMM	FE	GMM
No. Obs.	102,905	102,420	102,905	102,420	102,905	102,420	102,013	101,610
Dummies Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen J statistic (p-value)		16.38 (0.839)		30.17 (0.145)		21.10 (0.575)		48.51 (0.064)
AB test AR(2) (p-value)		0.09 (0.928)		0.29 (0.768)		−0.80 (0.425)		0.14 (0.887)

Note: The sample covers the period from 2000 to 2016. The dependent variable is non-performing loans (NPL). The estimation methods are pooled FE and the twostep Arellano-Bond system GMM. CI - corruption perception index from Transparency International; Bank size - natural logarithm of bank assets; LTCD - total loans as a proportion of total customer deposits; ROAA - return on average assets. Capitalization - total equity as a proportion of total assets. CLT - the level of collectivism. The macroeconomic indicators are: GDP growth ratio; Unemployment ratio; GCF - gross capital formation as a percentage of GDP; RIR - real interest rate. The regressions include Year dummies. AR(2) reports the p-values for the null hypothesis that the errors in the first regression exhibit no second-order serial correlation. The independent variables are lagged one period. Robust-standard errors in parenthesis are clustered at the level of country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

that before the global financial crisis, the effect of corruption on the NPLs is less pronounced. The interaction term of corruption index with the crisis dummy, CI*DURING GFC, is positively and significantly associated with NPLs. This implies that during the global financial crisis the effect of corruption on the NPLs is more pronounced. The interaction term of the corruption index with the post-crisis dummy, CI*AFTER GFC, is positively and significantly related to the NPLs, indicating that in the post-crisis period the positive effect of corruption on NPLs is more pronounced.

3.4 Corruption and NPLs in bank-based and market-based financial systems

We continue our investigation by exploring whether the impact of corruption on the NPLs is different in bank-based and market-based economies (see Demirguc-Kunt & Levine, 1999). Table 6 shows that corruption is positively related to NPL in the subsample of market-based economies, while in the subsample of bank-based economies the association is statistically insignificant. Interestingly, the regression coefficient of the corruption index is

Table 5. Corruption and the NPLs before, during, and after the global financial crisis.

Dependent variable: NPL	(1)	(2)	(3)
Intercept	1.211	−0.332	0.776
	(0.89)	(-0.23)	(0.52)
Corruption level			
CI	0.292***	0.230**	0.299***
	(3.19)	(2.28)	(2.98)
Bank-specific variables			
Bank Size	0.123***	0.173***	0.145***
	(3.46)	(6.74)	(3.85)
LTCD	0.00248*	0.00232	0.00282**
	(1.73)	(1.48)	(2.00)
ROAA	−0.432***	−0.427***	−0.436***
	(-31.88)	(-36.24)	(-31.37)
Capitalization	−0.0385***	−0.0365***	−0.0360***
	(-21.22)	(-21.04)	(-19.35)
Macroeconomic indicators			
GDP growth	0.0116	0.0656	−0.130***
	(0.89)	(1.49)	(-3.57)
Unemployment	0.183***	0.260***	0.0903***
	(5.50)	(4.52)	(4.47)
GCF	−0.0606	−0.0609	−0.0453
	(-1.09)	(-1.28)	(-0.75)
RIR	0.0672***	0.0936***	0.0734***
	(5.77)	(4.17)	(5.00)
CI*BEFORE GFC	−0.344***		
	(-9.80)		
CI*DURING GFC		0.174**	
		(2.53)	
CI*AFTER GFC			0.380***
			(5.24)
Coefficient Estimates	FE	FE	FE
No. Obs.	102,905	102,905	102,905
Dummies Year	Yes	Yes	Yes

Note: The sample covers the period from 2000 to 2016. The dependent variable is non-performing loans (NPL). The estimation method is pooled FE. CI - corruption perception index; Bank size - natural logarithm of bank assets; LTCD-total loans as a proportion of total customer deposits; ROAA - return on average assets; Capitalization - total equity as a proportion of total assets. The macroeconomic indicators are: GDP growth ratio; Unemployment ratio; GCF - gross capital formation as a percentage of GDP; RIR - real interest rate. The regressions include Year dummies. The independent variables are lagged one period. Robust-standard errors in parenthesis are clustered at the level of country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

larger in the market-based economies (0.434) than in the bank-based economies, indicating that the effect of the corruption on the level of NPLs is pronounced in the market-based economies.

3.5 The legal environment and the effectiveness of the regulatory framework

The relationship between the level of corruption and NPLs may be affected by cross-country differences, especially in the legal environment, and might impact the efficiency of the regulatory framework. In

Table 6. Corruption and NPLs in bank-based and market-based economies.

Dependent variable: NPL	(1)	(2)
Intercept	12.16**	−2.339*
	(2.09)	(-1.83)
Corruption level		
CI	−0.652	0.434***
	(-1.29)	(5.00)
Bank-specific variables		
Bank Size	0.120	0.203***
	(0.60)	(11.08)
LTCD	0.00406	0.000917
	(1.21)	(1.64)
ROAA	−0.717**	−0.415***
	(-2.51)	(-26.85)
Capitalization	0.0708	−0.0335***
	(1.03)	(-14.55)
Macroeconomic indicators		
GDP growth	−0.0979	0.00827
	(-1.52)	(0.71)
Unemployment	−0.200	0.273***
	(-0.95)	(12.00)
GCF	−0.140	0.000791
	(-1.35)	(0.02)
RIR	0.0289	0.126***
	(0.49)	(11.92)
Coefficient Estimates	FE	FE
No. Obs.	788	100,901
Dummies Year	Yes	Yes
Financial Systems	Bank-based economy	Market-based economy

Note: The sample covers the period from 2000 to 2016. The dependent variable is non-performing loans (NPL). The estimation method is pooled FE. CI - corruption perception index; Bank size - natural logarithm of bank assets; LTCD - total loans as a proportion of total customer deposits; ROAA - return on average assets; Capitalization - total equity as a proportion of total assets. The macroeconomic indicators are: GDP growth ratio; Unemployment ratio; GCF - gross capital formation as a percentage of GDP; RIR - real interest rate. The regressions include Year dummies. The independent variables are lagged one period. Robust-standard errors in parenthesis are clustered at the level of countries. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 7, we add the interaction term between the corruption index and the rule of law, CI*RoL.

The interaction term between the corruption index and the rule of law is negatively and significantly related to the NPLs (see Table 7). This confirms the view that in countries where the laws are better enforced, the impact of corruption on the NPLs becomes less pronounced. This finding is consistent with Hypothesis 4.

We also evaluate the impact of corruption on the effectiveness of capital regulation by including the level of capital stringency, Cap_Str, and the interaction term between the corruption index and a measure of capital stringency, CI*Cap_Str, in the regression model. Capital stringency has no

Table 7. Corruption and NPLs and the quality of the legal and regulatory environment.

Dependent variable: NPL	(1)	(2)
Intercept	0.111	6.124***
	(0.16)	(2.91)
Corruption level		
CI	1.261***	−0.572
	(13.96)	(-0.74)
Bank-specific variables		
Bank Size	0.153***	−0.241***
	(5.85)	(-4.55)
LTCD	0.00245***	−0.00113
	(2.98)	(-1.47)
ROAA	−0.441***	−0.500***
	(-21.81)	(-34.93)
Capitalization	−0.0350***	−0.0647***
	(-8.96)	(-23.73)
Macroeconomic indicators		
GDP growth	−0.0292***	−0.257
	(-2.64)	(-1.29)
Unemployment	0.202***	0.144
	(10.93)	(0.94)
GCF	−0.0430*	−0.153*
	(-1.67)	(-1.72)
RIR	0.00713	0.134
	(0.42)	(0.73)
Legal system quality		
RoL	−1.829***	
	(-7.40)	
CI*RoL	−0.288***	
	(-6.81)	
Regulatory effectiveness		
Cap_Str		0.370
		(1.20)
CI*Cap_Str		0.0147
		(0.17)
Coefficient Estimates	FE	FE
No. Obs.	91,657	18,187
Dummies Year	Yes	Yes

Note: The sample covers the period from 2000 to 2016. The dependent variable is non-performing loans (NPL). The estimation method is pooled FE. CI - corruption perception index; Bank size - natural logarithm of bank assets; LTCD - total loans as a proportion of total customer deposits; ROAA - return on average assets; Capitalization - total equity as a proportion of total assets. The macroeconomic indicators are: GDP growth ratio; Unemployment ratio; GCF - gross capital formation as a percentage of GDP; RIR - real interest rate. The regressions include Year dummies. The independent variables are lagged one period. Robust-standard errors in parenthesis are clustered at the level of country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

significant effect on the level of NPLs. This indicates that the fifth hypothesis is not confirmed.

3.6 High-corrupt vs. low-corrupt group of countries

We now want to confirm that the relationship between the corruption index and NPL is positive for countries with high and low levels of corruption and countries with high and low levels of NPL. We use the average value as a reference unit to divide countries in the high-corrupt group (with the corruption index above the mean value of 2.736 and NPL above the mean value of 1.809) and the low-corrupt group (with the corruption index below the mean value of 2.736 and NPL below the mean value of 1.809). Table 8 shows that corruption is positively related to NPLs for countries in the high-corrupt group and for countries in the low-corrupt group. Furthermore, we find a significant and positive effect of corruption on the level of NPLs on both high and low NPL countries. This implies that country-level corruption affects positively the level of NPL in the bank.

4 Robustness checks

4.1 Alternative corruption index and loan quality indicator

As a robustness check, we also use the value of corruption index based on the International Country Risk Guide $ICRG_{c,t}$. The score for the $ICRG_{c,t}$ ranges on a scale from 0 (least corrupt) to 6 (most corrupt). Table 9 provides the regression results using the alternative corruption indexes, corruption index from *TI*, *CI*, and *ICRG*. The estimated results remain widely unchanged and corroborate our main finding that corruption is positively related to NPLs.

Table 9 also provides the results of the alternative model in which we use loan loss provisions, LLP, as a loan quality indicator instead of NPL (following De Haan & Van Oordt, 2018; Tarchouna et al., 2017; Chaibi & Ftiti, 2015; Boudriga et al., 2009).

The results in Table 9 confirm a positive and significant relationship between the level of corruption index and LLP. This implies that corruption aggravates loan quality which results in increased levels of LLPs. The effects of other variables on loan loss provisions remain similar to the basic model with NPLs as a dependent variable.

4.2 Subsamples of commercial banks

We tested the robustness of our results based on the subsample of commercial banks (see Table 10). The results remain similar to the ones in the basic model. The level of corruption is positively and significantly related to the level of non-performing loan in both estimation methods (FE and GMM) to bank lending. This confirms the view that the corruption is widespread across different bank specializations.

Table 8. Corruption and NPLs in low and high corrupt group of countries.

Dependent variable: NPL	(1)	(2)	(3)	(4)
Intercept	4.995***	0.296	3.576*	−0.368
	(3.03)	(0.93)	(1.81)	(-1.11)
Corruption index				
CI	0.403**	0.598***	0.554**	0.0928***
	(2.23)	(5.50)	(2.23)	(5.39)
Bank-specific variables				
Bank Size	0.0522	0.214***	0.0790	0.0571***
	(0.44)	(18.34)	(0.90)	(10.54)
LTCD	0.00679***	0.000632***	0.00604***	0.000243***
	(3.62)	(3.33)	(3.37)	(3.39)
ROAA	−0.614***	−0.342***	−0.527***	0.00862***
	(-14.11)	(-63.99)	(-13.74)	(11.03)
Capitalization	−0.0763***	−0.0235***	−0.0355***	−0.00139***
	(-6.33)	(-20.99)	(-3.37)	(-6.01)
Macroeconomic indicators				
GDP growth	−0.126**	−0.103***	−0.0425	−0.00182
	(-2.36)	(-12.17)	(-1.40)	(-0.55)
Unemployment	−0.000532	0.274***	0.168***	0.0394***
	(-0.01)	(95.08)	(3.37)	(5.55)
GCF	−0.101** (−2.31)	−0.129*** (−33.78)	−0.113* (−1.89)	−0.00165 (−0.17)
RIR	0.0324	0.136***	0.0699**	0.0255***
	(1.36)	(11.36)	(2.42)	(5.50)
Coefficient Estimates	FE	FE	FE	FE
No. Obs.	20,452	82,453	27,908	74,997
Group	Low corrupt group	High corrupt group	Low NPL group	High NPL group

Note: The sample covers the period from 2000 to 2016. The dependent variable is non-performing loans (NPL). The estimation method is pooled FE. CI - corruption perception index; Bank size - natural logarithm of bank assets; LTCD - total loans as a proportion of total customer deposits; ROAA - return on average assets; Capitalization - total equity as a proportion of total assets. The macroeconomic indicators are: GDP growth ratio; Unemployment ratio; GCF - gross capital formation as a percentage of GDP; RIR - real interest rate. The regressions include Year dummies. The independent variables are lagged one period. Robust-standard errors in parenthesis are clustered at the level of countries. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 9. Alternative measures of corruption and loan quality.

Dependent variable:	(1)	(2)	(3)	(4)
	NPL	NPL	LLP	LLP
Intercept	−0.186		−1.126***	
	(-0.13)		(-2.83)	
Corruption level				
CI			0.104***	0.637**
			(5.34)	(2.27)
ICRG	0.206***	2.415***		
	(5.97)	(3.46)		
Bank-specific variables				
Lagged NPL		0.798***		
		(24.94)		
Lagged LLP				0.182*
				(1.84)
Bank Size	0.212***	0.174***	0.0600***	0.0659***
	(6.84)	(4.08)	(4.05)	(3.83)
LTCD	0.00258*	0.00209*	0.00132***	0.00140***
	(1.90)	(1.81)	(3.62)	(3.16)
ROAA	−0.439***	0.0171	−0.113***	−0.0339
	(-37.13)	(0.37)	(-9.77)	(-0.99)
Capitalization	−0.0341***	0.0238***	0.0103***	0.00236
	(-22.49)	(3.44)	(17.53)	(0.45)
Macroeconomic indicators				
GDP growth	0.0208	−0.955**	−0.0941***	−0.640**
	(1.27)	(-2.45)	(-17.34)	(-2.01)
Unemployment	0.229***	0.300	0.0324***	0.00156
	(5.44)	(1.21)	(2.87)	(0.01)

(*continued on next page*)

Table 9. (continued)

Dependent variable:	(1)	(2)	(3)	(4)
	NPL	NPL	LLP	LLP
GCF	−0.0508	0.0122	0.0349***	−0.0280
	(-1.02)	(0.06)	(3.67)	(-0.17)
RIR	0.0813***	−0.798***	0.0498***	−0.145
	(3.69)	(-4.11)	(4.13)	(-1.59)
Coefficient Estimates	FE	GMM	FE	GMM
No. Obs.	102,810	102,328	103,012	96,234
Hansen J statistic (p-value)		27.94 (0.218)		39.37 (0.144)
AB test AR(2) (p-value)		0.20 (0.840)		0.35 (0.724)

Note: The sample covers the period from 2000 to 2016. The dependent variables are non-performing loans (NPL) and loan loss provision (LLP). The estimation methods are FE and twostep Arellano-Bond system GMM. CI - corruption perception index; ICRG - corruption index from the International Country Risk Guide; Bank size - natural logarithm of bank assets; LTCD - total loans as a proportion of total customer deposits; ROAA - return on average assets; Capitalization - total equity as a proportion of total assets. The macroeconomic indicators are: GDP growth ratio; Unemployment ratio; GCF - gross capital formation as a percentage of GDP; RIR - real interest rate. The regressions include Year dummies. AR(2) reports the p-values for the null hypothesis that the errors in the first regression exhibit no second-order serial correlation. The independent variables are lagged one period. Robust-standard errors in parenthesis are clustered at the level of countries. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 10. Corruption and NPLs for the subsample of commercial banks.

Dependent variable: NPL	(1)	(2)
Intercept	−0.683	−0.408
	(-0.42)	(-0.27)
Corruption level		
CI	0.468***	
	(2.99)	
WBCI		0.390***
		(3.58)
Bank-specific variables		
Bank Size	0.199***	0.198***
	(6.16)	(5.50)
LTCD	0.00375**	0.00384**
	(2.16)	(2.30)
ROAA	−0.432***	−0.439***
	(-34.02)	(-31.92)
Capitalization	−0.0383***	−0.0384***
	(-19.53)	(-20.83)
Macroeconomic indicators		
GDP growth	−0.00552	0.00244
	(-0.34)	(0.15)
Unemployment	0.207***	0.233***
	(5.05)	(4.82)
GCF	−0.0582	−0.0371
	(-1.21)	(-0.74)
RIR	0.0993***	0.0858***
	(3.33)	(3.05)
Coefficient Estimates	FE	FE
No. Obs.	88,386	83,620
Dummies Year	Yes	Yes
R-squared within	0.1938	0.1919

Note: The sample covers the period from 2000 to 2016. The dependent variable is non-performing loans (NPL). The estimation method is FE. CI - corruption perception index from Transparency International; WBCI - corruption perception index from World Bank-World Development Indicators; Bank size - natural logarithm of bank assets; LTCD - total loans as a proportion of total customer deposits; ROAA - return on average assets. Capitalization - total equity as a proportion of total assets. The macroeconomic indicators are: GDP growth ratio; Unemployment ratio; GCF - gross capital formation as a percentage of GDP; RIR - real interest rate. The regressions include Year dummies. Robust-standard errors in parenthesis are clustered at the level of country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

5 Conclusion

To unveil the relationship between corruption and loan quality, we combine an unbalanced panel data of 109,178 bank level observations from 140 countries over the period from 2000 to 2016 with macroeconomic and regulatory indicators and the indexes of corruption. Our main finding is that corruption is positively and significantly related to the level of NPLs, indicating that corruption leads to reduced loan quality in a banking system.

We find that the relationship between corruption and NPLs is weaker for larger banks. Potential explanations reside in hierarchical practices of large banks and in the regulatory scrutiny. Larger banks may be less exposed to corruption due to their highly hierarchical structures. Hierarchical structures give little discretion to loan officers, successfully preventing corruptive behavior.

Furthermore, we find evidence that countries with a high level of collectivism are associated with a higher level of NPLs. Given that collectivist cultures are characterized by group and social cooperation, our findings support the hypothesis that countries with a high level of collectivism are associated with higher levels of NPLs. We also analyze the role of legal environment on the impact of corruption on loan quality. We find that stronger rule of law makes the relationship between corruption and NPLs less pronounced.

Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of interest

Ardit Gjeçi declares that he has no conflict of interest. Matej Marinč declares that he has no conflict of interest.

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Appendix A

Table A1. Definitions and data sources of variables.

Variable	Definition	Source
Bank-specific variables		
NPL	Non-performing loans ratio (%). Measured as impaired loans divided by total loans.	Fitch Connect
Bank Size	The natural logarithm of total assets of bank *i* at time *t*.	Fitch Connect
LTCD	The ratio of loans to customer deposits	Fitch Connect
ROAA	Return on average assets ratio	Fitch Connect
Capitalization	The capitalization ratio represents the ratio of total equity to total assets in (%).	Fitch Connect
LLP	Loan loss provisions divided by total loans in (%).	Fitch Connect
Macroeconomic indicators		
GDP	Annual growth rate of GDP	World Bank
Unemployment	The unemployment ratio (%)	World Bank
GCF	Gross capital formation as percentage of GDP (%)	World Bank
RIR	Real interest rates, measured as the difference between nominal interest rate and inflation rate.	World Bank
Economies classification	Is a dummy variable equal to 1 if the financial system is a bank-based financial system or 0 if the financial system is a market-based financial system.	Demirguc-Kunt & Levine (1999) and own calculations
Corruption indexes		
CI	Corruption perception index ranges from 0 to 10. Transformed (10-$CI_{c,t}$). Higher values indicate more corruption.	Transparency International
WBCI	World bank corruption perception index. Ranges from −2.5 to +2.5. Transformed (5-($CI_{c,t}$+2.5)). Higher value indicates more corruption.	Kaufmann et al. (2010); World Bank
ICRG	Corruption index, higher value indicates higher corruption.	International County Risk Guide; https://www.prsgroup.com/explore-our-products/international-country-risk-guide/
Institutional variables		
Capital stringency (Cap_Str)	Indicates "whether the capital requirement reflects certain risk elements and deducts certain market value losses from capital before minimum capital adequacy is determined". Higher values demonstrate grater capital stringency.	Barth, Caprio, & Levine (2013), Survey conducted in 2003, 2007 and 2011
Rule of law (RoL)	The indicator captures perceptions "of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence".	Kaufmann et al. (2010); World Bank
Global Financial Crisis (GFC)	Takes value 1 for the period 2008–2010 and 0 otherwise.	Own calculations
CLT	We account for Hofstede's individualism index. For interpretation reasons, we define a new index named collectivism (CLT) as an index equal to 100 minus Hofstede's individualism (IDV). Higher values of CLT index indicate higher collectivism in the country.	Hofstede (2001); Zheng et al. (2013); El Ghoul et al. (2016)

Table A2. Number of banks and average corruption index in sample countries from the period 2000–2016.

Country	Banks	Avg. of WBCI	Avg. of CI	Country	Banks	Avg. of WBCI	Avg. of CI
Albania	4	3.20	7.05	Kuwait	14	2.34	5.51
Andorra	6	1.22		Kyrgyzstan	2	3.67	7.50
Anguilla	1	1.22		Latvia	1	2.28	6.00
Antigua and Barbuda	1	1.24		Lebanon	24	3.32	7.17
Argentina	1	2.87	7.00	Libya	1	3.98	8.23
Armenia	6	3.13	6.91	Liechtenstein	1	1.21	
Aruba	2	1.31		Lithuania	2	2.16	5.55
Australia	18	0.58	1.63	Luxembourg	8	0.51	1.57
Austria	28	0.74	2.09	Macau	1	1.99	4.48
Azerbaijan	12	3.59	7.60	Macedonia	1	2.87	7.30
Bahamas	10	1.18	2.96	Madagascar	1	2.74	7.10
Bahrain	16	2.27	4.94	Malawi	3	3.11	6.86
Bangladesh	3	3.78	8.43	Malaysia	5	2.31	5.02
Barbados	3	1.04	2.75	Malta	1	1.59	3.90
Belarus	9	3.04	7.11	Mauritius	3	2.20	5.04
Belgium	19	1.01	2.75	Mexico	62	2.99	6.71
Benin	1	3.09	7.50	Moldova	2	3.27	7.33
Bolivia	1	2.95	7.13	Monaco	1		
Botswana	2	1.59	3.90	Mongolia	1	3.00	6.20
Brazil	48	2.57	6.21	Morocco	2	2.76	6.57
Bulgaria	10	2.65	6.13	Myanmar	1	3.89	
Burundi	1	3.47	7.65	Namibia	1	2.26	5.90
Cambodia	1	3.68	7.86	Netherlands	27	0.43	1.27
Canada	98	0.55	1.47	New Zealand	14	0.19	0.77
Cayman Islands	12	1.31		Nicaragua	2	3.27	7.22
Chile	26	1.08	2.95	Nigeria	5	3.64	7.81
China	35	2.97	6.42	Norway	10	0.39	1.30
Colombia	12	2.78	6.29	Oman	1	2.13	4.89
Costa Rica	11	1.88	5.06	Pakistan	1	3.41	7.55
Croatia	4	2.40	6.32	Panama	40	2.82	6.49
Cuba	2	2.25	5.80	Peru	2	2.77	6.52
Curacao	9			Philippines	9	3.07	7.09
Cyprus	10	1.45	4.03	Poland	13	2.04	5.21
Czech Republic	6	2.14	5.76	Portugal	17	1.44	3.68
Denmark	4	0.12	0.61	Puerto Rico	5	1.76	4.10
Dominica	2	1.92	4.63	Qatar	7	1.57	3.46
Dominican Republic	5	3.24	6.94	Romania	10	2.72	6.44
Ecuador	4	3.19	7.08	Russian Federation	101	3.42	7.49
El Salvador	8	2.89	6.22	Rwanda	2	2.31	5.33
Estonia	6	1.36	3.29	Saint Lucia	1		2.90
Ethiopia	3	3.09	7.28	San Marino	1		
Finland	10	0.23	0.82	Saudi Arabia	11	2.55	5.80
France	81	1.13	3.09	Serbia	3	3.15	7.10
Georgia	13	2.44	5.99	Singapore	1	0.29	0.85
Germany	37	0.67	2.15	Slovakia	7	2.18	5.77
Ghana	6	2.61	6.00	Slovenia	8	1.57	4.13
Greece	6	2.18	5.69	South Africa	13	2.27	5.42
Guatemala	4	3.20	7.09	Spain	49	1.45	3.65
Guernsey	6			Sri Lanka	2	2.76	6.68
Guyana	1	3.12	7.04	Sweden	9	0.28	0.82
Haiti	3	3.80	8.22	Switzerland	19	0.41	1.25
Honduras	1	3.25	7.10	Syrian Arab Republic	7	3.75	7.77
Hong Kong	13	0.67	1.87	Taiwan	3	1.72	3.94
Hungary	18	2.00	4.97	Tajikistan	3	3.70	7.76
Iceland	14	0.36	0.99	Thailand	1	2.75	6.57
India	2	2.83	6.58	Togo	1	3.42	7.04
Indonesia	15	3.34	7.71	Trinidad and Tobago	6	2.63	6.34
Iran	1	3.22	7.10	Turkey	34	2.64	6.34
Iraq	3	3.84	8.33	Uganda	3	3.43	7.47
Ireland	18	0.93	2.55	Ukraine	26	3.43	7.66
Isle of Man	1			United Arab Emirates	20	1.48	3.59

(*continued on next page*)

Table A2. (continued)

Country	Banks	Avg. of WBCI	Avg. of CI	Country	Banks	Avg. of WBCI	Avg. of CI
Israel	3	1.57	3.56	United Kingdom	43	0.67	1.76
Italy	33	2.21	5.29	United States	6270	1.03	2.58
Jamaica	3	2.70	6.32	Uruguay	2	1.21	3.04
Japan	10	1.06	2.59	Uzbekistan	18	3.74	8.22
Jersey	2			Vanuatu	1	2.27	6.73
Jordan	9	2.32	5.09	Venezuela	4	3.65	7.86
Kazakhstan	16	3.48	7.40	Yemen	3	3.85	8.02
Kenya	5	3.47	7.57	Zambia	2	2.95	7.28
Korea (South)	3	3.86	5.25	Zimbabwe	1	3.89	7.93

Source: CI - corruption perception index from Transparency International; WBCI - corruption perception index from World Bank-World Development Indicators and our calculation.