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Corruption, lending and bank performance

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ABSTRACT

This paper uses a sample of 7235 banks from 160 countries between 2000 and 2016 to investigate the link between corruption, lending and bank performance. It considers both country- and bank-level corruption. The study finds that while corruption increases bank lending, it has an adverse impact on bank profits and risks (credit, solvency and distance to default). Corporate lending is found to be most influenced by corruption. Bank-level corruption influences bank performance in both developed and developing countries whereas country-level corruption has a lesser effect on lending in developing countries. The study also finds that greater bank competition, market concentration and improved regulatory environments reduce the effect of corruption on bank lending and performance. Policy makers should focus on enhancing regulatory rules and institutions in order to deal with the adverse impact of corruption on bank performance.

1. Introduction

Corruption is a widespread social, political and economic phenomenon. Generally, it represents the abuse of delegated public power for private benefits. It can appear as a form of bribery and extortion, collusion, cronyism, fraud and other similar activities (Chen et al., 2015). Corruption can adversely influence economic development by affecting: entrepreneurs' investment incentives; the composition of government expenditure; accumulation of human capital; inflows of foreign investment (Rabbiosi & Santangelo, 2019; Sartor & Beamish, 2020); and the effectiveness of international aid. Ultimately, it can lead to a less efficient financial system (Cooray & Schneider, 2018; Toader et al., 2018) (see Fig. 1).

For banks and their lending behavior, corruption can have mixed effects. One strand of literature finds that it puts 'sand in the wheels' of economic activity and in the context of banking leads to a misallocation of loanable funds from satisfactory loans with a low probability of default to bad projects that mostly end up as non-performing. (Beck et al., 2005; Chen et al., 2015; Detragiache et al., 2008; Park, 2012). Firms that pay higher bribes are also more likely to obtain credits they least likely can repay[1]. Paying bribes enables both beneficiary firms and banks to avoid the regular loan review processes or to gain regulatory leniency. The resulting bad loans are ultimately expected to reduce bank performance and increase risk.

Another (somewhat more limited) strand of literature advances the opposing view noting that corruption 'greases the wheels' of economic activity. This only holds in cases where governance structures and institutional arrangements are weak (Aidt, 2009; Meon & Sekkat, 2005). If inefficient bureaucracy is by-passed by paying bribes the process of obtaining legal and other processes can be speeded-up (Shleifer & Vishny, 1993). As such, corruption can act as an 'escape hatch' in the presence of weak institutions. Chen et al.

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[1] See Levine (1998, 1999), Djankov et al. (2007), Park (2012) and Akins et al., (2016).

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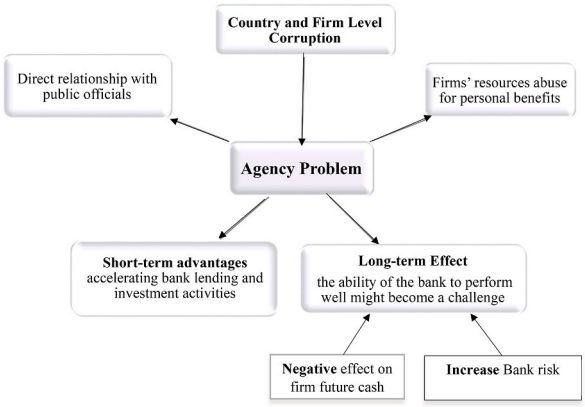

Fig. 1. Corruption effect on bank performance.
Source: developed by the authors

(2013) find strong empirical evidence that bribery, rather than firm performance, determines the extent to which private firms access bank credit in China. They argue that bribery enables an economic outcome whereby firms with better economic performance are awarded larger loans, and these firms pay more in terms of bribes. They conclude that the commercial principles in bank lending can be consistent with the weak Chinese institutional framework. In general, the literature on corruption and bank lending seems to favor the 'sand in the wheels' viewpoint.

Corruption effect on banks remains a controversial issue. While Fungacova et al. (2015) found that corruption can facilitates firms' access to bank loans, Weill (2011) concludes that corruption can hinder lending in banking, adversely affects loan quality and growth (Lardy, 1998), bank performance (Jeon et al., 2014), greatly damage bank reputation (Fiordelisi et al., 2014) and increase the probability of bank crisis (Ben Ali et al., 2020).

Park (2012) confirms that corruption significantly intensifies the bad loans problem in 76 countries' banking sectors. Corruption also can lowers economic growth by allowing banks to extend funds to bad instead of good productive projects. However, previous studies argue that corruption may affect the bank lending to the households and firms, not to the government (Weill, 2011). Generally, Institutional quality is an important factor to moderates the relation between corruption and firms' bank debt ratios (Fungacova et al., 2015).

The majority of the previous corruption and bank lending studies examined the effect of corruption focusing on one county (Weill, 2011) or using a number of counties (e.g. Petrou & Thanos, 2014). They also examined how corruption affect bank performance (Ben Ali et al., 2020). However, as far as we are aware, none of them examined the intermediation effect of corruption to show how loan growth speed on affecting bank performance. This study used comprehensive data set from the word developed and developing banking systems and distinguished between the effects of corruption on both banking systems and how this effect may change according to different levels of loan growth. This study generates important conclusions to the regulators and policy makers to overcome the corruption and irresponsible financing on banking stability.

Specifically, this paper seeks to extend the established literature on several dimensions. First, we collect information on a sample of 7235 banks based in 160 countries over 2000 to 2016 to investigate the interplay of corruption and bank lending on bank performance (measured as profitability ROA, as well as various risk measures - non-performing loans NPL, Z-score and distance-to-default DD). Second, we examine how the influence of loan growth varies according to total loans as well as different types of loans (corporate, mortgage and consumer) and consider various loan growth scenarios (annual loan growth as well as measures of abnormal loan growth and external acquisition driven loan growth). Third, we also extend the previous literature by recognizing the effects of a variety of external factors such as bank type, regulatory quality, competition and market structure in our analysis. Fourth, the study considers the expected non-linear effect of loan growth on bank performance to investigate how banks respond to extreme levels of loan growth. Fifth, the study runs a number of robustness checks examining the effect of corruption on loan growth and bank performance considering the level of country economic development. Finally, in all analyses, the study examines two types of corruption (country and bank lending corruption).

We generally find that loan growth increases with country level corruption and nonlinearly affects bank performance. Less than excessive lending, improves bank performance (increasing returns and reducing risks). A non -linear relationship between loan growth and performance exist. Additionally, we find that both credit and solvency risk measures are linked to loan growth. When banks aggressively increase their lending, they experience increases in non-performing loans. Also, at a higher level of loan growth banks witness greater non-performing loans. Banks that grow quickly extend loans that perform worse than the loans of other banks (Fahlenbrach et al., 2018). This is explained by factors linked to: 'disaster myopia' (Guttentag & Herring, 1984) and banks neglecting tail risk (Gennaioli et al., 2012); extrapolative expectations (Barberis et al., 1998); and this-time-is-different thinking (Reinhart & Rogoff, 2009). When market measure of bank performance used to assess the default risk probability with more loan growth results suggest that default risks abate when credit growth becomes rapid. However, both country- and bank-level corruption can hamper performance and mitigate the benefits of higher loan growth. Bank and country-level corruption affects lending differently relative to a

Table 1
Summary of variable definitions and descriptive statistics.

Variable (Acronym)	Description	Sources	Mean	S. Dev	Median	Min	Max
Bank Performance							
ROA	Bank return-on-assets measured as net income after tax divided by total bank assets	Bank Scope	0.008	0.012	0.008	−0.0513	0.047
Z-score	Natural logarithm of one plus the sum of return-on-assets and the equity-to-assets ratios of bank *i* at year *t* divided by the standard deviation of return-on-assets for the same bank. A higher score indicates a lower bank insolvency risk, or alternatively speaking, a higher degree of financial stability.	Bank Scope and authors' own calculation	7.900	0.083	5.100	0.000	31.700
Non-Performing Loans NPL	Measured as total impaired loans to net loans	Bank Scope and authors' own Calculations	0.024	0.030	0.012	0.001	0.118
Distance to Default DD	The possibility of bankruptcy using Merton's (1974) estimation. Where bank equity is viewed as a call option on the assets of a bank.	Bloomberg, Bank Scope and authors' calculations.	2.984	4.484	1.206	−0.457	17.090
Loan Growth							
Annual growth Rate LG	Percentage change in the amount of bank i's total customer loans from the year t-1 to year t.	Bank Scope and authors' own calculation	0.073	0.123	0.053	−0.116	0.391
Abnormal loan growth rate ALG	Defined as the difference between bank *i*'s loan growth rate and the median loan growth rate of all banks in the same country and year. This approach permits us to control for the macroeconomic and competitive conditions in each country and year when calculating loan growth.	Bank Scope and authors' own calculation	0.019	0.123	0.000	−0.170	0.336
External loan Growth ELG	A variable that takes the value of 1 if bank i's total equity increases by more than 30.0%, which represents the 95%-quantile of the equity growth rate distribution. Zero otherwise.	Bank Scope and authors' own calculation	0.054	0.14	0.037	−0.25	0.57
Mortgage Loan Growth MLG	Percentage change in the amount of bank i's mortgage loans from the year t-1 to year t	Bank Scope and authors' own calculation	0.077	0.155	0.048	−0.152	0.485
Consumer Loan Growth CLG	Percentage change in the amount of bank i's consumer loans from the year t-1 to year t	Bank Scope and authors' own calculation	0.083	0.253	0.045	−0.314	0.717
Corporate Loan Growth CORLG	Percentage change in the amount of bank i's corporate loans from the year t-1 to year t	Bank Scope and authors' own calculation	0.037	0.186	0.008	−0.256	0.523
Other Loans Growth OLG	Percentage change in the amount of bank i's loans other than mortgage, consumer and corporate from the year t-1 to year t	Bank Scope and authors' own calculation	0.106	0.269	0.057	−0.299	0.831
Corruption							
Corruption Index CI	Transparency International's Corruption Perception Index score indicates the perceived level of prevailing country-level corruption on a scale of 0–10, with a higher score suggesting greater economic and political integrity.	Transparency international, corruption perception index	6.602	1.780	7.300	2.600	8.600
Adjusted corruption MCPI	Is an index constructed as CIj,t/(Average(CIj,t)). It is interpreted as the corruption index of country j in year t relative to the average index of all countries in that year. A higher score implies the country is relatively more corrupt than a typical country.	Corruption perception Index	0.978	0.506	0.758	0.422	2.140
Control of Corruption COC	The Control of Corruption sub-index in the World Bank's Worldwide Governance Indicators (WGI). The index ranges from −2.5 to 2.5 with a higher value suggesting lower corruption. We use 0 deducted by this index and so the measure increases with the severity of corruption.	World Bank's WGI and authors' own calculation	1.157	0.803	1.342	−0.741	2.023
Bank Lending Corruption BLC	Is the corruption of bank officials and takes a value from 1 to 4, no obstacle (1), a minor obstacle (2), a moderate obstacle (3) or a major obstacle (4) to companies do business. Beck (2006) and Barry et al. (2015)	World Business Environment Survey (WBES)	1.515	0.181	1.505	1.158	1.989
Instrumental Variables:							
latitude	The country-level absolute value of the latitude	La Porta et al. (1999)	0.429	0.131	0.422	0.111	0.667
Ethnic fractionalization	The probability of two randomly selected persons not speaking the same language in a country	La Porta et al., (1999	0.163	0.100	0.209	0	0.376
Control Variables							
Banks Specific							
Bank Size SIZE	The logarithm of total bank assets	Bankscope	5.358	0.666	5.226	4.436	7.054

(*continued on next page*)

Table 1 (*continued*)

Variable (Acronym)	Description	Sources	Mean	S. Dev	Median	Min	Max
Capitalization ETA	The equity-to-total assets ratio	Bankscope	0.154	0.136	0.110	0.041	0.611
Bank efficiency CIR	Cost-income ratio	Bankscope	0.690	0.151	0.677	0.431	1.014
Liquidity ratio DTA	Deposits-to-total assets	Bankscope and authors' own calculation	0.921	0.403	0.859	0.305	2.010
Bank Type BT	A dummy variable for each bank type capturing specialization effects. This variable takes the value of one if the bank is Islamic and zero otherwise.	Bankscope and authors' own calculation	0.985	0.120	1.000	0.000	1.000
Assets Diversity AD	$1 - \lvert$(net loans− other earning assets)/total earning assets$\rvert$, where other earning assets include securities and investments, and total earning assets include net loans, securities, and investments	Bankscope and authors' own calculation	0.618	0.268	0.676	−0.033	0.959
Industry and Macroeconomic							
Bank Competition BC	A measure of banking system competition using the Lerner index It is defined as the difference between output prices and marginal costs (relative to prices). Prices are calculated as total bank revenue over assets, whereas marginal costs are obtained from an estimated translog cost function with respect to output. Higher values of the Lerner index indicate less bank competition. Lerner Index estimations follow the methodology described in Demirgüç-Kunt and Martínez Pería (2010). Calculated from underlying bank-by-bank data from Bankscope.	Financial Development and Structure Dataset	142.600	58.690	170.200	25.920	197.700
Bank Concentration CON	Assets of three largest banks as a share of assets of all commercial banks in a country.	Financial Development and Structure Dataset	44.520	20.440	35.410	23.080	88.610
GDP Growth GDP	Country Real GDP per capita	World Economic Indicators	2.202	2.072	2.426	−2.776	6.590
Inflation INF	Percentage change in the Consumer Price Index	World Economic Indicators	2.613	2.219	2.270	−0.356	8.991
Supervisory Strength REG	Dummy variable that takes the value of one for a country if the index of Supervisory Strength is greater than the cross-country median, and zero other wise	Bank regulation and supervision database (The World Bank 2003)	0.694	0.461	1.000	0.000	1.000
Government ownership	The assets share of banks that are more than50% controlled by the government in 2010	Cull et al. (2017)	0.217	0.152	0.220	0	0.440
Foreign ownership	The assets share of banks that are more than50% controlled by the government in 2010	Cull et al. (2017)	0.253	0.219	0.180	0.0800	0.850

country's level of economic development. Corruption in general and Bank-level corruption influences bank performance in both developed and developing countries. Country-level corruption has less effect on banks in developing countries. The reason could be that banks in developing countries have managed to incorporate corrupt practices into their normal ways of working so it is considered a standard feature of business activity and so has only limited influence on performance. When the aggregate loan growth has been decomposed to represent corporate, mortgage and consumer loans, corporate lending is most influenced by corruption. The study also considers bank business model (bank type, BT, Islamic or conventional), banking system features (competition, BS, concentration, CON) and a supervisory regulation variable (bank regulation, BR). Results show that corruption has less effect on loan growth performance for Islamic banks relative to conventional banks. It could be that the religious features and lending constraints of Islamic banks mitigate the adverse impact of corruption. In addition, the study finds that greater bank competition, market concentration and improved regulatory environments reduce the influence of corruption on bank lending and performance.

The remaining sections in this paper are organized as follows: Section 2 reviews the previous studies. Section 3 summarizes the data and methodology. Section 4 explains the empirical results and finally section 5 concludes.

2. Literature review

2.1. Bank lending and performance

Bank lending and credit market development can have a positive influence on economic development. Endogenous growth theory assumes a positive influence of financial deepening and loan growth on economic activity over the long-run (Bencivenga & Smith, 1991). Although various studies confirm this influence, such as Bekaert et al. (2002) and Mishkin (2001), other studies show that credit booms generally end poorly and are followed by adverse economic performance (Baron & Xiong, 2017). Earlier work by Keeley (1990) on bank lending behavior over the business cycle notes that periods of rapid loan growth tend to precede periods of high loan-losses. Bikker and Metzemakers (2005) examine the relationship between loan-loss provisions of banks in OECD countries over 1991–2001 and find a negative link between GDP growth and loan-loss provisioning. They also find a positive relationship between provisioning levels and lending growth.

Various explanations have appeared in the literature to explain the link between loan growth and loan-losses. First, some studies emphasize variations in bank credit policies and procedures as the main reason for loan-losses. As noted by Demsetz et al. (1997) variations in credit policies may cause agency problems. For instance, when management compensation is tied to target return-on-equity this can encourage higher risk-return activities promoting more rapid loan growth. Second, tougher competition in the financial system may motivate bank managers to sacrifice loan quality to compensate for declining profitability. Lower loan quality likely increases future non-performing loans but promotes spontaneous short term loan growth. Third, since managers are judged relative to their peers, herding behavior may exist (Ragan, 1994). This may help explain why bank managers decide to finance negative NPV projects with high probability of default during credit expansion periods. Borio (2009) and Alessi and Detken (2011), for instance, find that loan growth is a leading indicator of a financial crisis and Igan and Pinheiro (2011) show that during moderate growth periods well-capitalized banks tend to expand credit more than their weaker counterparts, however in boom period's credit growth becomes less dependent on bank soundness. An extensive literature has emerged looking at the build-up to the global financial crises and the impact of (negative) credit shocks, this is too numerous to cover here, for more detailed insight see Bernanke (2018) and Mian and Sufi (2014, 2018).

While there is substantial evidence about the impact of abnormal credit growth on financial stability from a macro perspective there is less evidence from a micro standpoint. Sinkey and Greenwald (1991) look at US bank data during the period 1984–1987 and find a significant positive link between credit growth and bank loan-losses. They suggest that banks suffer from institutional memory loss, forgetting that in the past rapid growth feeds through into future credit losses. This is in-line with Guttentag and Herring's (1984) disaster myopia hypothesis. Berger and Undel (2003) examine the pro-cyclicality of bank lending in the US from 1980 to 2000. They find evidence (as expected) that loan-losses peak when banks have more relaxed credit standards. Fahlenbrach et al. (2018) use data from 223 US banks over 1973 to 2014 to look at the link between stock price performance and bank credit growth. They find banks that experience loan growth in the top quartile of their sample (over a three-year period) have stock that is significantly outperformed by banks with loan growth in the bottom growth quartile. After high growth periods, however, the banks tend to experience lower profitability and higher loan-loss reserves. These findings are consistent with the view that banks, as well as investors, become over optimistic of lending performance in high growth periods. Salas and Saurina (2002) find that the loan growth of saving banks in Spain is positively and significantly associated with loan-losses 3–4 years ahead. Hess et al. (2009) examine data from 32 Australian banks during the period 1980–2005 and find that high loan growth translates into larger credit losses with a lag of two to four years. Foos et al., (2010) use information from 16 major countries and 16,000 banks over 1997 and 2007 to test the relationship between abnormal loan growth, assets risk, profitability and solvency. They confirm that loan growth is a major driver of bank risk. In particular, they find that loan growth reduces capital strength and increases loan-loss provisioning over the subsequent three years. Vithessonthi (2016) examine the link between bank credit growth and non-performing loans for a sample of 82 publicly listed commercial banks in Japan over 1993 and 2013 and find that the relationship between credit growth and non-performing loans varies before and after the global financial crisis (GFC). The link is positive prior to the GFC and then becomes negative thereafter. More evidence of low loan growth as a result of the GFC is presented by Merilainen (2016) who shows that credit growth falls as a result of the GFC and subsequent euro sovereign debt crisis.

So far, we have mainly covered the literature linking bank credit behavior to bank performance in advanced economies. There are a number of studies that examine similar relationships in emerging economies. Tamirisa and Igan (2007) analyze the risks associated

with rapid credit expansion for 217 commercial banks operating in new European member states. They find that high credit growth results in more risky banks and lower capitalized institutions grow the fastest. Amador et al. (2013, p. 26) examine Colombia with a sample of 42 banks and 22 financial corporations over 1990 to 2011. Like in the aforementioned study, they find that abnormal growth leads to greater risks. Another study by Erdinc (2010) uses data from 30 Bulgarian banks over the period 1999 to 2008. Again, they find that rapid credit growth results in increased non-performing loans and a weakened solvency position.

Based on the above, the relationship between loan-growth and bank stability is clear. Studies that look at credit build-up from a macro- and microeconomic perspective argue that rapid credit growth generally results in weakened bank performance in terms of higher loan-losses and an erosion of capital strength. An aggressive bank lending that exceeds the borrower's capability to meet loan obligations can greatly affects performance of banks. High banks risk taking to increase the potential of high risk. Altunbas et al. (2010) argue that banks may underestimate the risk and focus on earning more profits. Therefore, the risk and return of aggressive loan growth has attracted significant attention of previous researchers. Foos et al. (2010), for example, find out that in most major OECD countries, high loan growth has caused greater risks for banks in subsequent years, implying that the implementation of rapid loan growth strategies make banks to face more poor performance.

Some theoretical foundations can explain loan growth and its effect on bank performance. "Herd behavior" theory state that for banks to compete in lending with other banks, they may apply soft credit policy by extending the borrowing limits and relaxing lending conditions. This will increased banks credit risk in their loan investments (Rajan, 1994).

Perception and behavior of banks is another way to interpret loan growth negative effect on bank performance. Guttentag and Herring (1984) argue that although banks could improve performance through fully understanding the markets, economic industries and borrowers' information, but they have limitation in terms of orientation and subjective psychology when underestimating the likelihood of occurrences of low-probability events. Banks may have the necessary information for management and decision-making but tend to be biased interpretation, reinforcing their existing beliefs about the market and borrowers. Borio et al., (2009) state that such issues of awareness and behavior will lead to wrong decisions and cause risks in the process of expanding credit at banks. Agency theory also explains shareholders and bank managers' possible conflict of interest. Bank managers could offer risky strategies (Saunders et al., 1990). While liberalized loan policy and more lending can increase managers' personal benefits, long run risk effect will hamper shareholders wealth. Adrian and Shin (2010) also proposed the link between the collateral value and the poor bank performance. At the period of high loan growth, bank managers depend on collateral value and adversely select borrowers. Less eligible borrowers who originally do not meet the lending conditions will be financed. Therefore, any decline in the collateral value cause banks high risk.

2.2. *Corruption and performance*

Study of the consequences of corruption has a long history in economics and most of this literature links high levels of corruption to reduced economic growth (Mauro, 1996). Corruption is viewed as representing a large obstacle to financial and economic development (Wilhelm, 2002) through the negative influence it has on national saving rates and encouraging capital flight (Swaleheen, 2007).

In theory, corruption may have a strong effect on firms' performance. Higher corruption inspires the agency problem that is identified in 1976 by Jensen and Meckling, which relies on the separation between ownership and management control. Firms' resources may be abused to pay public officials to reap personal, instead of, firm level benefits. At the same time, direct relationship with public officials may be established. The private relationship between banks' managers and public officials may facilitate short-term advantages for the firm (bank) by accelerating lending and investment activities by the firm as lending corruption is an important agency problem for banks (Jiang ei al., 2018). However, on the long run the ability of the bank to perform well might become a challenge.

Garmaise and Liu (2005) develop a theoretical model to examine the effect of corruption, indicated by dishonest managers and firm profitability and value. They argue that corruption may help mangers to make false reports with misleading investments that reduce firm value and cash flows. In states with high level of corruption, managers have higher advantages to enable them to have more access to information supported with higher control. This is found to put extra pressure on firm value and firms' profit. Further, country and firm level corruption inactivate corporate governance thus increase exposure to systematic risk. Garmaise and Liu (2005) empirically examined the effect of corruption on systemic risk, indicated by beta coefficient. They found that firms' beta increases in more corrupted countries and countries with weak shareholder rights. Lee and Ng (2006) support the previous results to find that country level corruption adversely influences firms' future cash flows, shareholders realized return and firm value. Donadelli et al. (2014) in addition to examining the relationship between agency problem, financial performance and corruption at country and firm level, they examined industry level relationship to find that country corruption negatively affect firm return. This negative relationship between corruption and returns found to be stronger in what defined to be "corruption sensitive industries" with a severe agency problem.

This feeds through into financial instability and reduced investment (IMF, 2016). The World Economic Forum's 2016 Global Risk Report ranked the failure of national governments (including their ability to tackle corruption) as the sixth highest global risk. In addition, the aforementioned report notes that corruption appears to trouble economies at all stages of economic development and is becoming a bigger problem in the developed world. Using census data for Swedish manufacturing firms, Thede and Gustafson (2017) found that corruption affect firms' investment decisions. In addition, corruption affect international trade (Musila & Sigue, 2010; Thede & Gustafson, 2012).

Generally, corruption arises from the "abuse of public office for private gain" and may extend to "prevent the lawmaking process itself" IMF (2016). Corruption can adversely affect lending to poor and non-influential people (Barth et al., 2007) and discourage banks from extending credit (Weill, 2009). La Porta et al., (1997) seminal work was the first to highlight the importance of legal institutions

and good governance in protecting banks in the case of loan default, where loan contracts could be enforced. With less corrupt legal institutions, a bank can smoothly force repayments, grab collateral or proceed to some legal actions that apply an influence on its lending behavior to enforce claims against defaulting borrowers. Improved legal protection also for loan holders can increase the level of lending (Djankov et al., 2007; Levine, 1998, 1999; Qian & Strahan, 2007).

Corruption takes place in banks when senior managers/executives (or even loan officers) receive bribes to grant loans that otherwise would unlikely be granted. The traditional view is that corrupt bank officials do not maximize social welfare, instead they maximize their own private benefits consistent with the "political/regulatory capture view"[2]. Lien (1990) finds that bribery can cause resource allocation inefficiency. Firms that pay bribes face: higher time and capital costs (Kaufmann & Wei, 1999); a lower potential to maintain quality (Paunov, 2016); and become less involved in monitoring company investment (Chen et al., 2015). Consequently, corruption increases credit risk as loan portfolio quality deteriorates (Goel & Hasan, 2011; Park, 2012). Chen et al. (2015) examine the effect of corruption on 1200 banks across 35 emerging economies during the period 2000 to 2012. They find evidence of the "sand in the wheels" view in which banks increase their risk tolerance in countries with higher levels of corruption. In a recent study, Asteriou et al. (2021) examined the effect of corruption in addition to a number of institutional factors on bank profitability and stability using a sample from 326 banks from the 19 Eurozone countries over the period 2005–2018. The study concludes that corruption and transparency have a negative effect on bank profitability and stability.

Using international dataset, Park (2012) assessed the effect of corruption on bank soundness to find that corruption motivate banks to extend funds to bad projects that scale up bad loans in the banking sector inducing higher risk accompanied with lower profitability. Consequently, corruption reduces banks soundness. Additionally, Park, 2012 found that corruption played a major role in the Asian and global financial crises.

As mentioned earlier, there is another strand of literature that advances an opposing view noting that corruption helps "grease the wheels" of economic activity. In countries where institutions and governance structures are weak, corruption may help by-pass bureaucratic processes leading to more efficient loan-contracting and aiding economic development (Aidt, 2009 and Meon & Sekkat, 2005). An interesting study by Chen et al. (2013) find such evidence where bribery, rather than firm performance, determines the extent to which Chinese private firms access bank credit. They note that companies with better economic performance tend to be granted larger loans and these pay more in terms of bribes.

Lalountas et al. (2011) argue that corruption in countries with high-risk averse banking sectors can increase bank lending and bank profitability but only on the short run. However, on the long run non-performing loans due to less eligible credit holders may increase risk and eventually raises borrowing cost for the bank and the new customers.

On balance, however, there is stronger evidence in the literature on the "sand in the wheels" compared to the "grease the wheels" viewpoint.

Jiang et al. (2018) propose a "protection against risk" hypothesis to explain the effect of corruption on loan growth. Under this hypothesis banks in countries where bribing bank officials is common, lending policies will be tightened because lenders have greater pre-contracting expectations that corruption at the bank official level will increase costs. This encourages policy makers to tighten lending conditions and strengthen institutional factors resulting in lower loan growth.

Previous literature also finds various institutional factors that help mitigate banking sector corruption. For instance: improved bank supervisory policies; higher transparency and information sharing about borrowers; and heightened media reporting on bribery cases can help to mitigate corruption. Barry et al. (2016) test whether bank-lending corruption is influenced by bank regulatory environments and the country level of economic development. They find that a stronger supervisory regime and a higher quality of external audits, limits bank lending corruption for family-owned and other types of banks. Akins et al. (2017), examine the effect of regulating timely loan-loss recognition on lending corruption using a large set of World Bank individual banking data for 44 countries. They find that greater transparency and more timely recognition of loan-losses tends to reduce the influence of corruption. In addition, Imam and Kpodar (2015) find that the quality of institutions is linked positively to economic development, suggesting that weaker institutions and (therefore greater corruption) have the opposite effect.

Toader et al. (2018) examined large sample of 26,865 banks in 40 developing and developed economies for a period of 26 years to find that lower credit losses in banks are linked with less country corruption. Ho et al. (2019) analyzed the role of investors' protection to reduce the impact of corruption on bank stability.

From the previous set of literature, it can be concluded that the role of corruption in influencing bank lending, profitability and stability relationship is fundamentally an empirical issue with the consensus being that greater corruption is likely to have a negative impact on lending growth on bank profitability and stability.

3. Model specification, variables and data sample

3.1. Model specification

In order to investigate whether corruption has any mitigating impact on bank lending and performance, we estimate a number of models using three groups of variables relating to bank performance, loan growth and measures of corruption. In addition, we also include a broad set of variables to control for bank- and industry-specific effects as well as for various macroeconomic factors. Spe-

[2] For more details about this view see Beck et al. (2005).

cifically, we investigate whether corruption influences loan growth (model 1) and whether loan growth or corruption (and their interaction) influence bank performance (model 2):

$$LG_{b,i,t} = \alpha_0 + \gamma LG_{b,i,t-1} + \eta COR_{i,t} + \delta X_{b,i,t} + \lambda_t + \mu_b + \varepsilon_{b,i,t} \tag{1}$$

Where $LG_{b,i,t}$ denotes bank loan growth for bank b operating in country i in year t; COR_{it} is the country i corruption indicator (bank loan official and country indicators) in year t. $X_{b,i,t}$ is a vector of bank-level control variables for bank b at year t and selected measures of industry and macroeconomic variables that affect bank performance. λ_t and μ_b are year and bank fixed effects, respectively. $\varepsilon_{b,i,t}$ is the error term assumed to be independent for each i over all t. And:

$$\begin{aligned} y_{b,i,t} = {} & \alpha_0 + \lambda y_{b,i,t-1} + \beta_1 LG_{b,i,t} \times COR_{it} \\ & + \gamma LG_{b,i,t} + \theta LG^2_{b,i,t} + \Gamma COR_{i,t} + \delta' X_{b,i,t} \\ & + \lambda_t + \mu_b + \varepsilon_{b,i,t} \end{aligned} \tag{2}$$

Where $y_{b,i,t}$ is the performance measure for bank b operating in country i in year t, $y_{b,i,t-1}$ denotes performance for bank b operating in country i in period $t - 1$ (capturing the persistence of the dependent variable). We also consider the possibility of a nonlinear relationship between loan growth and bank performance by including the squared-term LG^2_{it}.

Positive and significant values of coefficient η in model (1) indicate higher lending in countries that are more corrupt. In other words, this finding would support the "grease the wheels" hypothesis; corruption may enhance the chance of giving loans and motivate bank officials to lend in order to reap personal benefits. γ in equation (2) measures the effect of higher loan growth on bank performance. η, in equation (2), indicates the direct effect of corruption on bank performance. If loan growth increases (decreases) bank performance in more corrupt banking system, the coefficient β_1 in equation (1) should be positive (negative) and statistically significant. Therefore, a significant coefficient of β_1 in equation (2) indicates the moderating effect of country and bank-level corruption on the loan growth/bank performance linkage. If corruption weakens (strengthens) in the country, a positive (negative) effect of credit growth on bank performance would be expected highlighting the grease- (sand-) in-the-wheels hypothesis. We expect a positive (negative) association between loan growth (corruption) and bank performance. To summarize, the effect of loan growth on bank performance is provided by the coefficient γ; the effect of corruption on bank performance is indicated by the coefficient η; and the interaction effect of corruption and loan growth on bank performance is tested through coefficient β_1.

This study further decomposes total loan growth (LG) into four types, namely, mortgage (MLG), consumer (CLG), corporate (CORLG), and other loan growth (OLG).

So:

$$y_{b,i,t} = \alpha_0 + \sum_{j=1}^{4} \beta_j \left(LG_{b,i,t}\right) \times COR_{i,t} + \sum_{j=1}^{4} \gamma LG_{b,i,t} + \eta COR_{i,t} + \lambda y_{b,i,t-1} + \delta' X_{b,i,t} + \lambda_t + \mu_b + \varepsilon_{b,i,t} \tag{3}$$

Where β_j indicates the effect of each type of loan growth has on bank performance with varying levels of corruption.

Our model set-up includes a number of control variables. We include banking system variables (bank competition, concentration), policy variables (bank regulation) as well as for different business models (Islamic or conventional banking). We suggest that banks faced with high competition or a concentrated market structure operating in a country with strong regulatory quality should be able to, at least partially, reduce the negative effects of corruption when loans are growing (Fue et al., 2014; La Porta et al., 1999),

$$\begin{aligned} y_{b,i,t} = {} & \alpha_0 + \beta_1 LG_{b,i,t} \times COR_{i,t} \times Factor_{i,t} + \gamma LG_{b,i,t} + \eta COR_{i,t} + \lambda y_{b,i,t-1} + \delta' X_{b,i,t} + \\ & \lambda_t + \mu_b + \varepsilon_{b,i,t} \end{aligned} \tag{4}$$

In equation (4) we introduce a triple interaction term between loan growth, corruption, and various other factors. The idea for this test follows from the premise that if there were still unobserved forces biasing our estimates in equation (3), these would be more potent in countries where banking systems are relatively more concentrated, competitive, regulated and focus on Islamic or conventional banking. In this case, the coefficient on the triple interaction term would be statistically and economically significant. Essentially, this is a placebo test that seeks to confirm or reject the findings derived from Equation (3).

To estimate our models we follow previous studies and estimate a series of panel models (as in Jha, 2019; Ding et al., 2018; Deli & Hasan, 2017 among many others). In particular, we use Dynamic Panel GMM estimation techniques to control for possible estimation bias caused by residual autocorrelation in addition to dealing with various endogeneity issues and omitted variable bias (Dima, 2014). Endogeneity may occur due to possible reverse causality between banks and corruption. Jha (2018), for example, found that banking sector could play a role in reducing corruption.

We adopt the Blundell and Bond (1998) set-up. We use the two-step estimator with adjusted standard errors with the Windmeijer's (2005) correction procedure. The two-step system GMM methodology applies moment conditions in which lagged differences are instruments for the levels equation. It has been argued that the system GMM produces more efficient output relative to the one-step GMM (see Baltagi, 2005).

In estimating the system GMM, corruption measures are taken as endogenous variables in all models. We also take into account bank-level fixed effects and control for time-specific effects relating to business cycle fluctuations. As argued by Soedarmono et al. (2017), the system GMM estimation is valid, as long as both of AR (2) and Hansen-J tests are not statistically significant. These tests confirm second-order autocorrelation among residuals of the first-differenced equation, and that the identifying restrictions in

dynamic panel data models are valid, respectively. In all of our models, both conditions are applied. In order to check the robustness of our results, we provide a number of alternative specifications of the base model.

3.2. Variable construction and description

The following explains the rationale for the choice of variables used in the above models. All variables are listed in Table 1 and explained as follows:

3.2.1. Loan growth

In-line with the established literature (Foos et al., 2010; Niu, 2016), loan growth is simply calculated as the percentage change for bank *i* total customer loans from the year *t-1* to year *t*. The data are collected from the Bankscope database. In particular, a measure of total customer loans includes credits to consumers, mortgages, corporates and other loans (inter-bank lending is not included) (Foos et al., 2010). Marcucci and Quagliariello (2009) and Bonfim (2009) argue that the impact of bank loan growth depends on the relative growth rate compared to competitors. As such, we extend our analysis to include two more measures. First, abnormal loan growth rate (ALG) is defined as the difference between bank i's loan growth rate and the median loan growth rates for all banks in the same country and year. This adjustment allows for comparison between banks as well as controlling for country-specific economic and competitive effects. To distinguish between the effects of each type of loan growth we further decompose total loan growth into four types, namely, consumer, mortgage, corporate and other loans.[3]

We also follow Foos et al. (2010) and extend our analysis by distinguishing between internal and external growth (ELG). We assume that a bank may expand beyond internal (or organic) growth as it may grow via takeover or merger. To deal with this we construct a variable that takes the value of 1 if bank i's total equity increases by more than 30% (corresponding to the 95% percent of the equity growth rate distribution). Otherwise, the value of the external growth variable is 0. The assumption is that a bank's equity is unlikely to grow by more than 30% from retained earnings over a year so any large increase is indicative of acquisition or merger activity.

Table 1 shows the aggregate annual loan growth of 7.3%, close to what has been reported in previous studies (see for example Deli & Hasan, 2017, who report 8% loan growth for a sample of 125 countries). Average loan growth rates for the various type of credit are as follows: mortgages (7.7%), consumer (8.3%), corporate (3.7%) and other loans (10.6%). Among the specifically defined loan types, consumer loans have the highest average growth and are also the most variable.

3.2.2. Bank performance

We use several accounting and market-based measures to assess bank performance (profitability and risk). We measure profitability for each bank using the return on assets computed as the ratio of net income to total assets (ROA). ROA is recommended by previous literature (Saghi-Zedek, 2016) in examining bank profitability (compared to return-on-equity, ROE) as it is less susceptible to bias due to leverage.

The Z-scores of individual banks in each country are also used as a performance indicator. The Z-score measures the number of standard deviations that a bank's return on assets can decrease in a single period before it becomes insolvent. Thus, a higher Z-score indicates a lower probability of insolvency (Bertay et al., 2013). Z-score is calculated as:

$$Z_{it} = \frac{(ROA_{it} + E/A_{it})}{\sigma_{ROA\,it}}$$

Where ROA is the return on assets, E/A_{it} is the shareholders' equity divided by total assets, $\sigma_{ROA\,it}$ is the standard deviation of the return on assets estimated using a three-year window. Because the Z-score is usually highly skewed, we follow Dima et al. (2014) and rescale the Z-score in order to display a zero mean and unit variance. We apply the natural logarithm to (1+ Z-score) to smooth higher values (Beck et al., 2013). 1+ Z-score is used in place of using only Z-scores to avoid the truncation of the Z-score at zero. We denote ln (1+ Z-score) as the Z-score in the latter part of the paper for brevity. We also employ another indicator of banks' accounting based credit risk, namely, Non-Performing Loans (NPL) measured as the fraction total impaired loans to net loans (Ahamed & Mallick, 2017; Goretti & Souto, 2013).

Although the ROA, Z-score, and NPL are widely used measures of profitability and risk in the banking literature, they still rely on backward looking accounting values and suffer from possible earnings management. As such, any analysis of bank performance should be complemented (where possible) with market-based measures.

To estimate a market-based performance variable we consider bank market value and volatility. We estimate bank volatility using Merton's (1974) Probability of Default (PD) model. A country's banking system PD is a weighted average of the PD of a country's individual banks. This model is widely used in the finance literature (see Duffie et al., 2007; Fue et al., 2014; Kabir et al., 2015; Abuzayed et al., 2018). The distance to default (DD) measure assumes that equity holders are residual claimers. They can claim their invested value after meeting all banks' debt obligations. The main assumption of the model is that equity is a call option on the assets of a bank. The strike price equals the face value of the liabilities at time *T*. If the value of the assets is more than the face value of debt, equity holders will decide to exercise their option. In contrast, if the call option is out of the money and expires this will mean the company will be bankrupt. The below is used to approximate PD:

[3] Loans extended to public officials and government have been excluded due to limited data.

$$PD = N\left(-\frac{\ln\left(\frac{V_A}{D}\right) + \left(r - \left(\frac{\sigma_A^2}{2}\right)\right)T}{\sigma_A\sqrt{T}} \right)$$

Where, PD is the probability of default, N ( ) is the cumulative normal density function, V_A is the value of assets, D is total debt, r is the expected return and σ_A is assets volatility. T is the time of expiration assumed as one year; r is the expected return calculated using the bank return over the previous period. Following Baharath and Shumway (2008) and Fue et al. (2014) negative expected returns are replaced by the country risk free rate. The standard deviation of assets is the weighted average of the standard deviation of debt and equity estimated using the below equation:

$$\sigma_D = 0.05 + 0.25 * \sigma_E$$

$$\sigma_E = \sigma_{rt} * \sqrt{N}$$

Where, σ_E is the standard deviation of daily stock returns and N is the average number of trading days in the year. The larger the DD (distance to default) the greater is the distance of a bank from the default point and the lower is the PD.

Following Due and Sue (2007), we measures the Default by the number of standard deviation distance to default (DD) is calculated using the below equation:

$$DD = \frac{LN\left(\frac{V_A}{D}\right) + \left[r - \left[\frac{\sigma_A^2}{2}\right]\right]T}{\sigma_A\sqrt{T}}$$

Where the log value of the ratio deviates from its mean before the bank default.

It is worth noting that while previous literature argues that DD provides a better predictor of the probability of default than the Z-score (Gropp et al., 2006) both measures assess solvency risk. They both link volatility in returns to default. Table 1 reports the descriptive statistics for both the accounting and market performance measures. While Z-score varies between 31 and zero for risky banks its average value is7.[4] This value indicates that, on average, profits have to fall seven times their standard deviation to eat up all bank equity. The average DD for all banks in the sample is around three which suggests that default within a year on average is a three standard deviation event, assuming that the variation of the market value of assets follows a recent historical value and using the current market value of assets as a starting point. DD values vary from −0.5 to 17 with a high standard deviation of 4.48. It is worth noting that a negative or zero value of DD does not mean that the bank has failed at this point. Instead, it signals that the bank needs to liquidate assets in order to repay any short-term debt expected to be covered within a year. This will increase the likelihood of bank failure unless asset values improve. The mean (median) values for ROA are 0.8% (0.30%) with a standard deviation of 1.2.[5]

3.2.3. Corruption

Corruption is measured using both country- and bank-level indicators. We use two measures as corrupt institutions outside the banking sector may encourage or direct banks to lend to non-credit worthy customers even though bankers themselves maybe relatively incorrupt (Chen et al., 2015). Our first country level corruption measure is derived from the Transparency International Corruption Perception Index (CPI), a frequently employed measure in the literature (Mo, 2001; Adit 2009; Chen et al., 2015). The CPI indicates public sector corruption levels based on a scale from 0 (highly corrupt) to 10 (very clean).[6] Following Park (2012), we use 10 minus the CPI so that higher values reflect more country level corruption:

$$CI = 10 - CPI$$

Lambsdorff (2008), however, suggests that the CPI should not be employed for year-to-year comparisons since a country's CPI value may vary because of relatively minor changes in the way in which Transparency International constructs their data. As such it is suggested that an adjusted CPI is used that indicates relative corruption:

[4] Previous studies tend to report lower values of Z-score for banks operating in emerging markets (Chen et al., 2015, for 35 emerging markets finds an average Z-score of 3.2 and Lee et al., 2014 report a value of 4.4 for a sample of 29 Asian Pacific countries). However, Forssbaeck and Shehzad (2011) report a Z-score of 10 for a sample of European banks. These findings generally support the view that emerging markets face, on average, greater solvency risks.

[5] ROA values are slightly lower than the profitability figures found for Asian Pacific banking (0.99%) but similar to that for Australian banks (0.80%), see Lee et al. (2014).

[6] Recently Transparency International uses a scale of 0–100, with 0 indicating high levels of corruption and 100 low levels.

$$MCPI_{i,t} = \frac{CI_{j,t}}{\sum_{j=1}^{n} CI_{j,n} \Big/ n}$$

CPI in country *j* in year *t* is divided by the mean of CPI indices across all countries for each year that we denote as the adjusted-CI (MCPI). To recall, our analysis focuses on 160 countries and 117,666 bank country year sample. Table 1 shows that the MCPI values vary from 2.6 (for UK, the least corrupt country) to 8.6 (for Venezuela, the most corrupt).

For an alternative indicator of country level corruption, we also follow Kaufmann et al. (2010) and from the World Bank's Worldwide Governance Indicators (WGI) use the sub-index of Control of Corruption (COC).[7] The index value ranges from −2.5 to 2.5. A higher value in COC indicates less corruption. COC for the sample of countries is on average 1.16 with the lowest value (most corrupt) of −0.74 reported for Venezuela and the least corrupt country being the UK with a value of 2.02..[8]

In order to consider bank-level corruption we use a measure of bank lending corruption collected from the World Business Environment Survey (WBES) - a survey conducted by the World Bank in 1999 on 10,032 firms from 81 countries which analyzed managers' perception of 'actors' that ease or restrain firms' performance and growth. The survey includes questions on the extent to which corruption in bank lending represents an obstacle to firms. Following Beck et al. (2005), the level of bank lending corruption is measured with a variable taking values from 1 to 4, depending on the answers provided by sample firms in each country to the following question: "Is the corruption of bank officials an obstacle for the operation and growth of your business?". An answer of 1 indicates no obstacle, 2 a minor obstacle, 3 a moderate obstacle, and 4 a major obstacle. Firms responding to the survey are anonymous which minimizes the response bias expected due to firms concerns about indicating being engaged in bribery with bank officials. WBES covers 81 countries but for our analyses, we only consider 59 where we have related bank-specific variables. Table 1 shows that WBES indicates that the UK (low score of 1.16) has the least corrupt bankers with Egypt reporting the highest level of lending corruption (score of 2 overall).

3.2.4. Control variables and other factors

Following the established literature (see Lee et al., 2016; Abuzayed et al., 2018; among others) we control for a set of bank-specific, industry and macroeconomic determinants of bank performance so as to isolate the effect of loan growth and corruption. In particular, the bank-specific variables we include are: size ($SIZE_{i,t}$), measured as the log value of each bank's total assets in each year; capital strength ($ETA_{i,t}$), total equity to total assets; bank liquidity ($DTA_{j,t}$) measured as deposits to total assets, and bank efficiency ($CIR_{i,t}$) the cost-income ratio for bank *i* in each year *t*.

In addition, we also include an assets diversity factor (AD) to capture variation in bank credit strategies across countries. Here we use the breakdown of bank assets into loans and other earning assets and create the following diversity index:

$$\mathrm{AD} = 1 - \left| \frac{NL_{itj} - OEA_{itj}}{TEA_{itj}} \right|$$

Where NL_{itj} is bank *i* net loans at time *t* in country *j*. OEA_{itj} is the other earning assets which includes securities and investments and other earning assets except loans. TEA_{itj} are total earning assets – simply the sum of net loans and other earning assets. Asset diversity takes a value of between 0 and 1 in which 1 designates full diversification and 0 a fully loan concentrated bank. The study also controls for macroeconomic factors including growth in GDP per capita and inflation (INF), as banks located in faster growing countries and more stable monetary environments are expected to have improved performance. As our sample also includes both Islamic and conventional banks we include a dummy variable to reflect the two different bank types (BT) – this takes the value of one if the bank is Islamic and zero otherwise. In addition, we also control for banking market competition using the Lerner Index (BC). BC for each banking system in each year is collected from the Financial Development and Structure Dataset following the methodology of Demirgüç-Kunt and Martínez Pería (2010) and calculated by Beck et al. (2016),.[9] Higher values of the Lerner Index indicate less bank competition. Additionally, we include a bank concentration (CON) variable measured as assets of three largest banks as a proportion of total commercial banking sector assets. According to the structure conduct performance hypothesis (SCP), more concentrated banking system with few banks lead to higher prices and greater profit levels (Bain, 1951), which may encourage banks to take-on greater risks. On the other hand, bank competition may enhance corruption (Badinger & Nindl, 2014). Also the regulatory environment is expected to influence bank performance as this can enforce stronger governance and other rules (Stigler, 1971). Following Barry et al. (2015) we

[7] This index uses an unobserved components model instead of the average of the results of various surveys. See Kaufmann et al. (2010) for more detail about the methodology used to calculate the COC index.

[8] Data for 102 countries are only available in the World Bank data set for COC, therefore the sample is reduced when COC is used as a corruption indicator.

[9] Beck et al. (2016) defines the Lerner Index as "the difference between output prices and marginal costs (relative to prices). Prices are calculated as total bank revenue over assets, whereas marginal costs are obtained from an estimated translog cost function with respect to output". See http://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database for more details about the calculation of the index.

construct an index that reflects the strength of supervisory regime drawn from the World Bank's 2003 Bank Regulation and Supervision Database. The estimated index value ranges from zero to ten, and covers areas linked to capital stringency and powers to intervene in and resolve troubled banks. The responses to ten (yes/no) type survey questions are coded to take the value of one and zero for each response respectively[10]. The higher the value for the supervisory regime the stronger the regulatory environment (REG). All descriptive statistics for the abovementioned control variables are in Table 1.

3.3. Data

This study analyzes yearly balance sheet and income statement data collected from Bankscope for a maximum of 11,350 banks from 190 countries over the period 2000–2016. The data we start with for all countries and years comprise 192,950 annual observations from 11,350 banks. However, 69,955 observations (some 4115 banks) have been removed because at least one of our key variables (loan growth, corruption, any of the performance measures) are missing. The total number of countries remaining is 160. All accounting data are collected from Bankscope whereas market prices are from Bloomberg.

As already noted, our distance-to-default measure requires market values. In this case, we can only use listed banks and here the sample sizes falls to 778 banks (there are 6458 non-listed banks in our sample). We also moderate the impact of outliers by winsorizing the main financial variables at the 5% and 95% levels.

Table 2 displays the number of banks in our final dataset and compares the sample composition to the total number of banks in each region included in Bankscope. Our sample banks cover no less than 60% of total banking assets per region in most cases. Our sample is an unbalanced panel, with some banks entering the sample after 2000 and others dropping out before 2016.

4. Results

4.1. Loan growth, corruption and bank performance: baseline results

As discussed above, the literature highlights that corruption can influence bank lending behavior and rapid loan growth can have an adverse impact on bank performance (by reducing profits and increasing risk), although more moderate growth can feed through into improved performance. As a first check, we test the effect of different levels of corruption on bank lending and loan growth. Then, we assess the effect of loan growth on bank performance regardless of the corruption level to examine if banks worldwide benefit, in performance terms, from higher loan growth. Table 3-and Table 4 list the results.

Table 3 summarizes the results of the effect of corruption on loan growth in two panels. Each panel uses one indicator of loan growth (percentage change in loan growth, panel A, and abnormal loan growth, panel B). In each panel, model 1 (see above section) has been estimated using three corruption measures reported in three columns (corruption perception index (CPI), control of corruption (COC), and bank lending corruption (BLC)). All results support the view that higher corruption and lower control of corruption can increase bank lending growth. Although the MCPI (Panel A of Table 3) is not statistically significant while the relations between MCPI and all other proxies of bank's performance (NPL, Z-score and DD) are stable and statistically significant.

This result is consistent with Jiang et al. (2018) in which lower corruption is found to moderate loan growth and higher corruption makes loan terms more favorable to lenders.[11]

Table 4 on the other hand, summarizes the results of applying equation (2). It shows the effect of loan growth on bank performance, namely, ROA (panel A), NPL (panel B), Z-score (panel C) and DD (panel D). In each panel, five models are estimated. Results reported in column 1 of each panel reveal that both bank lending and corruption affects performance. When ROA is the dependent variable, our results confirm that more lending increases profitability. However, a non-linear relationship between loan growth and bank profitability is found to exist as the squared loan growth term LG^2 is significant and the opposite sign to LG. This suggests that at higher levels of growth the positive influence of loan growth on bank performance reverses. This non -linear relationship is supported by the loan growth non-performing loans relationship (Fahlenbrach et al., 2018).[12] When banks aggressively increase their lending they experience increases in non-performing loans. This is found in the significant positive LG2 coefficient in panel B model 1. At a higher level of loan growth banks witness greater non-performing loans. In Appendix A, Table 1 reports the likelihood ratio test and results for the

[10] (1) Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank? (2) Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse? (3) Can supervisors take legal action against external auditors for negligence? (4) Can the supervisory authority force a bank to change its internal organizational structure? (5) Are off-balance sheet items disclosed to supervisors? (6) Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses? (7) Can the supervisory agency suspend directors' decision to distribute: (a) Dividends? (b) Bonuses? (c) Management fees? (8) Can the supervisory agency legally declare – such that this declaration supersedes the rights of bank shareholders – that a bank is insolvent? (9) Does the Banking Law give authority to the supervisory agency to intervene that is, suspend some or all ownership rights in a problem bank? And (10) Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency do the following: (a) Supersede shareholder rights? (b) Remove and replace management? (c) Remove and replace directors? A higher value indicates wider and stronger authority for bank supervisors.

[11] Some may argue that loan growth is a rate variable and is not an integrated variable, meaning that it is not so strongly influenced by its own past values. For robustness, we re-estimate model 1 using 2SLS using instrumental variables. Results hold constant in both estimation (reported in Appendix Table A-6) the reported results confirm that higher country and lending corruption increase bank lending.

[12] Benczur et al. (2019) find a nonlinear effect of bank credit on economic growth.

threshold analysis confirming the non-linear relationship between bank performance and credit growth.

We also find that both credit and solvency risk measures (NPL and Z-score) are linked to loan growth. Again, a non-linear effect is found so for modest levels of credit growth as risks appear to fall but higher rates feed through into greater credit and solvency risk. The non-linear relationship is consistent with Baron and Xiong (2017) and Fahlenbrach et al. (2018) who find that banks that grow quickly extend loans that perform worse than the loans of other banks. This is explained by factors linked to: 'disaster myopia' (Guttentag & Herring, 1984) and banks neglecting tail risk (Gennaioli et al., 2012); extrapolative expectations (Barberis et al., 1998); and this-time-is-different thinking (Reinhart & Rogoff, 2009).

When we consider our market measure of bank performance our findings, however, differ. In Table 4 panel D, loan growth increase the probability of market default (DD) - a significant negative effect is found in all of the models. The non-linear effect of loan growth, in contrast, suggest that default risks abate when credit growth becomes rapid. This result is (to some extent) consistent with the previous literature (Fahlenbrach et al., 2018).

It is worth noting that the inclusion of the interaction term reduces the effect of loan growth on bank performance as follows:

$$\frac{\partial y_{b,i,t}}{\partial LG_{b,i,t}} = \gamma + \beta COR_{it}$$

The interaction term is included to capture the belief that the control of corruption have a mitigating effect on the positive impact of loan growth on a bank's performance. This is can be confirmed by the positive value for γ and a negative value for β. Indeed, we expect $\frac{\partial y_{b,i,t}}{\partial LG_{b,i,t}} > 0$. The sign of interaction term in column (3) of Table (4) remains strongly significant at the 1 per cent level. The magnitude of the coefficient for the loan growth term increases in magnitude. Indeed, the effect of loan growth on the bank performance can be decomposed into two components: 1) γ is the effect of loan growth and 2) β is the partial effect as explained by Wooldridge (2010), the partial derivative on $E(y/x)$ with respect to x_j is usually called the partial effect of x_j on $E(y/x)$. The F test for joint significance of LG and LG*CORR yields a p-value of about 0.0001 for all specifications, so the interaction term is needed. So for banks belong to countries with a low level of corruption (MCPI = 0), the estimated effect of loan growth on bank's performance increases by 0.04 (Table 4-Column 3) while for banks belong to countries with a high level of corruption (MCPI>0), the predicted effect of loan growth on bank's performance decreased by 0.23 (0.04–0.017).[13]

Control variables mostly enter the models significantly. Large banks are shown to be less profitable (Table 4 panel A), and witness higher non-performing loans (Table 4 panel B). Size does not seem to be linked to Z-score but for the market measures, bigger banks face lower default risk. (Table 4 panel D). Higher capitalized banks (ETA) also are more profitable and seem to be less risky (for most measures). Bank efficiency measured using the cost-to-income ratio (CIR) is inversely linked to profits and liquidity (DTA). Asset diversity (AD) positively affects bank profitability and reduces non-performing loans, loan-losses and solvency risk (higher Z-score), but it increases the probability of default (lower DD) (see Table 4 panel D). This result is in-line with Abuzayed et al. (2018) who conclude that less than sufficient levels of diversification can increase bank risks.

From the baseline model, it is shown that growth in GDP per capita has no effect on bank profitability and it appears to be positively linked to credit risk (NPL) and distance to default (DD) but negatively linked to bank solvency (Z-score). Higher inflation also seem to have non stable impact on bank profits but feeds through into higher credit risks but more solvent banks (higher Z-score and DD).

4.2. *Corruption, loan growth, and bank performance*

In this part, we also examine the effect of corruption and its interaction with loan growth on bank performance. Table 4 reports the results in columns 2 to 5. First, we estimate the individual effect of corruption on different measures of bank performance (see column 2). As noted before, we use more than one measure of corruption, the country level modified corruption index (MCPI) is shown in models 2 and 3, and bank - lending corruption (BLC) is reported in 4 and 5 from panels A to D.

Bank-lending corruption negatively and significantly affect banks' return on assets. It also has a larger adverse impact on bank profits compared to country-level corruption. The direct impact of lending corruption that is linked to illegal payments to bank officials has a bigger impact compared to broader indirect countrywide institutional corruption. However, both types of corruption significantly increase the level of non-performing loans, loan-losses and (mainly) boost bank risks. Overall, these findings support the "sand-in-the wheels" hypothesis (Beck, et al., 2005) in which greater corruption leads to poorer bank performance.

Interaction variables are introduced to the model and the results are reported in Table 4, columns 3 and 5 in all panels. These variables show the joint effect between each of the corruption measures and loan growth. Results confirm the significant effect of corruption on loan growth and bank performance. This holds in almost all the regressions for both country and bank lending corruption measures. When the joint effect between loan growth and corruption are considered, a significant influence on performance exists. The interaction variable enters all models in an opposite sign relative to the single effect of loan growth indicating the reversal effect of loan growth on bank performance, in countries with higher corruption or when bank officials are more corrupted. Our results are supported by Jensen and Meckling (1976) and Jiang et al.'s (2018) agency cost argument. When corruption is high, the surrounding environment will motivate bank officials to accept bribes increasing their own benefits, but more likely sacrifice bank's owners and investors' interests. Higher loan growth in more corrupt countries, with bank officials more likely to accept bribes results in poorer bank

[13] The authors would like to thank the anonymous reviewer for his/her valuable point regarding the decomposed effect of loan growth on the bank performance.

Table 2
Sample banks.

Country	Total	Listed *Islamic Con*		Unlisted *Islamic Con*		# BS	%	AVG CPI	AVG LG
Developing Economies[a]									
Africa	209	3	25	2	179	336	0.622	2.109	8.522
Asia	555	10	116	5	424	870	0.637	2.394	8.147
Latin America and Caribbean	535	2	57	5	471	827	0.646	2.411	7.263
Economies in Transition:									
South Eastern Europe	35	0	3	0	32	50	0.700	1.636	10.662
Commonwealth of Independent States	243	0	15	1	227	569	0.427	1.712	7.508
Developed Economies									
Europe	1658	12	224	16	1406	2417	0.581	4.321	7.955
Other Countries	4000	19	292	30	3659	6281	0.636	4.197	6.795
Total	7235	46	732	59	6398	11350	0.637		

Source: Authors' own calculations
Please see http://data.worldbank.org/about/country-classifications.
Con is conventional banks. **#BS** is the number of banks in the Bankscope database**. %** is the fraction of banks covered in the data set. **AVG CPI** is the average corruption perception Index. **AVG LG** is the average loan growth.

[a] For countries classification we used the World Economic Situation and Prospects (WESP) in 2014. No significant change on countries classifications has been found during the study period. WESP employs to delineate trends in various dimensions of the world economy. The classification was prepared by the Development Policy and Analysis Division (DPAD) of the Department of Economic and Social Affairs of the United Nations Secretariat (UN/DESA). It is based on information obtained from the Statistics Division and the Population Division of UN/DESA, as well as from the five United Nations regional commissions, the United Nations Conference on Trade and Development (UNCTAD), the United Nations World Tourism Organization (UNWTO), the International Monetary Fund (IMF), the World Bank, the Organization for Economic Cooperation and Development (OECD), and national and private sources. For analytical purposes, WESP classifies all countries of the world into one of three broad categories: developed economies, economies in transition and developing economies. Geographical regions for developing economies are as follows: Africa, East Asia, South Asia, Western Asia, and Latin America and the Caribbean.

Table 3
Corruption and loan growth.

Variables	Panel A LG			Panel B ALG		
Model	**1**	**2**	**3**	**1**	**2**	**3**
Lagged LG	0.651***	0.683***	0.672***	0.631***	0.674***	0.658***
COC	−0.055***			−0.063**		
MCPI		0.047***			0.036***	
BLC			0.102***			0.275**
SIZE	0.146***	0.080***	0.042***	0.083*	0.097***	0.039***
ETA	−2.703***	−1.104***	−0.487***	−0.389***	−0.141***	−0.136
CIR	0.245***	0.243***	0.164***	−0.147***	−0.267***	0.209***
DTA	0.123***	0.353***	0.337***	0.157***	0.361**	0.574***
AD	0.672***	0.981***	0.883***	1.399***	1.430***	1.573***
GDP	0.195***	0.186***	0.105***	0.272***	0.245***	0.106***
INF	0.009	−0.032**	−0.018**	−0.023	−0.058*	−0.047***
crisis	0.597***	0.714***	0.255***	0.883***	0.931***	0.157
Constant	−2.369***	0.989***	−1.288***	−1.450	0.776	−8.532**
Observations	22,192	25,800	23,827	22,200	25,809	23,836
Bank-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Time-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of id	5580	5703	4848	5583	5706	4851
Hansen Test (p-value)	0.415	0.262	0.384	0.436	0.854	0.156
AR2 test (p-value)	0.593	0.432	0.438	0.587	0.498	0.205

This Table reports the results for model 1(see section 3.1). We estimate the effect of three measures of corruption (COC is control of corruption, MCPI is the modified corruption perception index; BLC is the bank corruption index) on loan growth (LG is loan growth; ALG is the Abnormal loan growth). A number of control variables have been included in the analyses. ETA is the equity-to-total assets ratio; CIR is the cost-to-income ratio; DTA is the deposit-to-total assets ratio. AD is assets diversification, GDP gross domestic product, INF is the inflation ratio. Results are stated in two panels A and B. Each panel reports the results using one loan growth measure.
In each panel, three models are estimated and results are reported in columns numbered 1 to 3. Column (1) examines the effect of control of corruption COC on loan growth. Column (2& 3) test the effect of country MCPI and bank level corruption, respectively. In each model, sets of bank specific and macroeconomic variable are added (see Table 1 for variable definitions).
This Table also reports the post estimation results of the second order residual autocorrelation (serial correlation) AR (2) under the null of no serial correlation. Hansen J-test of over-identification is under the null that all instruments are valid. Standard errors are values between parentheses. *Significant at 10%., **Significant at 5%., ***Significant at 1%.

Table 4
Loan growth, corruption and bank performance.

Performance Measure	ROA Panel A					Panel B NPL				
Model	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Lagged	0.597***	0.580***	0.585**	0.559**	0.573**	0.741***	0.743***	0.749***	0.745**	0.758***
LG	0.031***	0.037***	0.040***	0.046***	0.278***	−0.296***	−0.307***	−0.280***	−0.320***	−1.521**
LG^2	−0.180***	−0.214***	−0.041***	−0.171**	−0.032***	0.713***	0.770***	1.544***	0.677***	0.341***
SIZE	−2.098***	−1.837***	−1.450***	−1.389***	−2.075***	1.495	−1.164	2.187**	20.771***	6.919***
ETA	0.127***	0.106***	0.049**	0.263***	0.011	−0.626***	−0.475***	−0.303***	−0.188*	−0.924***
CIR	−0.077***	−0.071***	−0.070***	−0.120***	−0.073***	0.077*	0.050	0.111**	0.181***	0.187***
DTA	−0.033***	−0.025***	−0.018***	0.021*	−0.022***	0.123***	0.057***	0.069***	0.067**	0.234***
AD	0.040***	0.033***	0.038***	0.039***	0.049***	−0.124***	−0.124***	−0.084***	−0.034	−0.211***
GDP	−0.016	0.005	−0.005	−0.047**	−0.026*	0.221**	0.151*	0.164*	0.103	0.367**
INF	0.009	−0.006	0.007	0.073***	0.029*	0.232**	0.013	−0.015	−0.129	0.471***
MCPI		−0.005	−0.006*				0.018***	0.005**		
LG*MCPI			−0.017***					0.064***		
BLC				−0.050***	−0.049**				0.292***	0.395**
LG*BLC					−0.029*					0.352*
Constant	0.168***	0.150***	0.123***	0.815***	0.161***	−0.070	0.101	−0.149*	−10.95***	−0.463***
Bank-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	27,075	25,746	25,746	23,787	23,787	21,334	21,334	19,663	19,663	22,502
Number of id	5694	5686	5686	4836	4836	4490	4490	3783	3783	4502
Hansen Test (p-value)	0.430	0.234	0.388	0.386	0.486	0.498	0.295	0.161	0.093	0.680
AR2 test (p-value)	0.333	0.188	0.186	0.083	0.134	0.176	0.178	0.274	0.134	0.349
Performance Measure	Panel C Z-score					Panel D DD				
Model	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Lagged	0.379***	0.583***	0.584**	0.532**	0.473**	0.741***	0.743***	0.749***	0.745**	0.758***
LG	0.483***	0.232***	0.867***	0.487***	5.764***	−0.117**	−0.162***	−0.103*	−0.140**	−0.130**
LG^2	−1.265***	−0.614***	−0.981***	−1.208***	−0.027	0.416**	0.590***	0.615***	0.520***	0.524***
SIZE	0.999	3.885	0.543	−2.460	−2.684	−0.793***	−0.633***	−0.641***	−0.843***	−0.824***
ETA	−3.371***	−1.135***	−2.880***	−3.248***	−2.292***	−0.002	0.022***	0.021**	0.010	0.008
CIR	−0.679***	−0.565***	−0.714***	−0.690***	−0.921***	−0.001	−0.004	−0.005	−0.013*	−0.012*
DTA	0.285***	0.098***	0.257***	0.240***	0.040	0.001	−0.001	−0.001	0.002	0.002
AD	0.912***	0.502***	0.739***	0.711***	1.062***	−0.003	−0.006**	−0.006**	−0.010***	−0.010***
GDP	−0.955***	−0.192	−0.639**	−0.784***	−1.185***	−0.071	0.070*	0.072*	0.109**	0.035
INF	0.483***	0.232***	0.867***	0.487***	5.764***	0.464**	0.027	0.036	0.009	−0.033
MCPI		−0.146***	−0.077***				−0.007***	−0.011**		
LG*MCPI			−0.906**					−0.046*		
BLC				−0.128***	−0.115***				−0.015***	−0.030*
LG*BLC					−1.148**					−0.05**
Constant	0.738**	0.478**	0.698***	0.732***	1.150***	0.076***	0.080***	0.075***	0.116***	0.095***
Bank-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,412	23,325	23,325	21,528	21,528	1861	1772	1772	1404	1404
Number of id	5454	5442	5442	4636	4636	520	518	518	389	389
Hansen Test (p-value)	0.239	0.300	0.359	0.127	0.268	0.302	0.446	0.416	0.190	0.194
AR2 test (p-value)	0.166	0.170	0.073	0.168	0.170	0.198	0.129	0.112	0.178	0.07

This table reports the results of model 2 to examine the interaction effect between loan growth and corruption on bank performance. Results are stated in four panels A to D. Each panel reports the results using one performance measure. Four models have been estimated using accounting and market based performance measures, ROA, NPL, Z-score and DD. In each panel, five models are estimated and results are reported in columns numbered 1 to 5. Column (1) examines the effect of Loan Growth LG and LG^2. Model 2 and 4 in columns (2& 4) test the effect of country and bank level corruption, respectively. Models 3 and 5 show the interaction effect between the two levels of corruption to display the intermediate effect of corruption on the relationship between loan growth and bank performance. In each model, sets of bank specific and macroeconomic variables are included. Variable definitions: ROA assesses individual bank profitability, NPL, is Non-performing loans measured as totally impaired loans to net loans, Z-score assesses the number of standard deviations that a bank's return has to fall to erode a bank's capital, DD is the distance-to-default which measures the number of standard deviations the log value of total assets to total debt needs to deviate from its mean before the firm defaults. MCPI is the modified score based on a constructed index to measure the corruption of country j in year t relative to the median index of all countries in that year, with a higher score suggesting a higher economic and political integrity. BLC is the corruption of bank officials which takes a value from 1 to 4. Size is bank size measured by the natural logarithm of total assets; ETA is the equity-to-total assets ratio, CIR is the cost-income ratio, DTA is the deposits-to-total assets ratio, AD is the assets diversity measured as $1 - |$(net loans− other earning assets)/total earning securities and investments, and total earning assets include net loans, securities, and investments. GDP is the percentage annual growth in gross domestic product, INF is the country annual inflation rate. This Table also reports the post estimation results of the second order residual autocorrelation (serial correlation) AR (2) under the null of no serial correlation. Hansen J-test of over-identification is under the null that all instruments are valid. Standard errors are values between parentheses. *Significant at 10%., **Significant at 5%., ***Significant at 1%.

Table 5
Instrumental variables regression- Corruption and loan growth.

Dependent variable	Panel A			Panel B			Panel C		
	Stage 1	Stage 2		Stage 1	Stage 2		Stage 1	Stage 2	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
	COC	LG	ALG	MCPI	LG	ALG	BLC	LG	ALG
Latitude	0.321***			−0.107***			−0.280***		
Ethnic Fractionalization	−0.398***			0.292***			0.126***		
Corruption		−0.027***	−0.023***		0.021***	0.012**		0.058**	0.028***
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Bank-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22192	22359	22359	22192	22192	22192	23945	23945	23945
Adjusted R^2	0.364	0.274	0.225	0.361	0.372	0.290	0.393	0.377	0.276
weak identification test		487.139	486.483		693.431	691.613		689.823	688.775
Sargan-Hansen test of over-identifying restriction		0.476	0.469		0.688	0.619		0.163	0.191

This table presents the results of two-stage least squares regressions to examine the effect of corruption on loan growth. Our corruption measures are control of corruption (COC), modified CPI (MCPI) and bank lending corruption (BLC). We use two instruments for corruption: the latitude and the country ethnic fractionalization measured as the probability that any two random people in the state are of the same ethnicity. Each panel shows the results of one of the corruption measure. In each panel Column (1) shows the first stage of the regression, and columns (2 and 3) show the second stage for the performance measures. The weak identification test is a Kleibergen-Paap Wald statistic. The over-identification J-statistic p-value is from the Sargan-Hansen test of over-identifying restrictions. *, **, *** denote significance at the 10%, 5%, and 1% levels.

performance. In other words, the results reveal that corruption prevents banks from benefiting from more lending (negative link to ROA, panel A) due to heightened non-performing loans (positive NPL, panel B). Lower loan quality appears to increase bank insolvency (negative link to Z-score, panel C) and increase the probability of default (negative DD, panel D).

We also address potential endogeneity problems when examining the effect of corruption on loan growth by using the instrumental variable (IV) estimation method. The main assumption with choosing instrumental variables is that they are correlated with corruption but do not directly affect bank lending (Jiang 2018). This study uses two variables used in the previous literature as IVs namely, the latitude of the country and ethnic fractionalization (Jiang 2018, Barth et al., 2009; La Porta et al., 1999; Altunbas & Thornton, 2012). Country latitude and ethnic fractionalization are expected to be linked to corruption but have no direct effect on bank lending. Latitude refers to the country-level absolute value of the latitude and ethnic diversity is the probability of two randomly selected persons not speaking the same language in a country (see Table 1 for data description). Where latitude is assumed to negatively affect corruption and be positively linked to the quality of political institutions (Treisman, 2000; Acemoglu et al., 2001), ethnic fractionalization may increase corruption. It has been argued that public officials are more likely to be corrupt in more ethnically diverse areas for two reasons: first, corrupt politicians are more willing to expropriate from people of a different ethnicity. Second, when ethnicities are in powerful positions, they can support corrupt politicians who protect their own ethnicity at the expense of others (see Easterly and Levine and 1998 among others).[14]

Tables 5 and 6 show the results of the 2SLS when examining the effect of corruption on loan growth and bank performance, respectively. Results reported in Table 5 are in three panels A, B and C. In each panel, an estimation including the three different corruption measures: COC, MCPI and BLC are included. The results of the first stage regression are reported in column (1) of each panel. Both instrumental variables strongly influence corruption as confirmed in the earlier literature. A strong significant negative (positive) effect links latitude (ethnic fractionalization) to corruption. In columns 2 and 3, the second stage results for each performance measure are reported. In all panels, the coefficients of instrumented corruption measures are positive (and significant) confirming that corruption increases bank lending. Table 6 on the other hand reports the second stage when each of the performance measures are used as dependent variables. Again, the results are consistent with previous findings, namely, that corruption lessens profitability and increase credit, solvency and default risks. In all of the models, the weak identification F-statistic with the null hypothesis that our instruments are only weakly related to corruption is rejected. Additionally, the Hansen *J*-statistic for over-identifying restrictions accept the null hypothesis that the instruments are uncorrelated with the error term. These results serve to reduce concerns about endogeneity and help support a causal interpretation of the negative effect of corruption on bank performance.[15]

[14] For estimation, we used ivstyle function in STATA. It specifies a set of variables to serve as standard instruments, with one column in the instrument matrix per variable. The instrumental variables of the latitude of the country and ethnic fractionalization are exogenous regressors included in ivstyle options, in order to enter the instrument matrix. This suboption of xtabond 2 specifies which equations should use the instruments. In particular, first-difference and levels both are used and the instruments are transformed into differences and orthogonal deviations for use in the transformed equation. Predetermined variables used as IV-style instruments in system GMM.

[15] We re estimated the models using fixed and random effect. Results held constant. Results are not reported but available upon request.

Table 6
Instrumental variables regression- Corruption and Bank Performance.

Corruption Measure	COC				*MCPI*				*BLC*			
Dependent variable	ROA	NPL	Z-Score	DD	ROA	NPL	Z-Score	DD	ROA	NPL	Z-Score	DD
Model	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Corruption	0.003***	−0.013**	0.017**	0.015**	−0.282***	−1.07**	−0.459**	1.03***	−0.022***	−0.105***	−0.119**	0.447**
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time- Bank- Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22151	18166	21804	1283	25750	24144	22181	1917	23791	21618	19766	1405
Adjusted R^2	0.572	0.496	0.527	0.343	0.255	0.407	0.287	0.214	0.274	0.306	0.270	0.233
weak identification test	222.361	362.893	423.100	40.39	686.244	574.482	617.958	101.071	701.072	629.380	587.004	85.341
Sargan-Hansen test of over-identifying restriction	0.204	0.545	0.320	0.350	0.346	0.260	0.184	0.190	0.376	0.544	0.443	0.137

Table 7
Loan types, corruption and bank performance.

Performance Measure	ROA	NPL	Z-score	DD	ROA	NPL	Z-score	DD
Panel A: Corruption measure	MCPI				BLC			
	1	2	3	4	1	2	3	4
Lagged	0.666***	0.952***	0.478***	0.152*	0.596***	0.888***	0.505***	0.185
MLG	−0.015***	0.059***	−0.065***	−0.019	−0.012***	0.069***	−0.113***	−0.000
CLG	−0.013***	0.068***	−0.048***	−0.013	−0.010***	0.072***	−0.094***	−0.021*
CORLG	0.072***	−0.402***	0.263***	0.093*	0.059***	−0.436***	0.568***	0.128**
OLG	−0.006***	0.027***	−0.025***	−0.010*	−0.005***	0.028***	−0.050***	−0.013*
COR	−0.007**	−0.001	−0.192***	−0.013***	−0.033**	0.025***	−0.985***	−0.011
Constant	0.034***	−0.069***	0.230***	0.050***	0.077***	−0.039***	−1.214***	0.065***
Control variable	YES	YES	YES	YES	YES	YES	YES	YES
Bank-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	19,263	18,098	3394	932	18,225	17,048	16,623	729
Number of id	3537	3481	17,623	257	3069	3021	2956	184
Hansen Test (p-value)	0.554	0.077	0.190	0.155	0.219	0.256	0.498	0.127
AR2 test (p-value)	0.902	0.770	0.765	0.343	0.513	0.668	0.832	0.619
Panel B: Corruption measure	MCPI				BLC			
	1	2	3	4	1	2	3	4
Lagged	0.677***	0.868***	0.476***	−0.106	0.684***	0.787***	0.530***	0.078
MLG	−0.031***	−0.024**	−0.536***	−0.143	−0.237***	−2.747***	1.033***	1.289**
CLG	−0.019***	−0.019***	−0.281***	−0.071	−0.161***	−1.058***	0.434***	0.402*
CORLG	0.104***	0.046	1.840***	0.347	0.863***	7.676***	3.353***	−3.053**
OLG	−0.011***	−0.015***	−0.229***	−0.020	−0.087***	−1.080***	0.495***	0.246
MLG*COR	0.035***	0.012	0.617***	0.147	0.155***	1.812***	−0.689***	−0.833**
CLG*COR	0.020***	0.013*	0.293***	0.061	0.104***	0.688***	−0.283**	−0.268*
CORLG*COR	−0.112***	−0.057	−2.035***	−0.282	−0.564***	5.080***	−2.219***	−2.003**
OLG*COR	0.013***	0.006	0.262***	−0.001	0.058***	0.716***	−0.330***	−0.171*
Constant	0.022***	−0.033***	0.088***	0.028	0.008***	−0.034***	0.158***	0.111**
Control variable	YES	YES	YES	YES	YES	YES	YES	YES
Bank-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	19,263	18,098	17,623	932	34,156	17,048	16,623	729
Number of id	3537	3481	3394	257	3518	3021	2956	184
Hansen Test (p-value)	0.409	0.116	0.503	0.543	0.395	0.587	0.566	0.534
AR2 test (p-value)	0.873	0.285	0.956	0.275	0.484	0.991	0.869	0.462

This Table reports the results for different types of loans using model 3 as described in section 3.1. MLG is mortgage loan growth, CLG is consumer loan growth, CORLG is corporate loan growth, OLG is other loan growth. Results are reported in two panels A and B. Where panel A shows the results of each loan type growth and its effect on bank performance, panel B shows the interaction effect between loan growth and corruption on bank performance. Two corruption measures are used: BLC bank lending corruption and MCPI the modified country corruption perception index. Five models have been estimated using accounting and market based performance measures, ROA, NPL, Z-score and LL and DD and the results are reported in columns numbered 1 to 5. In each model, sets of bank-specific and macroeconomic variables are added. See Table 1 for variables definitions. This Table also reports the post estimation results of the second order residual autocorrelation (serial correlation) AR (2) under the null of no serial correlation. Hansen J-test of over-identification is under the null that all instruments are valid. Standard errors are values between parentheses. *Significant at 10%., **Significant at 5%., ***Significant at 1%.

4.3. Loan types, corruption and bank performance

In this section, we examine model 4 that assesses the effect of the growth of different loan types on bank performance. Table 7 reports the results for equation (3) in two panels. Panel A shows the effects of each loan type growth on bank performance separately and panel B adds the interaction effects to the model in which each type of loan growth is multiplied by the two measures of corruption: MCPI (columns 1 to 3) and BLC (columns 4 to 6).[16]

Looking at panel A, among all loan types, corporate loans are found to have a positive impact on bank profits (positive and significant CORLG coefficients in the ROA model) and also reduce credit and solvency risk (negative and positive CORLG coefficient in NPL and Z-score, respectively). This result suggests that bank managers should not underestimate the risks of mortgage and consumer lending at the expense of corporate credits. For most of the model estimates, corruption has a negative influence on bank profits and generally raises bank risk. If one looks at mortgage and consumer lending growth these seem to reduce profits and boost risk. When the interaction variables are introduced (see Table 7 panel B), these have a significant and opposite sign with the counterparty variables. This means that corruption reduces the benefits of corporate lending. While bank profitability increases with greater corporate loan growth, in more corrupt countries, corporate lending growth has a lesser effect on bank profitability (see Table 7 row 3, 7 and column 1

[16] COC results have not been reported due to space limitations but they are similar to those using MCPI. Results available from the authors on request.

Table 8
Loan growth, corruption and bank performance: Factors effect.

Performance Measure	ROA				NPL				Z-score			
Panel A	MCPI				MCPI				MCPI			
Model	1	2	3	4	1	2	3	4	1	2	3	4
Lagged	0.710***	0.684***	0.734***	0.693***	0.862***	0.943***	0.889***	0.973	0.482***	0.510***	0.487***	0.470***
LG	0.125***	0.166***	0.101***	0.650***	−1.467***	−1.147***	−0.851***	−3.513***	1.801***	2.308***	0.315***	1.407***
LG*MCPI*BT	−0.119***				1.367***				−1.798***			
LG*MCPI*REG		−0.177***				1.185***				−2.563***		
LG*MCPI*CON			−0.002***				0.014***				−0.006***	
LG*MCPI*BC				−0.005***				0.024***				−0.010***
Size	0.000	−0.004***	0.001***	−0.005***	0.002*	0.033***	−0.003**	0.033***	0.013***	−0.044***	0.003**	−0.012***
CIR	−0.015***	−0.013***	−0.015***	−0.017***	0.020***	0.011***	0.020***	0.041***	−0.058***	−0.041***	−0.073***	−0.082***
ETA	0.001***	−0.007***	0.002***	−0.016***	−0.035***	0.048***	−0.029***	0.091***	0.079***	−0.045***	0.007	−0.040***
DTA	−0.001***	−0.001***	−0.001***	−0.001**	0.020***	0.013***	0.017***	0.009***	−0.028***	−0.028***	−0.010***	−0.006***
Inflation	0.074***	0.065***	0.030***	−0.044***	−0.689***	−0.328***	−0.145***	0.274***	0.761***	0.567***	−0.059*	−0.226***
GDP	0.027***	0.005	0.025***	0.057***	0.030	0.107***	0.033	−0.192***	0.109***	−0.093	0.269***	0.347***
Constant	0.016***	0.035***	0.011***	0.047***	0.022**	−0.146***	0.038***	−0.185***	0.031***	0.322***	0.118***	0.209***
Observations	25,750	25,750	20,960	20,894	21,337	21,337	17,203	17,137	23,325	23,325	20,552	20,489
Bank-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of id	5688	5688	5251	5198	4491	4491	4117	4066	5442	5442	5083	5031
Hansen Test (p-value)	0.415	0.335	0.330	0.107	0.294	0.582	0.592	0.170	0.059	0.411	0.149	0.147
AR2 test (p-value)	0.200	0.176	0.078	0.275	0.306	0.102	0.098	0.178	0.207	0.086	0.293	0.545
Panel B	BLC				BLC				BLC			
Model	1	2	3	4	1	2	3	4	1	2	3	4
Lagged	0.689***	0.703***	0.700***	0.726***	0.868***	0.988***	0.864***	0.883***	0.547***	0.521***	0.466***	0.458***
LG	0.681***	0.310***	0.082***	0.013	−3.694***	−1.464***	−1.165***	−2.064***	8.914***	5.040***	−0.259***	2.704***
LG*BLC*BT	−0.445***				2.388***				−5.839***			
LG*MCPI*REG		−0.194***				0.893***				−3.186***		
LG*MCPI*CON			−0.001***				0.017***				0.004***	
LG*MCPI*BC				−0.000				0.007***				−0.010***
Size	−0.002***	−0.007***	0.000***	−0.001***	0.015***	0.040***	−0.007***	0.037***	−0.013***	−0.104***	−0.006***	−0.042***
CIR	−0.013***	−0.010***	−0.013***	−0.014***	0.022***	0.006**	0.015***	0.027***	−0.061***	−0.030***	−0.080***	−0.084***
ETA	−0.005***	−0.027***	0.001	−0.003***	0.032***	0.127***	−0.025***	0.132***	−0.042***	−0.404***	−0.038***	−0.191***
DTA	0.001***	0.003***	0.000***	0.001***	0.005***	−0.005***	0.008***	−0.001	−0.002	0.032***	0.003***	0.008***
Inflation	0.043***	0.008**	0.002	0.012***	−0.125***	0.046**	0.135***	0.305***	0.290***	−0.134**	−0.046*	−0.492***
GDP	0.076***	0.003	0.024***	0.044***	−0.281***	0.044*	0.116***	−0.236***	0.793***	−0.083	0.531***	0.608***
Bank-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.023***	0.051***	0.014***	0.021***	−0.067***	−0.193***	0.053***	−0.205***	0.165***	0.625***	0.159***	0.363***
Observations	22,469	22,469	19,637	19,604	18,505	18,505	16,022	15,986	20,438	20,438	19,252	19,223
Number of id	4831	4831	4715	4696	3773	3773	3653	3634	4622	4622	4560	4543
Hansen Test (p-value)	0.187	0.227	0.177	0.102	0.575	0.495	0.109	0.220	0.429	0.284	0.286	0.116
AR2 test (p-value)	0.144	0.247	0.095	0.636	0.682	0.371	0.385	0.228	0.159	0.104	0.294	0.514

This Table reports the results of model 4 outlined in section 3.1 of the paper. A triple interaction term between loan growth, corruption, and other factors (controls) are examined. Four controls are introduced to the model. BT is a bank type dummy variable that takes the value of one when the bank is Islamic and zero for a conventional bank, REG is a regulatory environment variable, CON is the measure of banking system concentration and BC is bank competition (Lerner index). See Table 1 for variable definitions. This Table also reports results of the second order residual autocorrelation (serial correlation) AR (2) under the null of no serial correlation. Hansen J-test of over-identification is under the null that all instruments are valid. Standard errors are values between parentheses. *Significant at 10%., **Significant at 5%., ***Significant at 10%.

Table 9
Loan growth, corruption and bank performance – developed countries.

Performance Measure	ROA				NPL			
Model	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Lagged	0.675***	0.650***	0.670***	0.675***	0.766***	0.775***	0.739***	0.745***
LG	0.059***	0.068**	0.041***	0.730***	−0.363***	−0.827***	−0.416***	−3.005***
LG^2	−0.155***	−0.045**	−0.170***	−0.037***	0.883***	0.992***	1.077***	0.796***
SIZE	−0.358***	−0.065	−0.072***	−0.019***	1.738	3.093*	−0.008	−0.065***
ETA	−0.017***	−0.013***	−0.109***	0.075***	0.112	0.193***	0.322*	−0.009
CIR	−0.109**	−0.006	−0.024***	−0.061***	1.030***	1.441***	0.003	−0.110***
DTA	0.009	0.000	−0.039***	−0.030***	−0.175***	−0.169***	−0.074**	−0.062**
AD	0.000	0.007	0.036***	0.045***	−0.070*	−0.034	−0.026	0.020
GDP	0.021*	0.026**	0.025	0.013	−0.106	−0.300*	0.059	−0.257*
Inflation	−0.025	−0.007	−0.002	0.011	−0.236*	0.353	0.114	0.132*
Crisis	−0.004***	−0.002*	0.001	0.002**	0.022**	0.018*	0.010	0.006
MCPI	0.001	−0.002***			0.103**	−0.022**		
LG*MCPI		0.021**				0.545**		
BLC			−0.210***	−0.219***			0.100**	−0.060**
LG*BLC				0.153*				1.796***
Constant	0.045***	0.014*	1.941***	0.144***	−0.134	−0.272*	0.127	0.506***
Bank-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	21,632	21,632	21,375	21,375	18,809	18,809	17,720	17,720
Number of id	4499	4499	3980	3980	3638	3638	3121	3121
Hansen Test (p-value)	0.290	0.580	0.104	0.103	0.186	0.384	0.526	0.317
AR2 test (p-value)	0.139	0.181	0.155	0.093	0.205	0.102	0.460	0.413
Performance Measure	Z-score				DD			
Model	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Lagged	0.417***	0.429***	0.358***	0.498**	0.543***	0.586***	0.387***	0.350***
LG	0.578***	1.342***	0.936***	4.809**	−0.005	−0.160	0.191*	1.420*
LG^2	−1.377***	−5.928***	−6.108***	−3.430***	0.153	0.064	−0.549*	−0.685*
SIZE	−9.064	0.078***	−0.041	−0.003	0.017	0.017	0.001	−0.012
ETA	−0.510***	0.104***	−0.258**	0.133	−0.252	−0.226	−0.266	0.013
CIR	−3.626***	0.102***	0.057**	−0.003	0.173*	0.179**	0.105	0.016
DTA	0.270**	0.007	0.069***	−0.097**	0.064	0.057	0.157	0.025
AD	0.116	0.010	−0.051**	0.067***	0.006	−0.178	−0.130	−0.105
GDP	−0.369	0.004	2.775***	1.183***	−0.338	−0.276	0.736	0.607
Inflation	0.783**	0.585***	−0.518**	−0.615***	−0.110	0.053	−0.217	0.056
Crisis	−0.036*	−0.027*	0.073***	0.038***	0.043	−0.160	0.046	0.063
MCPI	−0.384***	−0.239***			−0.005	−0.002		
LG*MCPI		1.679**				0.196		
BLC			−2.111***	0.060			−0.075*	−0.062
LG*BLC				−2.636*				0.847*
Constant	1.290**	−0.399**	3.414***	0.135***	−0.215	0.255	0.023	0.121
Bank-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	20,821	20,821	19,576	19,576	1287	1287	1042	1042
Number of id	4434	4434	3835	3835	360	360	272	272
Hansen Test (p-value)	0.430	0.533	0.365	0.390	0.694	0.578	0.627	0.144
AR2 test (p-value)	0.162	0.120	0.140	0.227	0.610	0.117	0.106	0.102

This table reports the results of model 2 in section 3.1 of the paper using only developed countries data. Results are stated in four panels. Each panel reports the results using one performance measure. Four models have been estimated using accounting and market based performance measures, ROA, NPL, Z-score and DD. In each panel, models are estimated and results are reported in columns numbered 1 to 4. Column (1) examines the effect of Loan Growth LG and LG^2. Column 1 and 2 show the effect of country-level corruption and 3 and 4 bank level corruption. Variable definitions: ROA is our measure of individual bank profitability, NPL, is the non-performing loans ratio measured as totally impaired loans to net loans, Z-score assesses the number of standard deviations that a bank's return has to fall to erode a bank's capital, LL is the measure of bank loss estimates as the proportion of loan-loss provisions established in the year *t* relative to total customer loans in year t – 1. DD is the distance-to-default which measures the number of standard deviations the log value of total assets to total debt needs to deviate from its mean before the firm defaults. MCPI is the modified score based on a constructed index to measure the corruption of country j in year t relative to the median index of all countries in that year, with a higher score suggesting higher economic and political integrity. BLC is the corruption of bank officials and takes a value from 1 to 4. Size is bank size measured by the natural logarithm of total assets; ETA is the equity-to-total assets ratio, CIR is the cost-income ratio, DTA is the deposits-to-total assets, AD is the assets diversity measured as 1 − |(net loans− other earning assets)/total earning securities and investments, and total earning assets include net loans, securities, and investments. GDP is the percentage annual growth in gross domestic product, INF is the country annual inflation rate. This Table also reports the post estimation results of the second order residual autocorrelation (serial correlation) AR (2) under the null of no serial correlation. Hansen J-test of over-identification is under the null that all instruments are valid. Standard errors are values between parentheses. *Significant at 10%., **Significant at 5%., ***Significant at 1%.

Table 10
Loan growth, corruption and bank performance – developing countries.

Performance Measure	ROA				NPL			
Model	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Lagged	0.508***	0.509***	0.482***	0.478***	0.725***	0.732***	0.641***	0.639***
LG	0.038***	0.022**	0.044***	0.086***	1.146***	1.291***	−0.293***	−0.991***
LG^2	−0.102***	−0.073***	−0.113***	−0.111***	−3.151***	−3.162***	0.706***	0.714***
size	−0.225	−0.080	−0.004**	−0.003***	−1.872***	−1.848***	0.018	0.010
ETA	−0.011	−0.012***	−0.020	−0.006**	−0.020	−0.015	0.035	0.002
CIR	−0.003**	0.007	−0.022*	−0.020	−0.016	−0.019	0.042	0.029
DTA	0.000	−0.006	0.001	−0.001	−0.036	−0.004	−0.014*	−0.010
AD	0.014**	0.012**	0.012***	0.011***	0.026**	0.026***	−0.007	0.034
GDP	0.056	−0.012*	0.063*	0.041	−2.361**	−0.195**	0.389***	0.497***
Inflation	0.042	−0.003	0.027	0.031	−1.458*	−0.307***	0.671***	0.565**
Crisis	−0.002	−0.001	0.002	−0.002	−0235*	0.039*	0.007	0.076
MCPI	−0.001				−0.006			
LG*MCPI		0.004				−0.083		
BLC			−0.004***				0.144**	
LG*BLC				−0.026***				0.403**
Constant	0.019	0.018**	0.048**	0.032**	0.212***	0.199***	−0.385	−0.098
Bank-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	3098	3098	2412	2412	2502	2502	1943	1943
Number of id	1081	1081	856	856	1007	1007	662	662
Hansen Test (p-value)	0.140	0.144	0.251	0.286	0.525	0.549	0.414	0.472
AR2 test (p-value)	0.722	0.481	0.777	0.355	0.305	0.414	0.366	0.333
Performance Measure	Z-score				DD			
Model	1	2	3	4	1	2	3	4
Lagged	0.304***	0.316***	0.322***	0.323***	0.460*	0.483	0.147	0.131
LG	−0.488***	−0.479***	1.013***	2.135**	0.377**	0.343**	0.273*	0.929**
LG^2	1.237***	1.274***	−2.894***	−1.334**	−0.846**	−0.723*	−0.638*	−0.318**
size	1.063***	0.973***	−0.021***	−0.117***	−0.041	−0.155	0.001	0.004
ETA	0.005*	−0.006	−0.034**	−1.421***	0.049***	0.043**	0.013	0.034**
CIR	−0.008	0.008**	−0.049**	−0.086***	0.064***	0.053***	0.044**	0.027***
DTA	0.003	0.002	0.021**	0.064***	−0.000	0.003	0.017**	0.014**
AD	−0.030	−0.002	0.035***	0.119***	−0.021***	−0.023***	−0.037***	−0.037***
GDP	−0.049	−0.019	0.436*	−0.208	−0.275***	−0.219***	0.774**	0.137
Inflation	−0.065	−0.021	−0.269***	−0.565***	−0.252***	−0.171**	0.188	−0.056
Crisis	−0.002	−0.000	0.084***	−0.014	−0.013	−0.006	0.081**	0.030
MCPI	0.010				0.014			
LG*MCPI		−0.013				−0.007		
			−0.293***				−0.219**	
				−0.959*				−0.428**
Constant	−0.757	−0.011	0.707***	1.014***	−0.017	−0.337	0.331*	−0.029
Bank-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2525	2525	1948	1948	485	485	362	362
Number of id	852	852	799	799	158	158	117	117
Hansen Test (p-value)	0.355	0.380	0.251	0.286	0.494	0.436	0.284	0.168
AR2 test (p-value)	0.242	0.337	0.777	0.602	0.703	0.723	0.608	0.581

This table reports the results of model 2 as outlined in Section 3.1 when only developed countries data are. See Table 9 for an explanation of the variables. The Table also reports the post estimation results of the second order residual autocorrelation (serial correlation) AR (2) under the null of no serial correlation. Hansen J-test of over-identification is under the null that all instruments are valid. Standard errors are values between parentheses. *Significant at 10%., **Significant at 5%., ***Significant at 1%.

of panel B) and also increases solvency risk (see Z-score in columns 3 and the same row in panel B). On the other hand, mortgage and consumer loan growth reduces profitability (ROA) and increase insolvency risk (Z-score). However, when the interaction variable between corruption and each loan type is introduced into the models this has a significant effect and strengthens the negative influence of consumer and mortgage loan growth on performance.

4.4. Further robustness checks

In this part, we further analyze additional variables that may influence the effect of corruption in mitigating possible benefits of lending growth. We consider four types of variables covering bank business model (bank type, BT, Islamic or conventional), banking system features (competition, BS, concentration, CON) and a supervisory regulation variable (bank regulation, BR). For this purpose, we augment equation (4) by interacting each factor with each corruption measure and the loan growth variable. To save space, we only present the results obtained using the most significant models (ROA, NPL and Z-score). All results are reported in Table 8 in two panels

A (MCPI) and B (BLC).

We consider whether different business models, Islamic or conventional, are impacted by corruption. In column 1 in Table 8, the coefficients on the triple interaction term confirms that corruption has less effect on loan growth performance for Islamic banks relative to conventional banks. It could be that the religious features of Islamic banks mitigate the adverse impact of corruption. Competition (concentration) in banking systems is expected to reduce (boost) corruption (Barth et al., 2007), and this should feed through into improved (worsened) bank performance. Table 8 shows the results for concentration CON (column 3) and competition BS (column 4). In the majority of cases, CON negatively affects bank profitability, increase non-performing loans, and reducing the Z-score (see LG*MCPI*CON variable in panel A and see LG*BLC*CON variable in panel B). In contrast, greater competition (measured using the Lerner index) reduces the effect of corruption on bank performance (see LG*MCPI*BC row in panel A and LG*BLC*BC variables in panel B from Table 8). Hence, competition may play a mitigating role in controlling for the effects of corruption on banks while more concentrated banking systems do the opposite. It is likely that the costs of coordinating corrupt activities are lower in a concentrated system as there are fewer banks through which to coordinate such behavior.

We then investigate if the aforementioned relationships vary for banks operating in countries at different stages of development. First, we re-estimate model 1 testing for the effects of corruption on loan growth in developed and developing countries (results are reported in Appendix Tables A-2 and A-3). We also report results using two measures of loan growth shown in panel A (annual percentage growth in loans) and panel B (abnormal loan growth). While country level corruption (corruption perception index) is found to increase bank lending growth in both sets of countries (see columns 1 to 3 in panels A and B), bank-lending corruption is found to affect banks in developed and developing countries differently. Bank lending corruption increase loan growth in developing countries, but negatively affect lending growth in developed countries.

Results in Table 9 show that country level corruption (see column 1) has no effect on bank performance, whereas bank-lending corruption (see column 3) reduces bank profitability. This result is consistent with the protection against corruption risk hypothesis (Jiang et al., 2018). Under this hypothesis, in countries where bribing bank officials is common, lending policies will be tightened because senior bank managers know that such activity will incur substantial costs. It also encourages policy makers to tighten lending conditions and to look to ways to strengthen institutional arrangements – all this feeds through into lower loan growth. Table B-2 in appendix B confirms these results by showing a positive (negative) effect of corruption on loan growth in developing (developed) countries loan growth.

It is worth noting that lending corruption can be managed by banks, however country corruption is beyond their control. All types of corruption increase bank risks. However, the interaction effect is different in each sample. For developed countries, corruption interacted with loan growth generally increases risks (although results are non-consistent in all models).

The results for developing countries in Table 10 show that country level corruption (see columns 1 and 2 for each dependent performance panel) has no impact on profitability or on (most) of our risk measures. Although, rapid loan growth reduces profits and generally increases risks. Country corruption by itself or interacted with loan growth has no impact on profits or risks. This is a surprising finding, it could be that banks in developing countries have managed to incorporate corrupt practices at the country level in their normal ways of working so it is considered a standard feature of business activity and is factored into their main operational procedures.[17] This conclusion is not consistent with previous literature that finds that firm performance in developing and transition economies are affected negatively by corruption (Donadelli & Persha, 2014; Wieneke and Gries, 2011).

However, when bank lending corruption is introduced to the model (see Table 10 column 3 and 4) we show how this reduces profitability and increases bank risks. We also control for the effect of the GFC. The result are consistent with Olson and Zoubi (2017) as we find that the GFC negatively affects bank performance. In developed countries (Table 9), the crisis reduces bank profits (ROA) and increases risks (NPL and Z-score). However, no significant effect is found for developing countries apart from an increase in loan-losses post-crisis.

For a further robustness check, other loan growth and corruption measures are used. In Table A-4, we also replace the previous annual loan growth measure with abnormal loan growth (when loan growth is greater than median loan growth in the country) and external growth (Table A-5) (when high growth is linked to mergers and/or acquisitions). When growth exceeds system median levels banks achieve higher profitability and they also manage to reduce risk. In contrast, when interaction effects between external and abnormal growth and corruption are introduced an inverse effect is found. More loan growth brings about higher loan -losses, non-performing loans and extra solvency risk in more corrupt countries. Corruption is found to play a significant role in magnifying the effect of external financing on bank performance. Our findings also suggest that banks in more corrupt countries are exposed to additional risk when growth is financed externally. However, this extra risk is not matched with greater profitability.

Furthermore, we also control for different types of bank ownership government and foreign using data from Cull et al. (2017). When banks are state owned there may be a greater chance of corrupt activities whereas the opposite may more likely be the case foreign banks (as they do not have the relevant corrupt networks). Using information for a sample of 81 countries, we include government and foreign ownership variables when examining the effect of corruption on loan growth in model 1. Results are reported in Table A-6 and are similar to those results reported in Table 3. Banks with higher (lower) government (foreign) ownership affect loan growth positively which is consistent with Sapienza (2004) who confirms that state owned banks charge lower interest rate which

[17] We also cross-check our overall findings using a different corruption indicator, the control of corruption (COC) measure and find similar results.

motivate higher lending.[18]

For further robustness, we rerun the original model in equation (2) and exclude the nonlinear term of the loan growth as follows:

$$y_{b,i,t} = \alpha_0 + \lambda y_{b,i,t-1} + \beta_1 LG_{b,i,t} \times COR_{it} + \gamma LG_{b,i,t} + \Gamma COR_{i,t} + \delta X_{b,i,t} + \Delta_t + \mu_b + \varepsilon_{b,i,t} \quad (5)$$

The results are similar to the results reported in Table 4 loan growth increases risk and return and Corruption (measured by MCPI) negatively affect stability and profitability.[19]

5. Conclusion

Using a large bank level dataset from 160 countries and comprising 7235 banks between 2000 and 2016 we find a nonlinear relationship between loan growth and bank performance (from both a return and risk perspective). When bank managers become overoptimistic in growing their loan portfolios, profitability falls and risks associated with lower quality loans increases. Corruption is found to put "sand-in the wheels" in terms of bank performance. The higher country-level and bank loan officer corruption, the poorer bank performance. Banks operating in more regulated, competitive and less concentrated systems perform better when growing their loan portfolios (and are less adversely affected by corruption). Islamic banks, compared with their conventional counterparts are also found to be less influenced by corruption.

When we investigate these relationships for developed and developing banking systems we find that the latter are less affected by country level corruption. We suggest that it could be that banks in developing countries have managed to incorporate corrupt practices in their normal ways of working so it is considered a standard feature of business activity and is factored into their main operational procedures so has limited overall influence on performance.

Bank-level corruption, on the other hand, shows varying effects for countries at stages of economic development. Banks in developing countries appear to extend more credit when loan official corruption exists yet this is not found to be the case for developed countries. Bank risks (credit and solvency) for both sets of countries are affected negatively by lending corruption. This result supports the view bank loan officer corruption is more harmful to banks than country-level corruption. Our results are robust to using different estimation techniques and alternative measures of our main variables.

Our findings have important policy implications. Corruption can hamper bank performance and mitigate the benefits of additional lending so serious attention should be given to reducing corruption at both the country and bank-level - and particularly in the latter for developing countries.

This table presents the results of two-stage least squares regressions to examine the effect of corruption on bank performance. Our corruption measures are control of corruption (COC), the modified corruption perception index (MCPI) and bank lending corruption (BLC). We use two instruments for corruption: the country latitude and ethnic fractionalization where the latter is measured as the probability that any two random people in the state are of the same ethnicity. The first stage of the regression results are reported in A-6, and columns (1–4) show the second stage for the performance measures. The weak identification test is a Kleibergen-Paap Wald statistic. The over-identification J-statistic p-value is from the Sargan-Hansen test of over-identifying restrictions. *, **, *** denote significance at the 10%, 5%, and 1% levels. Variable definitions can be found in Table 2.

Author statement

Bana Abuzayed: Conceptualization, Development and design of methodology; Creation of Models, Validation and Writing - Original and Final Draft Preparation. Mouldi Ben Aammar: Data Curation, Formal Analysis. Philip Molyneux: Development and Design of Methodology, Validation and Writing - Review & Editing. Nedal Al-Fayoumi: Data Analysis, Writing- Original draft preparation.

Data availability

The authors do not have permission to share data.

Appendix A

Likelihood-Ratio Test

The test statistic of the likelihood-ratio test is LR = −2(L1 - L0), LR is approximately chi 2 distributed with d_0-d_1 degrees of freedom, where d_0 and d_1 are the model degrees of freedom associated with the full and constrained models, respectively. To conduct the test, both the unrestricted and the restricted models must be fit using the maximum likelihood method.

[18] We also examine the effect of ownership on corruption, loan growth and performance relationship. We reexamined model 2 including the two ownership variables as interaction with corruption and with corruption and loan growth variables. Results show no significant difference between foreign or government ownership effect for the majority of performance measures. Results are not reported but available upon request.

[19] Thanks for the anonymous reviewer for suggesting the examination of model 2 without the nonlinear term to test the original effect of corruption and loan growth on performance.

In our study, the likelihood-ratio test (LRT) to test how the model with the extra squared term compares to the linear-only nested model.

H0: Linear relationship between loan growth and stability measures

H1: Non-linear relationship between loan growth and stability measures

Table A-1
Non-linear Test and Estimate Threshold

Dependent Variable	Z-score	NPL	ROA	DD
- LR chi2	925.810	2807.210	1126.76	5.96
- LR- P-value	0.000	0.000	0.000	0.014
- Threshold	0.130	0.214	0.167	0.105

We conclude that the model that includes the linear and squared terms fits significantly better than the model containing only the linear term (namely, the non-linear relationship fits better).

Table A-2
Loan Growth and Corruption: Evidence from Developing Countries

Variables	Panel A LG			Panel B ALG		
Model	1	2	3	1	2	3
Lagged	0.977***	0.657***	0.560**	1.107***	0.653***	0.701***
COC	−0.453**			−1.142**		
MCPI		0.044**			0.028**	
BLC			0.112***			0.091**
SIZE	0.115***	−0.027	0.123***	0.210***	0.027***	0.104***
ETA	0.292***	0.301***	0.293***	0.672***	0.045***	0.358**
CIR	−0.076***	−0.984***	−0.061***	−0.063***	−0.096***	−0.069***
DTA	−0.098**	−0.191	0.144***	−0.223**	0.006	0.041
AD	0.017	−0.324**	−0.523***	0.045*	−0.027**	−0.528**
GDP	0.008	0.005*	−0.016**	0.005	−0.006*	0.008
INF	−0.022**	0.008	0.041**	−0.073**	0.008**	0.046*
crisis	−0.082***	−0.115***	−0.217	−0.122***	−0.063***	0.044
Constant	−0.490***	1.035**	−0.816***	−1.150***	−0.088***	−0.747**
Bank-fixed-effects	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES
Observations	1967	3113	2421	1968	3114	2422
Number of id	1037	1087	860	1038	1088	861
Hansen Test (p-value)	0.413	0.570	0.790	0.355	0.246	0.294
AR2 test (p-value)	0.217	0.519	0.753	0.287	0.314	0.752

Table A-3
Loan Growth and Corruption: Evidence from Developed Countries

Variables	Panel A LG			Panel B ALG		
Model	1	2	3	1	2	3
Lagged	0.643***	0.650***	0.577***	0.595***	0.618***	0.534***
COC	−0.246***			−0.432***		
MCPI		0.423***			0.570***	
BLC			−0.361***			−0.426***
SIZE	0.182***	0.047	−0.024**	0.273***	0.144***	0.059***
ETA	−3.730***	−2.653***	0.059***	−6.952***	−3.750***	0.021
CIR	0.231***	−1.750***	0.067***	−1.053**	−1.387***	0.066***
DTA	1.638***	1.172***	0.374***	2.615***	1.457***	0.063
AD	0.237	0.390**	−0.907***	1.404***	1.113***	−0.107
GDP	0.162***	0.178***	0.042***	0.281***	0.268***	0.132***
INF	−0.011	−0.065***	−0.023***	−0.016	−0.061**	0.016
crisis	0.432***	0.551***	0.035	0.901***	0.934***	0.378***
Constant	−2.239***	−0.486	0.795***	−3.043**	−2.201***	0.076
Bank-fixed-effects	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES
Observations	20,225	22,687	21,406	20,232	22,695	21,414
Number of id	4543	4616	3988	4545	4618	3990
Hansen Test (p-value)	0.659	0.476	0.111	0.336	0.164	0.131
AR2 test (p-value)	0.392	0.513	0.383	0.270	0.407	0.455

Table A-4
Performance, Abnormal Loan Growth and Control of Corruption: Full Sample

Performance Measure	ROA		NPL		Z-score		DD	
Model	1	2	1	2	1	2	1	2
Lagged	.0743***	0.697***	0.744***	0.670***	0.338***	0.324***	0.504***	0.330***
ALG	3.679***	0.039***	−0.051***	−0.247***	0.278***	0.348***	0.123***	0.071*
size	−0.123***	−0.034**	0.983***	−0.242***	0.979***	0.261***	−0.665***	−0.002
ETA	−0.463***	−0.253*	0.013***	−0.209	0.080***	−2.342***	0.023***	−0.097***
CIR	−1.430***	−0.087***	0.037***	0.098*	−0.058***	−0.620***	0.020***	0.024***
DTA	−0.135***	0.009	0.005***	−0.078*	−0.038***	0.190**	−0.002	0.078***
AD	0.278***	0.040***	−0.000	−0.037	0.033***	−0.220**	−0.007***	−0.038***
GDP	−1.536***	−0.085	−0.032***	0.279	−0.162***	−0.666	−0.003	0.062
Inflation	3.416***	0.066*	−0.006	−0.127	0.951***	−0.407	−0.018	0.056
Crisis	−0.309***	−0.002	0.004***	0.013	−0.030***	−0.067***	0.013***	0.006
MCPI	−0.073***		0.002***		−0.142***		−0.007***	
BLC		−0.437***		8.850***		−3.739**		−0.016***
Constant	2.493***	0.915***	−0.061***	−11.963***	0.179***	5.052**	0.066***	0.015
Bank-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,756	23,796	21,337	19,666	23,329	21,532	1773	1405
Number of id	5689	4839	4490	3783	5443	4637	518	389
Hansen Test (p-value)	0.215	0.273	0.103	0.483	0.121	0.180	0.370	0.278
AR2 test (p-value)	0.343	0.085	0.780	0.514	0.521	0.253	0.076	0.236

Table A-5
External Loan Growth, Abnormal Loan Growth and Country Level Corruption

	ROA			Z-score			NPL			DD		
Model	1	2	3	1	2	3	1	2	3	1	2	3
Lagged	0.486***	0.485***	0.453***	0.592***	0.597***	0.678**	0.711***	0.749***	0.659***	0.235***	0.204***	0.370***
ALG-LG	2.472***	2.461***	0.103***	0.584***	0.122*	−1.211***	−0.292***	−0.515***	0.298**	0.087***	0.069***	0.137**
ELG*ALG	−2.110***	−2.235***	−0.693***	−1.090***	−0.861***	1.331***	0.237***	0.452***	−1.362***	−0.078**	−0.077*	−0.192**
ELG*ALG*MCPI		0.150*			0.936***			−0.027***			0.023*	
MCPI	−0.226***	−0.229***		−0.193***	−0.022***		0.018***	0.019**		−0.015***	−0.018***	
ELG*ALG*BLC			0.429***			−0.154*			0.715***			0.037*
BLC			−0.043***			0.141*			−0.727***			−0.018***
Size	−0.069***	−0.064***	−0.002***	1.407***	−0.243***	0.017***	1.119***	1.222***	0.001	−0.673***	−0.685***	−0.025***
ETA	−0.423***	−0.427***	−0.007***	0.189***	0.011	0.070***	0.029***	0.032***	0.007	0.022***	0.034***	−0.026
CIR	−1.580***	−1.583***	−0.013***	−0.052***	−0.086***	0.019***	0.030***	0.032***	−0.072***	0.015*	0.018*	−0.186*
DTA	−0.042***	−0.046***	−0.002***	−0.052***	−0.026***	0.007***	0.013***	0.012***	−0.011***	−0.002	−0.001	−0.007
AD	0.159***	0.158***	0.004***	0.037***	0.029***	−0.004*	−0.001***	−0.018***	0.012***	−0.016***	−0.017***	−0.011***
GDP	−0.834***	−0.839***	0.016	0.293***	0.147***	0.810***	−0.016	0.019	0.776***	0.021	0.024	−0.022
Inflation	0.081***	0.084***	0.053***	−0.291	−0.086**	−0.225**	0.017	0.018	0.822***	0.034	0.037	0.006
Crisis	−0.293***	−0.287***	−0.003***	−0.025***	−0.012***	0.080***	0.013***	0.018***	−0.022***	0.015***	0.019***	0.017***
Constant	2.299***	2.308***	0.091***	0.207***	0.183***	−0.321***	−0.076***	−0.079***	1.200***	0.081***	0.083***	0.355**
Bank-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,756	25,756	23,796	23,329	23,329	19,666	21,337	21,337	21,532	1773	1773	1405
Number of id	5689	5689	4839	5443	5443	3783	4490	4490	4637	518	518	389
Hansen Test (p-value)	0.110	0.153	0.323	0.336	0.409	0.663	0.344	0.251	0.290	0.333	0.155	0.469
AR2 test (p-value)	0.107	0.109	0.211	0.117	0.425	0.410	0.161	0.175	0.116	0.136	0.154	0.187

Table A-6
Loan growth, Corruption and ownership.

Variables	Panel ALG			Panel B ALG		
Model	**1**	**2**	**3**	**1**	**2**	**3**
Lagged LG	0.199***	0.700***	0.233***	0.497***	0.721***	0.210***
COC	−0.059*			−0.095***		
MCPI		0.010**			0.011**	
BLC			0.967**			0.927*
SIZE	0.011***	0.008***	0.005*	0.022**	0.007**	0.016*
ETA	−0.034	−0.007	−0.288**	−0.021	−0.008	0.419**
CIR	−0.054***	−0.027	−0.034	−0.001	0.032	0.076
DTA	0.022***	0.005	−0.027	0.009	0.005	−0.011
AD	−0.001	−0.012	−0.307**	−0.027**	−0.012	−0.442**
GDP	0.004***	0.001	0.027	0.004	0.001	0.008

(*continued on next page*)

Table A-6 (*continued*)

Variables	Panel ALG			Panel B ALG		
INF	−0.017**	−0.002	0.006	−0.062***	−0.001	0.042**
crisis	0.010	−0.017	0.700	−0.236	−0.017	−0.611***
Gov. ownership	0.071**	0.024*	0.020***	0.033***	0.022*	−0.039**
For. Ownership	−0.060*	−0.005*	−0.035**	−0.010*	−0.009*	−0.050**
Constant	0.106**	−0.047*	0.156*	0.346***	−0.060**	0.687*
Observations	3745	5648	3878	3748	5652	3881
Bank-fixed-effects	YES	YES	YES	YES	YES	YES
Time-fixed-effects	YES	YES	YES	YES	YES	YES
Number of id	1679	1998	1512	1680	1999	1513
Hansen Test (p-value)	0.167	0.118	0.474	0.155	0.334	0.610
AR2 test (p-value)	0.501	0.232	0.886	0.109	0.122	0.323

Appendix B

Table B-1
Loan Growth, Corruption and Bank Performance (Baseline results)

Performance Measure	ROA		NPL		Z-score		DD	
Model	1	2	3	4	5	6	7	8
Lagged	0.605***	0.685***	0.823***	0.823***	0.692***	0.692***	0.781***	0.781***
LG	0.041***		−0.415***		0.372***		−0.258***	
SIZE	−2.098***	−1.698***	−1.164	−1.357	2.945	1.863	−0.679***	−0.549***
ETA	0.127***	0.137***	−0.385***	−0.296***	−1.105***	−1.615***	0.062***	0.054***
CIR	−0.077***	−0.047***	0.050	0.109	−0.536***	−0.419***	−0.008	−0.016
DTA	−0.033***	−0.093***	0.087***	0.129***	0.108***	0.219***	−0.004	−0.007
AD	0.040***	0.100***	−0.115***	−0.215***	0.467***	0.208***	−0.013**	−0.029**
GDP	−0.016	−0.116	0.151*	0.351**	−0.203	−0.311	0.090*	0.107*
INF	0.009	0.069	0.013	0.208	0.246***	0.179***	0.047	0.080
MCPI	−0.001*	−0.027*	0.023***	0.083***	−0.158***	−0.216***	−0.012***	−0.157***
Constant	0.068***	0.108***	0.106***	0.249***	0.230***	0.650***	−0.084	−0.172
Bank-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	27,075	27,075	21,334	21,334	23,325	23,325	1.772	1.772
Number of id	5694	5694	4490	4490	5442	5442	518	518
Hansen Test (p-value)	0.230	0.156	0.164	0.357	0.254	0.378	0.238	0.305
AR2 test (p-value)	0.133	0.2383	0.228	0.330	0.230	0.185	0.206	0.415

Table B-2
Corruption and Loan Growth (Developed and Developing Countries)

Variables	Developing countries	Developed countries
Model	**1**	**2**
Lagged LG	0.693***	0.641***
BLC	**0.08****	**−0.026***
SIZE	−0.06***	0. 106***
ETA	−0.017***	−0.023***
CIR	0.306***	0.283***
DTA	0.019***	0.026***
AD	0.024**	0.071***
GDP	0.170***	0.189***
INF	−0.018***	−0.103***
crisis	0.157***	0.283**
Constant	−0.829***	−0. 518***
Observations	2217	19,430
Bank-fixed-effects	Yes	Yes
Time-fixed-effects	Yes	Yes
Number of id	853	3953
Hansen Test (p-value)	0.215	0.362
AR2 test (p-value)	0.493	0.232

Table B-3
Correlation matrix

A. Correlation matrix of raw variables

	ROA	MCPI	SIZE	ETA	CIR	DTA	AD	GDP	INF	crisis
ROA	1.000									
MCPI	0.013	1.000								
SIZE	0.051	0.133	1.000							
ETA	−0.037	0.148	−0.174	1.000						
CIR	−0.277	−0.023	−0.257	0.062	1.000					
DTA	−0.064	−0.085	−0.168	0.462	0.044	1.000				
AD	−0.011	−0.065	−0.065	0.159	0.027	0.376	1.000			
GDP	0.049	0.120	0.049	0.006	−0.098	−0.021	−0.009	1.000		
INF	0.026	0.541	−0.060	0.104	−0.009	−0.027	−0.105	0.048	1.000	
crisis	−0.040	−0.100	−0.088	−0.011	0.088	0.063	−0.073	−0.560	−0.076	1.000

B. Correlation matrix of coefficients of estimated model

e(V)	ROA	MCPI	SIZE	ETA	CIR	DTA	AD	GDP	INF	crisis
ROA	1.000									
MCPI	0.068	1.000								
SIZE	−0.026	−0.175	1.000							
ETA	−0.043	−0.067	0.281	1.000						
CIR	0.117	−0.068	0.176	0.059	1.000					
DTA	0.237	0.176	−0.486	−0.157	0.097	1.000				
AD	−0.098	−0.071	0.067	0.067	−0.070	−0.312	1.000			
GDP	−0.090	−0.249	0.227	0.216	0.007	−0.221	0.108	1.000		
INF	−0.103	−0.065	0.353	0.219	0.043	−0.285	0.105	0.260	1.000	
crisis	−0.046	0.044	−0.004	−0.020	−0.052	−0.051	0.153	0.570	−0.006	1.000

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