

Tran Hung Son; Hoang Cong Gia Khanh; Nguyen Thanh Liem

Article

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Corresponding author: Tran Hung Son, Institute for Development and Research in Banking Technology, University of Economics and Law, Vietnam National University-HCM, Ho Chi Minh City, Vietnam
E-mail: sonth@uel.edu.vn

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David McMillan, University of Stirling, UK

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BANKING & FINANCE | RESEARCH ARTICLE

Credit information sharing, corruption and financial development: International evidence

Tran Hung Son^{1,2}, Hoang Cong Gia Khanh^{1,2} and Nguyen Thanh Liem^{1,2}

Abstract: This study investigates the individual impact of credit information sharing and corruption as well as their interaction on financial development, using a sample of 120 countries for the period 2004–2017. Public credit registries (PCR) and private credit bureaus (PCB) are used as proxies for the level of credit information sharing, whereas financial development is measured in terms of size, activity and efficiency. We obtain evidence in support of the following arguments. First, PCB has a negative impact on the size of the financial sector, whereas PCR has an insignificant effect. Second, PCB and PCR have a positive impact on the financial intermediation activity, with the magnitude of the latter being higher. Third, PCB and PCR increase the financial sector efficiency, again with the magnitude of the latter being stronger. Fourth, both PCR and PCB reduce the negative effects of corruption on financial sector development, but PCR tends to be more effective, suggesting that PCR may play a more important role compared to that of PCB. The findings survive a battery of robustness tests, including the use of an alternative corruption indicator and sub-sample analysis. Finally, policy implications are discussed.

Subjects: Economics; Finance; Banking

Keywords: information sharing; corruption; financial development

Jel: G15; G21; O16

ABOUT THE AUTHORS

Dr. Tran Hung Son is currently working for the University of Economics and Law, Vietnam National University, Hochiminh city and Institute for Development and Research in Banking Technology. His research interests cover contemporary issues in banking and finance, financial crisis, financial development.

Associate Professor Hoang Cong Gia Khanh is a Vice Rector of University of Economics and Law, Vietnam National University, Hochiminh city. His research interests are in the fields of banking and finance issues.

Dr. Nguyen Thanh Liem is a Research Fellow at the Institute for Development and Research in Banking Technology. He mainly works in the field of corporate governance, innovation and bank stability and performance.

PUBLIC INTEREST STATEMENT

The information about the creditworthiness of the borrowers is shared by public credit registries (PCRs) and private credit bureaus (PCBs). However, whether these agencies can mitigate the information asymmetry and support financial development remains an empirical question to answer. This study uses a sample of 120 countries in the period from 2004 to 2017, and finds that PCBs and PCRs have different impacts on financial development depending on how financial development is measured. However, in general, PCRs have a more positive impact compared to PCBs. We also find that corruption hampers financial development, and both PCBs and PCRs help contain the negative impact of this factor. Interestingly, PCRs tend to be more effective with regard to this. Several implications are provided to promote the effectiveness of PCBs and PCRs in encouraging financial development.

1. Introduction

The financial sector plays a vital role in a country's economy, and the lack of it may adversely affect firms' performance (Pradhan & Hiremath, 2020a). Nevertheless, the financial sector does not always function properly especially when there is a high level of information asymmetry, causing damages to the economy. In a lending relationship, asymmetric information is a situation in which borrowers have more information than lenders. Asymmetric information adversely affects financial development by reducing the efficient allocation of capital (Jappelli & Pagano, 2002). Information-sharing bureaus have been introduced to reduce concerns over the moral hazard and adverse selection issues in the financial markets (see Triki & Gajigo, 2014). Information-sharing might mitigate issues related to foreign-currency borrowings of firms in developing countries like India (Pradhan & Hiremath, 2019, 2020b), as financial soundness of firms is exposed in more detail for easier credit appraisal.

Credit information sharing is the exchange of information on a client's financial history, covering credit history, credit worthiness and the current debt level of the borrower (Jappelli & Pagano, 2002). Information sharing via private bureaus and public credit registries has become an important part of banking system development (Barth et al., 2009). Previous studies tend to support the argument that credit information sharing exerts a positive effect on financial development. For instance, Jappelli and Pagano (2002) show that information-sharing institutions help to increase the size of the credit market. Djankov et al. (2007) find that public credit registries could lead to higher ratios of private credit to GDP in developing countries.

The literature has extolled the benefits of credit information sharing on credit activities. Houston et al. (2010) argue that information sharing leads to higher bank profitability and lower bank risk. Better credit information sharing can reduce the negative effect of abnormal loan growth on bank risk (Soedarmono & Sitorus, 2017), and mitigate financial fragility as well as the detrimental impact of a credit boom on financial fragility (Guérineau & Léon, 2019). Other studies show that information-sharing bureaus may increase corporate access to finance and financial development in terms of depth, efficiency, activity and size (Asongu et al., 2016; Triki & Gajigo, 2014).

Besides credit information sharing, corruption can have an impact on the lending behavior of banks (Tran et al., 2020). The "sand the wheels" hypothesis suggests that corruption can adversely affect financial sector activity (see Cooray & Schneider, 2018), and greater corruption may result in a financial crisis (e.g., Park, 2012). Barth et al. (2009) show that information sharing helps mitigate corruption in lending.

In this study, we analyze whether the relationship between credit information sharing and financial development depends on the degree of corruption in a country. Using aggregate data from World Bank covering 120 countries over the period 2004–2017, we address two fundamental questions: First, are credit information sharing and corruption significantly associated with financial development? Second, does the relation between credit information sharing and financial development change at high and low levels of corruption?

This paper contributes to the existing literature in three important ways. First, the vast majority of extant studies tend to focus on the corruption-economic growth nexus, and little has been researched on the link between corruption and financial development. In this paper, we show that corruption has a negative impact on financial development, considering several facets including the size, efficiency and activity of the financial sector. Second, several studies have discussed the influence of credit information sharing on financial development, but those works only cover particular regions (see for example, Asongu et al. (2016)), so the generalizability of the findings might suffer. We use a sample of 120 countries with the most updated dataset. Finally, we show consistent and robust evidence suggesting that credit information sharing can alleviate information asymmetry associated with corruption, thus allowing more credit availability with lower levels of non-performing loans.

The rest of the paper is organized as follows. Section 2 presents the discussion on the relevant literature on the link between information sharing, corruption and financial development. Section 3 outlines the research methodology, including estimation method, models, hypotheses and variable definition. Section 4 displays the results of the estimation of the models to test the hypotheses. Section 5 concludes the paper with the implications and suggestions for future research.

2. Literature review

This section summarizes two strands of empirical literature focusing on: (1) information sharing and financial development and (2) corruption and financial development. Then, we discuss the background on the impact of the interaction of information sharing and corruption on financial development.

2.1. Information sharing and financial development

According to Jappelli and Pagano (2002), there has been a substantial theoretical foundation showing that information asymmetry reduces the efficient allocation of capital, thus adversely affecting financial development. Due to the fact that lenders tend to lack information about the genuine situation of borrowers, they are exposed to the risk of adverse selection. The lenders could face more severe losses when they are unable to monitor or control the behaviors of borrowers in the post-credit period. For both insolvent and solvent borrowers, there could be incentives to limit the reimbursement of financial obligations that are associated with the loan.

Therefore, to protect the lenders' capital against such risks, credits are granted only with high interest rates and through costly screening processes, which substantially imposes adverse effect on financial development and the ability of firms to compete well as their costs of debt have increased markedly. Asongu et al. (2016) suggest that these disadvantages could be contained with the advent of information sharing on the borrowers' credit history and solvency traits. Across the globe, private credit bureaus (PCB) and public credit registries (PCR) have been established to share the much-needed information with banks. By addressing the issue of information asymmetry, information sharing helps promote efficient allocation, lower the possibility of firms encountering credit constraints as long as they have more ability to exchange information with the lenders, and nurture credit market competition (Jappelli & Pagano, 2002), and improve credit availability and lower borrowing cost (Barth et al., 2009; Brown et al., 2009).

Guérineau and Léon (2019) find that credit information sharing decreases financial fragility for both advanced and less developed countries, and it also alleviates the negative impact of a credit boom on financial fragility but this effect only exists for more developed countries and for household credit booms. Jappelli and Pagano (2002) opine that bank lending is higher and credit risk is lower in countries where lenders share information about borrowers. Ivashina (2009) examines how the lead bank's ownership share of a syndicated loan affects the information asymmetry in the lending syndicate. The results find that the information asymmetry problem within a syndicate has an important economic impact on loan spread. Soedarmono and Sitorus (2017) investigate the joint effect of abnormal loan growth and credit reporting system on bank risk. The results find that better information sharing can reduce bank risk one year ahead due to higher abnormal loan growth.

A number of studies have assessed the effect of stronger rights to information of creditors on risk-taking behavior of banks as well as bankruptcy likelihood (Djankov et al., 2007; Houston et al., 2010). Examining the effect of stronger rights to information by creditors, Djankov et al. (2007) find that legal creditor rights and information-sharing institutions not only increase credit amount, but also reduces borrowers' bankruptcy later on. On the contrary, using a sample of approximately 2,400 banks in 69 countries, Houston et al. (2010) show that stronger creditor rights tend to promote greater bank risk taking, while information sharing among creditors beneficially leads to higher bank profitability and lower bank risk.

Information-sharing bureaus are expected to theoretically increase access to finance by promoting the development of the financial sector (Asongu et al., 2016; Triki & Gajigo, 2014). Asongu et al. (2016) examine the relationship between information sharing and financial development in African countries, and show differing findings about the effects of information-sharing bureaus on financial development in terms of depth, efficiency, activity and size. Triki and Gajigo (2014) investigate: (1) the effects of public and private credit registries on firms' access to finance and (2) the effect of public credit registries' design on the obstacles in access to finance. Their findings show that (1) access to finance is on average better in economies with more private credit bureaus (PCBs), compared to countries with more public credit registries (PCRs) or countries with no presence of both, and (2) there are considerable differences in firms' access to finance among countries with PCRs.

2.2. Corruption and financial development

"Sand the wheels" hypothesis suggests that corruption negatively affects economic activities. Mauro (1995) shows that corruption degrades the quality of private investment and lowers economic growth. Corruption has a significant negative effect on the efficiency of public expenditure, the accumulation of human capital, foreign direct investment, and the effectiveness of international aids, thus implying a detrimental effect on economic growth (Cieslik & Goczek, 2018; Grundler & Potrafke, 2019; Mo, 2001; Murphy et al., 1993; Shleifer & Vishny, 1993; Wei, 2000).

The impact of corruption on the financial system is scantily researched, compared to the corruption-growth nexus. For the financial system, corruption may also have an adverse effect because it can undermine the integrity of the banking system and provide incentives for banks to accept more risks. For example, Khwaja and Mian (2005) and Charumilind et al. (2006) show that firms that own links to officials/politicians will be able to attain bank loans but those firms are more likely to end up with higher default rate, generating high risks for the banks and triggering financial crises.

Consistently, M. Chen et al. (2015) show that corruption will increase banks' risk-taking. Corruption is also a cause for the rise in capital costs (M. Chen et al., 2015; Ciocchini et al., 2003). Akins et al. (2015) show that banks with a higher governmental stake and/or those covered in deposit insurance scheme fail to reduce the adverse impact of corruption in lending activities even when they can identify the risk of capital loss. The quality assets of the banking system will be affected by the inefficient allocation of bank funds. Bougateg (2015) provides evidence that corruption aggravates the problem of impaired financing. Park (2012) and Tran et al. (2020) find that the banking system is a channel that transfers the impact of corruption on economic growth by considering nonperforming loans that are negatively affected by corruption. Cooray and Schneider (2018) examine the relationship between corruption and financial sector development. They find evidence to support the "sand the wheels" hypothesis, that is a decline in corruption is associated with higher levels of financial sector development.

The alternative view is that corruption "greases the wheels" of economic activities; in other words, corruption might improve economic development. For instance, efficient projects will be facilitated further by bribing politicians and banks to get credit approvals (see Mauro (1995) for a similar "speed money" argument). Y. Chen et al. (2013) find that bribery enables more productive firms to be granted larger loans. Toader et al. (2017) show that in countries with higher levels of corruption, banks could increase their stability if they implement rigorous corporate governance practices. That view is consistent with the argument that corruption could help counteract bad policies, thereby promoting economic activity in countries with weak institutions (Dreher & Gassenbner, 2013; Johnson, 1975; Lef, 1964; Leys, 1965; Nye, 1967; Wedeman, 1997).

In summary, the literature tends to suggest the positive effect of information sharing on financial development, thanks to its ability to tackle information asymmetry. Meanwhile, even though corruption can have both encouraging and detrimental effects on financial development, the findings from previous studies in general support the "sand the wheels" hypothesis. This leads to our following testable hypotheses:

Hypothesis 1: information sharing is positively associated with financial development.

Hypothesis 2: corruption is negatively associated with financial development.

According to Bermpei et al. (2020), there are several reasons why public corruption could negatively affect lending activity. First, corruption, with its characteristics of illegality and secrecy, can increase the information asymmetry between borrowers and banks (Shleifer & Vishny, 1993). As a consequence, firms in the region with high corruption could become more clandestine and less information is available about them. This could be seen as a defensive move in an effort to guard the firms' assets against the expropriation by public officials. However, it could also be a result of managers concealing their participation in corruption-related behavior. Empirical studies such as Dass et al. (2016), Dass et al. (2018), and Xu et al. (2019) confirm that firms in the region with higher levels of corruption tend to have lower information transparency.

Corruption could also increase information asymmetries between borrowers and lenders through the establishment of a culture that accepts unethical behavior, or create more uncertainty about the cash-flows, or firms' ability to honor the loans (Bermpei et al., 2020). Therefore, it is expected that credit information sharing should weaken the negative influence of corruption on bank lending: information-sharing bureaus should provide much-needed information about the true financial status, thus mitigating the association between corruption and information asymmetry between borrowers and lenders. This leads us to our third testable hypothesis as follows:

Hypothesis 3: credit information sharing weakens the negative influence of corruption on financial development.

3. Data and methodology

3.1. Data

This paper investigates 120 countries with data from the Financial Development and Structure Database and World Development Indicators (WDI) of the World Bank for the period 2004 to 2017. The chosen period is constrained by data availability. Specifically, the data on credit information sharing (PCBs and PCRs) from the World Bank are only available from the year 2004. In the meantime, the Financial Development and Structure Database is only updated until 2017.

We use the following proxies to gauge different aspects of financial development, in line with the previous literature (Asongu & Nwachukwu, 2017; Asongu et al., 2016; Demircug-Kunt & Maksimovic, 1996; King & Levine, 1993; Levine & Zervos, 1998): (1) FDGDP, the ratio of liquid liabilities to GDP, which is a measure of the size of the financial sector relative to the economy; (2) Two measures of financial intermediation activity are used: the ratio of domestic credit provided by the banking sector to GDP (BSD) and the ratio of domestic credit provided by the financial sector to GDP (FSD); (3) Non-performing loans to total gross loans (NPL), which is a measure of financial sector efficiency. A lower level of non-performing loans reflects higher financial sector efficiency.

Following previous studies (e.g. Asongu & Nwachukwu, 2017; Asongu et al., 2016; Barth et al., 2009; Triki & Gajigo, 2014), credit information sharing is measured with public credit registries and private credit bureaus as a percentage of adults covered.

Our main measure of cross-country corruption is the International Country Risk Guide (ICRG) corruption index. The ICRG index ranges from 0 (totally corrupt) to 6 (not corrupt). As an alternative measurement of corruption, we use the Control of Corruption index (CCI), which is established by the World Bank as a robustness test. CCI ranges from -2.5 to 2.5. Note that higher values of the corruption indices denote better control of corruption.

Five control variables are used in order to account for bias stemmed from variable omission, namely: GDP growth (GDP), financial freedom index (FINFREE), government expenditures, the rate of government expenditures over GDP (GOV), Trade openness, the ratio of the sum of total exports and imports to GDP (TRADE), rule of law (ROL). The choice of these variables is in accordance with the financial development literature (Asongu & Nwachukwu, 2017; Asongu et al., 2016; Cooray & Schneider, 2018; Herger et al., 2008).

The positive relationship between economic growth, trade openness and financial development has been recorded in the literature (Herger et al., 2008; Levine & Zervos, 1998). Previous studies show that financial freedom positively relates to financial development through financial liberalization and economic freedom (Chinn & Ito, 2006; Hafer, 2013). High public spending can put constraints on the financial system of a country (Cooray & Schneider, 2018), that is, the private credit provided by the financial system could be lower due to larger government expenditures. The nexus between rule of law and financial development has been assessed by Dima et al. (2018) who have found a positive relationship.

3.2. Methodology

To verify the effects of credit information sharing and corruption on financial development, i.e. hypotheses 1 and 2, we use the model as in Equation (1).

$$FD_{i,t+1} = \alpha_0 + \alpha_1 \cdot PCB_{i,t} + \alpha_2 \cdot PCR_{i,t} + \alpha_3 \cdot CORR_{i,t} + \beta X_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$FD_{i,t+1} = \gamma_0 + \gamma_1 \cdot PCB_{i,t} + \gamma_2 \cdot PCR_{i,t} + \gamma_3 \cdot CORR_{i,t} + \gamma_4 \cdot PCB \times CORR_{i,t} + \gamma_5 \cdot PCR \times CORR_{i,t} + \theta X_{i,t} + u_{i,t} \quad (2)$$

where *FD* is the financial development of a country; *PCB*, private credit bureaus; *PCR*, public credit registries; *CORR* is the corruption index; *X* is the vector of five control variables. The interaction terms *PCB* × *CORR* and *PCR* × *CORR* are entered (model 2) to examine hypothesis 3.

To estimate the models, pooled OLS is employed to with robust standard errors to control for heteroskedasticity within the panel data. We also use the one-order lead value of the dependent variable, i.e. the period of proxies of financial development is one year behind that of explanatory variables, to tackle the potential endogeneity associated with the two-way relationship between the dependent and independent variables. As the number of the units is approx. 10% percent of the observations, the use of a fixed effects model will lead to a huge loss of a degree of freedom. Furthermore, the use of pooled OLS is in line with several research works on financial developments including Asongu et al. (2019), Hafer (2013), and Djankov et al. (2007).

4. Empirical results

4.1. Descriptive statistics

Table 1 provides descriptive statistics on the value of the variables in the paper. The average ratio of liquidity liabilities to GDP (FDGDP) is 68.5%. Domestic credit provided by the banking sector to GDP (BSD) is 52.6%, while the ratio of domestic credit provided by the financial sector to GDP (FSD) for the period examined is 57.2%. The mean value of non-performing loans to total gross loans (NPL) is about 6.18%. Our variables of interest, *PCB*, Private credit bureau coverage (% of adults), and *PCR*, Public credit registry coverage (% of adults), recorded a mean of 32.8% and 10.9%, respectively. The corruption index ranges from 0 (totally corrupt) to 6 (not corrupt). The mean value of the ICRG (*CORR*) corruption index in the sample is 2.69.

Table 2 reports pairwise correlation coefficients between variables in the model. The three proxies of the financial sector (FDGDP, BSD, FSD) are positively correlated with the credit information sharing; which suggests that credit information sharing increases the levels of private-sector credit availability and liquid liabilities. The financial sector efficiency (NPL) is negatively correlated

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FDGDP	1,852	68.508	80.752	2.623	938.722
BSD	1,843	52.618	40.758	0.350	218.944
FSD	1,852	57.236	46.678	0.350	260.704
NPL	1,363	6.183	6.697	0.100	54.541
CORR	1,893	2.696	1.167	0.500	6.000
PCB	1,519	32.833	36.994	0.000	100.000
PCR	1,519	10.901	19.656	0.000	100.000
GDP	1,887	3.961	5.172	-62.076	123.140
FINFREE	1,709	56.121	18.551	10.000	90.000
GOV	1,828	15.605	4.837	0.952	30.003
TRADE	1,862	89.797	60.040	0.167	442.620
ROL	1,881	0.149	0.986	-2.090	2.100

Source: Author's calculation from research dataset

with credit information sharing, suggesting that increasing information sharing reduces the level of bad loans. Three proxies of the financial sector (FDGDP, BSD, FSD) are positively associated with the corruption index (CORR); in other words, lower levels of corruption are positively associated with higher levels of private-sector credit availability and liquid liabilities. Financial sector efficiency (NPL) is negatively correlated with the corruption index, suggesting that corruption increases non-performing loans.

4.2. Regression results

This section presents the results of the estimation of the models presented in section 3. Table 3 provides regression results on the impact of credit information sharing and corruption on financial development. The results in Column (1) show that PCB is significantly and negatively linked to the size of the financial sector (FDGDP), whereas the effect of PCR is not significant. From columns (2) and (3), we find that PCB and PCR have a positive impact on the financial intermediation activity, suggesting that information-sharing bureaus promote credit availability. The more positive coefficients of PCR relative to that of PCB suggest that PCR may play a more significant role compared to PCB for financial development. Finally, Column (4) shows that corruption enhances the ratios of non-performing loans, thus leading to a higher likelihood of a financial crisis. Both PCB and PCR have negative effects on financial sector efficiency, with the negative magnitude of the latter higher on the dependent variable.

Regarding the corruption factor (CORR), the results indicate that private-sector credit availability increases as a country becomes less corrupt. Those results provide evidence that information-sharing bureaus reduce non-performing loans or increase the financial sector efficiency. (2) Similarly, the effect of corruption on non-performing loans is negative and statistically significant, indicating non-performing loans decline as the corruption issue in a country is addressed. Those results provide evidence in support of the “sand the wheels” hypothesis (Hypothesis 2).

For control variables, the results imply that a country with higher financial freedom, trade openness and stronger rule of law has positive and significant effects on financial sector size and financial intermediation activity. Higher financial freedom, trade openness and better rule of law lead to increases in liquid liabilities and private credit availability, as well as lower ratios of non-performing loans (only in case of financial freedom). In addition, economic growth leads to a decrease in liquid liabilities, private credit and non-performing loans.

Table 2. Correlation matrix

	FDGDP	BSD	FSD	NPL	CORR	PCB	PCR	GDP	FINFREE	GOV	TRADE	ROL
FDGDP	1.000											
BSD	0.489	1.000										
FSD	0.473	0.938	1.000									
NPL	-0.108	-0.231	-0.179	1.000								
CORR	0.382	0.679	0.662	-0.337	1.000							
PCB	0.071	0.383	0.381	-0.144	0.389	1.000						
PCR	0.000	0.101	0.057	-0.069	0.031	-0.081	1.000					
GDP	-0.109	-0.233	-0.243	-0.069	-0.194	-0.163	-0.082	1.000				
FINFREE	0.304	0.511	0.490	-0.299	0.571	0.346	-0.137	-0.148	1.000			
GOV	0.111	0.374	0.358	-0.111	0.433	0.249	0.010	-0.309	0.337	1.000		
TRADE	0.545	0.363	0.283	-0.094	0.275	0.029	-0.039	0.006	0.297	0.046	1.000	
ROL	0.409	0.740	0.726	-0.299	0.867	0.436	0.006	-0.208	0.654	0.499	0.369	1.000

Source: Author's calculation from research dataset

Table 3. Credit information sharing, corruption and financial development

	(1)	(2)	(3)	(4)
	FDGDP	BSD	FSD	NPL
CORR	12.717*** (3.845)	4.955*** (1.467)	5.162*** (1.573)	-2.139*** (0.296)
PCB	-0.174*** (0.064)	0.062** (0.028)	0.069** (0.033)	-0.024*** (0.006)
PCR	0.004 (0.079)	0.207*** (0.061)	0.108* (0.063)	-0.049*** (0.009)
GDP	-2.41*** (0.511)	-1.286*** (0.208)	-1.67*** (0.267)	-0.551*** (0.078)
FINFREE	0.297*** (0.111)	0.298*** (0.058)	0.286*** (0.063)	-0.087*** (0.015)
GOV	-1.278*** (0.290)	-0.166 (0.198)	-0.307 (0.210)	-0.019 (0.043)
TRADE	0.620*** (0.084)	0.080*** (0.019)	0.052*** (0.019)	0.000 (0.002)
ROL	6.338* (3.609)	20.291*** (1.703)	22.738*** (1.850)	1.533*** (0.379)
CONSTANT	-6.587 (14.969)	18.656*** (6.168)	29.85*** (6.694)	20.441*** (1.442)
R ²	0.417	0.594	0.539	0.221
N	1211	1201	1209	1002

*, **, and *** represent the significance levels at 10%, 5%, and 1%, respectively. Numbers in parentheses are standard errors.

We further test hypothesis 3 and the results are reported in Table 4. The interaction between PCR with corruption factor (CORR) consistently has a negative coefficient towards the financial sector size and financial intermediation activity variables and a positive coefficient for the financial sector efficiency (NPL). This evidence strongly suggests that PCR has an effective role in addressing the information asymmetry between borrowers and lenders, especially when the asymmetry is related to corruption.

The interaction between PCB with CORR also exerts a significantly negative effect only in the regression of financial sector size, while having insignificant effects on other aspects of financial development. In general, the evidence implies that both PCB and PCR tend to be an enabler in alleviating the problem of information asymmetry, thus lowering the possibility of adverse selection which ultimately results in higher ratios of non-performing loans while increasing the amount of credit granted in the economy. In addition, credit information sharing reduces the negative effects of corruption on financial sector development, consistent with Hypothesis 3.

5. Robustness tests

To ascertain the robustness of the findings, we perform two tests: (1) conduct the same analyses replacing the ICRG corruption index with Control of Corruption index (CCI) (another measure of corruption); (2) conduct a comparative analysis of the impact of credit information sharing on financial development based on the degree of corruption by subdividing our main sample into two groups of high and low corruption based on whether a country's index of corruption is higher or lower than the median.

Table 4. Credit information sharing, corruption and financial development and interaction terms

	(1)	(2)	(3)	(4)
	FDGDP	BSD	FSD	NPL
CORR	19.77*** (6.521)	5.336*** (1.950)	6.604*** (2.122)	-2.461*** (0.339)
PCB	0.219 (0.158)	-0.051 (0.061)	0.049 (0.068)	-0.027* (0.014)
PCR	0.696** (0.273)	0.785*** (0.169)	0.652*** (0.173)	-0.14*** (0.025)
PCB*CORR	-0.136** (0.066)	0.028 (0.022)	-0.001 (0.024)	0.002 (0.004)
PCR*CORR	-0.242*** (0.089)	-0.178*** (0.055)	-0.172*** (0.056)	0.029*** (0.006)
GDP	-2.205*** (0.487)	-1.282*** (0.211)	-1.633*** (0.264)	-0.561*** (0.076)
FINFREE	0.254** (0.113)	0.325*** (0.056)	0.299*** (0.062)	-0.089*** (0.015)
GOV	-1.297*** (0.289)	-0.069 (0.188)	-0.238 (0.200)	-0.03 (0.042)
TRADE	0.596*** (0.076)	0.078*** (0.019)	0.046** (0.020)	0.001 (0.002)
ROL	8.241*** (3.117)	20.2*** (1.706)	22.976*** (1.868)	1.474*** (0.386)
CONSTANT	-20.991 (19.140)	14.488** (6.277)	24.357*** (6.717)	21.56*** (1.448)
R ²	0.425	0.604	0.545	0.229
N	1211	1201	1209	1002

*, ** and *** represent the significance levels at 10%, 5% and 1%, respectively. Numbers in parentheses are standard errors.

5.1. Alternative corruption index

We use the Control of Corruption index (CCI) which ranges from -2.5 to 2.5. Note that higher values on the corruption indices denote better control of corruption.

Table 5 shows results for the interaction between credit information sharing and the Control of Corruption index. Consistent with the result in Table 4, the interaction between PCR with corruption consistently has a negative coefficient towards the financial sector size and financial intermediation activity variables and a positive coefficient towards the financial sector efficiency. However, the interaction between PCB with corruption only has a significantly negative effect on domestic credit provided by the banking sector (BSD). These results have, again, reinforced the conclusion that credit information sharing reduces the negative effects of corruption on financial sector development.

5.2. Sub-sample analysis

In this sub-section, we conduct a comparative analysis of the impact of credit information sharing on financial development based on the degree of corruption by subdividing our main sample into two groups of high and low corruption based on whether a country's index of corruption (ICRG index) is higher or lower than the median. In Table 6, it is clear that PCB and PCR have more

Table 5. Interaction terms of credit information sharing and control of corruption index

	(1)	(2)	(3)	(4)
	FDGDP	BSD	FSD	NPL
CORR	16.098* (8.214)	6.469* (3.389)	5.983 (3.639)	-6.427*** (0.596)
PCB	-0.146*** (0.048)	-0.009 (0.027)	0.017 (0.031)	-0.02*** (0.007)
PCR	0.112 (0.098)	0.369*** (0.061)	0.253*** (0.064)	-0.066*** (0.012)
PCB*CORR	-0.11 (0.073)	0.071*** (0.024)	0.039 (0.026)	0.008* (0.005)
PCR*CORR	-0.289*** (0.098)	-0.256*** (0.068)	-0.25*** (0.068)	0.038*** (0.008)
GDP	-2.345*** (0.508)	-1.34*** (0.212)	-1.697*** (0.269)	-0.511*** (0.073)
FINFREE	0.263** (0.111)	0.332*** (0.057)	0.307*** (0.061)	-0.092*** (0.015)
GOV	-1.242*** (0.292)	0.014 (0.187)	-0.16 (0.201)	-0.04 (0.040)
TRADE	0.589*** (0.075)	0.073*** (0.019)	0.042** (0.020)	0.005** (0.002)
ROL	11.514** (5.055)	18.118*** (2.931)	22.757*** (3.371)	5.121*** (0.624)
CONSTANT	29.169*** (8.197)	27.089*** (4.831)	40.155*** (5.822)	14.875*** (1.319)
R ²	0.416	0.607	0.545	0.263
N	1211	1201	1209	1002

*, **, and *** represent the significance levels at 10%, 5%, and 1%, respectively. Numbers in parentheses are standard errors.

positive impacts on financial development (increasing the financial sector size and activity, while reducing non-performing loans) in countries that have higher levels of corruption (or lower ICRG index). When a country has higher levels of corruption, it is expected that more information asymmetry occurs between borrowers and lenders (Bermpei et al., 2020). As a result, PCB and PCR should help more efficiently in countries with high levels of information asymmetry. All the evidence in Tables 4–6 are strongly in line with Hypothesis 3. In other words, credit information sharing reduces the negative effects of corruption on financial sector development in countries with higher levels of corruption.

6. Conclusion

Our paper examines the individual effects of credit information sharing and corruption, and whether the impact of credit information sharing on financial development is based on the degree of corruption. The research sample comprises 120 countries over the period from 2004 to 2017. First, contrary to PCR which has insignificant effects, PCB has a negative impact on the size of the financial sector. Second, PCB and PCR have positive impacts on the financial intermediation activity, with the magnitude of the latter higher. Third, PCB and PCR increase the financial sector efficiency, with the magnitude of the latter higher. Fourth, PCR reduces the negative effects of corruption on financial sector development, suggesting that PCR may play a more significant role

Table 6. Sub-sample analysis

	FDGDPL	FDGDPH	BSDL	BSDH	FSDL	FSDH	NPLL	NPLH
CORR	-10.179** (4.999)	20.69*** (7.337)	-3.954* (2.140)	2.685 (2.721)	-2.384 (2.356)	1.018 (2.920)	-2.088*** (0.704)	-1.553*** (0.374)
PCB	0.001 (0.043)	-0.307*** (0.110)	0.183*** (0.032)	-0.023 (0.044)	0.229*** (0.036)	-0.069 (0.054)	-0.029*** (0.010)	-0.011 (0.008)
PCR	0.376*** (0.112)	-0.162 (0.113)	0.328*** (0.083)	0.082 (0.090)	0.228** (0.090)	-0.085 (0.095)	-0.076*** (0.015)	-0.02 (0.014)
GDP	-0.956*** (0.304)	-3.949** (1.628)	-0.74*** (0.194)	-2.172*** (0.508)	-0.839*** (0.216)	-3.254*** (0.714)	-0.598*** (0.076)	-0.493*** (0.173)
FINFREE	0.144 (0.099)	0.531** (0.260)	-0.022 (0.053)	0.769*** (0.113)	-0.004 (0.058)	0.616*** (0.131)	-0.095*** (0.022)	-0.06*** (0.022)
GOV	-0.329 (0.246)	-1.092* (0.593)	0.148 (0.185)	-0.745** (0.372)	0.462** (0.220)	-1.687*** (0.380)	-0.031 (0.070)	0.019 (0.047)
TRADE	0.2*** (0.039)	0.711*** (0.103)	0.215*** (0.033)	0.025 (0.024)	0.229*** (0.038)	-0.03 (0.025)	-0.014** (0.006)	0.005** (0.002)
ROL	13.967*** (2.645)	2.178 (6.286)	16.592*** (1.708)	25.447*** (3.334)	17.022*** (1.796)	31.75*** (3.764)	2.485*** (0.540)	-0.097 (0.551)
CONSTANT	56.811*** (9.995)	-52.885 (34.891)	29.738*** (6.011)	14.573 (13.591)	23.397*** (6.639)	61.752*** (16.493)	23.019*** (2.105)	15.785*** (2.704)
R ²	0.148	0.426	0.39	0.503	0.339	0.438	0.218	0.164
N	729	482	728	473	729	480	560	442

*, **, and *** represent the significance levels at 10%, 5% and 1%, respectively. Numbers in parentheses are standard errors. FDGDPL, BSDL, FSDL, NPLL refer to the sub-sample with countries having corruption index lower than the median of the whole sample. FDGDPH, BSDH, FSDH, NPLH refer to the sub-sample with countries having corruption index higher than the median of the whole sample.

compared to PCB. Fifth, we find that information sharing reduces the negative effect of corruption on financial development. The results are robust to an alternative corruption indicator and sub-sample analysis.

The main policy implication from the study is that information sharing increases financial sector development. Importantly, we find that PCR might play a more important role compared to PCB. As a consequence, countries could either promote PCB to make these agencies more useful, or if constrained in terms of resources, governments could just focus on PCR as these agencies are more efficient in terms of encouraging financial development.

A limitation of this is that it examines only three financial development perspectives, namely financial sector size, financial sector activity and financial sector efficiency. Therefore, other studies could analyze the impact of information sharing on other aspects of financial development to test the robustness of the results of this study, or investigate whether information sharing exerts different impacts on different aspects of financial development. In addition, information technology such as the use of information and communication technologies can affect financial sector development (Asongu et al., 2019). Future research can dissect the moderating effect of information and communication technologies on the link between corruption and financial development.

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Author details

Tran Hung Son^{1,2}
E-mail: sonth@uel.edu.vn
Hoang Cong Gia Khanh^{1,2}
E-mail: hcgk@uel.edu.vn
Nguyen Thanh Liem^{1,2}
E-mail: liemnt@uel.edu.vn

¹ University of Economics and Law, Ho Chi Minh City, Vietnam.

² Vietnam National University, Ho Chi Minh City, Vietnam.

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