Corruption and corporate investment efficiency around the world

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Abstract

Purpose – The paper investigates the effect of corruption on corporate investment efficiency around the world.

Design/methodology/approach – The sample includes 218,350 observations from 30,074 firms across 42 countries. The authors measure corruption based on the Corruption Perception Index (CPI) from Transparency International, Corruption Control Index (CCI) from the World Bank and Corruption Index from the International Country Risk Guide.

Findings – The authors find that corruption is negatively related to investment efficiency. The robustness checks with different measures of corporate investment and alternative regression approaches show consistent findings. Moreover, the authors also find that the effect of corruption is stronger (weaker) in strong (weak) shareholder protection countries.

Originality/value – The paper has two important contributions to the literature. First, it shows that corruption environment is also a determinant of corporate investment efficiency. Second, legal protection of shareholders can mitigate the negative effect of corruption on corporate investment efficiency.

Keywords Corruption, Investment efficiency, Investment

Paper type Research paper

1. Introduction

Modigliani and Miller (1958) posit that investment opportunities are the only determinant of corporate investment. Nevertheless, several market frictions are present in the real world; thus, corporate investment fails to archive its optimal status. Prior research shows that corporate investment efficiency is not only determined by firm-specific factors (Boubakri *et al.*, 2013; Chen *et al.*, 2006, 2017; Jensen and Meckling, 1976; Jiang *et al.*, 2011; Myers, 1977; Myers and Majluf, 1984b) but also by country-specific factors, such as shareholder protection (Xiao, 2013) and national culture (Zhang *et al.*, 2016). Recently, the effect of corruption on corporate financial decisions has attracted much attention from academics (Baxamusa and Jalal, 2014; Thakur and Kannadhasan, 2019; Tran, 2019, 2020a; Wang and You, 2012). This paper investigates how corruption influences corporate investment efficiency.

Cai *et al.* (2004), Svensson (2003), Wang and You (2012), Wei and Kaufmann (1999) and Xu *et al.* (2017) show that firms pay bribes to government officials as "grease money" and/or "protection money". Thakur and Kannadhasan (2019) and Tran (2020a) also find that firms in high corruption countries tend to save more cash for their bribery payment. These prior studies imply that managers in a highly corrupt environment are more flexible to use firm resources. Therefore, managers may exploit this flexibility to overinvest in unprofitable

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projects and reduce investment in profitable projects (Jensen and Meckling, 1976). This behavior leads to lower investment efficiency.

Following Baker *et al.* (2003) and Chen *et al.* (2017), we propose a model to examine how corruption influences the investment-investment sensitivity. Using a research sample of 218,350 firm years from 30,074 firms across 42 countries, we find that all corruption measures are negatively related to investment efficiency. Our robustness tests with various measures of corporate investment and alternative regression approaches report consistent findings. Moreover, prior research shows that legal protection of shareholders reduces agency costs and improves management quality. Therefore, we argue that the negative effect of corruption on investment efficiency is weaker in countries of strong shareholder rights. We divide the full sample into two sub-samples of strong and weak shareholder protection based on anti-self-dealing index, investor protection index and legal origin. We find that all corruption indices become more effective in corporate investment efficiency in weak shareholder protection countries.

This paper makes two contributions to the literature. First, prior studies document that corruption affects corporate financial decisions, such as cash holdings (Thakur and Kannadhasan, 2019; Tran, 2020a), dividend policy (Tahir *et al.*, 2020; Tran, 2019), capital structure (Singh and Kannadhasan, 2020), corporate risk-taking (Chen *et al.*, 2015b; Tran, 2020b), firm growth (Nguyen and Van Dijk, 2012) and investment growth (Asiedu and Freeman, 2009). However, they have not fully addressed how corruption determines corporate investment efficiency. This paper shows that managers take advantage of corrupt environments to increase overinvestment. Moreover, it provides additional evidence to support the negative relationship between corruption and national economic efficiency (Brunetti *et al.*, 1998; Doh and Teegen, 2003; Gründler and Potrafke, 2019; Zakharov, 2018). Second, while prior studies investigate the effect of shareholder protection on dividend policy (La Porta *et al.*, 2000b; Tran *et al.*, 2017) and cash holdings (Dittmar *et al.*, 2003; Iskandar-Datta and Jia, 2014), we examine the role of shareholder protection in mitigating the negative effect of corruption on corporate investment efficiency.

The rest of the paper is organized as follows. Section 2 reviews prior studies and develops main theoretical hypotheses. Section 3 and Section 4 describe the empirical strategy and the utilized data. Section 5 presents regression results and robustness checks. Section 6 concludes.

2. Corruption and investment

2.1 Literature review

Corruption is defined as behavior driven by personal interest to exploit public power and position (Jain, 2001). Main causes of corruption include market structure (Ades and Di Tella, 1999); legal, political and socioeconomic environment (Paldam, 2002; Treisman, 2000); institutional quality (Acemoglu *et al.*, 2001) and legal effectiveness (Herzfeld and Weiss, 2003). From a macroeconomic perspective, prior research shows that corruption tends to deteriorate economic efficiency. In a pioneer study, Mauro (1995) documents that corruption has a negative impact on investment, which in turn reduces national economic growth. Following studies also find that a high corruption environment is detrimental for investment (Brunetti *et al.*, 1998; Doh and Teegen, 2003; Zakharov, 2018). Lambsdorff and Cornelius (2000) document that corruption negatively affects both foreign direct investment and economic growth across 26 African countries.

Although many prior macroeconomic studies consistently show the negative relationship between corruption and economic performance, the effect of corruption on economic efficiency at firm level is still debatable. Svensson (2003) and Wang and You (2012) document a positive relationship between bribery payment and firm growth. However, Nguyen and Van Dijk (2012) find that corruption is negatively related to growth of private firms. Measuring corruption by entertainment and travel costs, Cai *et al.* (2004) find that some components of

these costs are positively associated with firm profitability despite their overall negative effect on firm productivity. Using the World Bank database of enterprise surveys, Sharma and Mitra (2015) show that the relationship between bribery and firm performance is rather mixed although they find positive effects of bribery on product innovation and export performance.

Corporate investment is important in corporate finance as it determines firm value. According to Modigliani and Miller (1958), corporate investment decisions are driven only by investment opportunities. Nevertheless, market frictions, such as information asymmetry and agency problem, make corporate investment deviate from its optimal status (Chen *et al.*, 2017). According to Jensen and Meckling (1976), due to the separation of corporate ownership and control, managers have high incentives to serve their own benefits by overinvesting corporate cash in negative net present value (NPV) projects. Harford (1999), Jiang *et al.* (2011) and Richardson (2006) show supporting evidence of this behavior. Chen *et al.* (2017) find that foreign investors play an important role in monitoring managers and thus help firms increase their investment efficiency. At the country level, Xiao (2013) analyzes how shareholder protection affects research and development (R&D) expenditure and finds that shareholder protection reduces both underinvestment and overinvestment. Furthermore, Asiedu and Freeman (2009) use the database of the World Business Environment Survey to examine how internal, external and hybrid measures of corruption influence corporate investment growth. They find that these corruption measures are negatively associated with investment growth in transition markets. This paper investigates the effect of corruption on corporate investment efficiency and its transmitting mechanism. Unlike Asiedu and Freeman (2009), we construct our sample from Compustat database.

2.2 Hypotheses

In this paper, we argue that in corrupt environments, firms have to pay bribes in order to receive better public services (e.g. lower red tape and better access to scarce resources) and/or reduce state predation (e.g. property right protection and tax reduction) (Cai *et al.*, 2004; Svensson, 2003; Wang and You, 2012; Wei and Kaufmann, 1999; Xu *et al.*, 2017). Since bribes are made unofficially, managers need more flexibility in using corporate cash. Thakur and Kannadhasan (2019) and Tran (2020a) also find that firms in countries of higher corruption tend to have more cash holdings and save more cash from their cash flows. Therefore, corporate managers may take advantage of this opportunity to expropriate shareholders. Managers in high corruption countries are more likely to reduce investment in profitable projects and use more corporate cash to overinvest in negative NPV projects. Based on these arguments, we hypothesize that corruption negatively affects corporate investment efficiency.

H1. Corruption is negatively related to corporate investment efficiency.

In addition, several prior studies document that shareholder protection is important to mitigate the agency problem in corporate financial decisions, namely dividend policy (La Porta *et al.*, 2000b; Tran *et al.*, 2017) and corporate liquidity (Dittmar *et al.*, 2003; Iskandar-Datta and Jia, 2014). Therefore, we argue that the negative effect of corruption on firm investment efficiency is stronger in countries of poor shareholder rights.

H2. The negative relationship between corruption and investment efficiency is stronger in countries of weak shareholder protection.

3. Data source

We construct our research data from Compustat database. Following Bates *et al.* (2009), we consider R&D expenditure as zero if it is unavailable. For subsequent analyses, we eliminate firms classified into utilities industry (SIC codes from 6,000 to 6,999) and financial industry (SIC codes from 4,900 to 4,999) since these industries are highly regulated and have different

accounting standards (Fama and French, 2001). Then, we delete 149 firm years with negative total assets to avoid meaningless variables. The final sample consists of 218,350 firm years from 30,074 firms across 42 countries over the period 2002–2015. To avoid outliers' effects, we winsorize all financial variables at 2% [1].

Prior research shows that there are three prominent corruption measures including the Corruption Perception Index (CPI) from Transparency International, Corruption Control Index (CCI) from the World Bank and Corruption Index (ICI) from the International Country Risk Guide. However, each measure has its own weaknesses. According to Gründler and Potrafke (2019), the ICI tends to measure investment risk of corruption rather than corruption *per se*. The CCI is criticized for many problems arising from its calculation method [2] (Langbein and Knack, 2010; Qu *et al.*, 2019). The CPI has been used as the main measure of corruption in many macroeconomic studies (Aidt, 2003, 2009; Gründler and Potrafke, 2019) and several studies at firm level (Asiedu and Freeman, 2009; Chen *et al.*, 2015b; Tahir *et al.*, 2020; Thakur and Kannadhasan, 2019; Tran, 2019, 2020a, b). However, its weakness is the incomparability in its calculation methodology. From 2012, Transparency International employs raw scores instead of country rankings to calculate the CPI. Therefore, we use the three corruption measures in our study in order to ensure that our findings are robust.

Before 2012, the CPI ranges from 0 to 10 but from 2012, its scale changes, and the value of CPI varies from 0 to 100. Lower values of CPI indicate higher corruption. In addition, the CCI originally ranges from −2.5 to 2.5, and its lower values also denote higher corruption. Therefore, we reverse and rescale both CPI ad CCI values so that new scales range from 0 to 1 and their higher values imply higher corruption (Please see formulas to obtain these new scales in Appendix). Besides, we fail to rescale the ICI since its scale is from 0 to 1 and its higher values indicate higher levels of corruption.

4. Empirical strategy

Following Baker *et al.* (2003) and Chen *et al.* (2017), we employ the investment-investment opportunities as a proxy for firm investment efficiency and use an interaction between corruption index and investment opportunities to investigate how corruption affects investment efficiency.

$$\mathrm{INV}_{i,j,t} = \alpha + \beta_1 \mathrm{TOB}_{i,j,t-1} + \beta_2 \mathrm{CI}_{j,t} + \beta_3 \mathrm{TOB}_{i,j,t-1} * \mathrm{CI}_{j,t} + \varphi_i \mathrm{F\_con}_{i,j,t-1} + \eta_j \mathrm{C\_con}_{j,t} + \pi \mathrm{Industry\ dummies} + \Omega \mathrm{Year\ dummies} + \omega \mathrm{Country\ dummies} + \varepsilon_{i,j,t} \quad (1)$$

where $X_{i,j,t}$ represents variable X of firm i in country j in year t. INV is corporate investment. TOB is Tobin's Q. CI is corruption index. F_con is a vector of firm-specific control variables including profitability (PRO), cash holdings (CAS), operating cash flow (OCF), financial leverage (LEV), asset tangibility (TAN), firm size (SIZ), net working capital (NWC) and dividend payout (DPR). Firms with high profitability, more cash holdings and cash flow tend to have higher investment expenditure since they have more resources (Chen *et al.*, 2017). According to pecking order theory (Myers and Majluf, 1984a), firms with high leverage, low tangibility and small size face high costs of external funds; therefore, their investment is low. Increases in net working capital and dividends lead to decreases in cash holdings. Consequently, firms with high net working capital and dividend payment have low investment expenditure. C_con is a vector of country-specific control variables, namely shareholder protection (AD) (Xiao, 2013), creditor protection (CR) (González, 2016), individualistic culture (ID) [3], private credit (Pcre), market capitalization (Mcap), GDP per capita (Gcap), inflation rate (Infla) and Rule of law (Rlaw). Definitions of all variables are presented in Table 1. Since shareholder protection, creditor protection and individualistic culture are nontime-varying variables, we use pooled ordinary least squares (OLS) as the

Variables	Variable names	Definitions
INV_t	Corporate investment	Total capital expenditure and R&D expenditure in year t divided by total assets in year $t-1$
TOB_{t-1}	Tobin's Q	Total market value of common equity and book value of debt divided by total assets in year $t-1$
CI_t	Corruption index	Corruption perception index from transparency international, control of corruption index from world bank and corruption index from international country risk guide in year t
PRO_{t-1}	Profitability	Net income to total assets in year $t-1$
CAS_{t-1}	Cash holdings	Cash and short-term investment to total assets in year $t-1$
OCF_{t-1}	Cash flow	Operating cash flow to total assets in year $t-1$
LEV_{t-1}	Financial leverage	Total debt to total assets in year $t-1$
TAN_{t-1}	Asset tangibility	Property, plant and equipment to total assets in year $t-1$
SIZ_{t-1}	Firm size	Natural logarithm of total assets in USD in year $t-1$
NWC_{t-1}	Net working capital	Current assets minus current liabilities, cash and short-term investment divided by total assets in year $t-1$
DPR_{t-1}	Dividend payout ratio	Cash dividends to total assets in year $t-1$
AD	Shareholder protection	Anti-self-dealing index from Djankov *et al.* (2008)
CR	Creditor protection	Revised creditor right index from Djankov *et al.* (2007)
ID	Individualistic culture	Individualism index from Hofstede (2001)
$Pcre_t$	Private credit	Domestic private credit to GDP provided by world bank in year t
$Mcap_t$	Stock market capitalization	Stock market capitalization to GDP provided world bank in year t
$Gcap_t$	GDP per capita	Natural logarithm of annual GDP per capita provided by world bank in year t
$Infla_t$	Inflation rate	Annual inflation rate provided by world bank in year t
Rlaw	Rule of law	Rule of law index is from international country risk guide. It ranges from 0 to 10 and its higher scores imply more tradition of law and order

Table 1.
Research variables

primary regression. However, we also present results of other regression methods as robustness checks.

Besides, we add dummy variables to control the effects of industry, year and country in all regression models. The incomparability problem of CPI is also controlled to some extent by year dummies [4].

5. Empirical results

5.1 Descriptive statistics

Table 2 describes our research data. Firm-specific data in Panel A shows that investment expenditure constitutes from 0% to 53% of total assets, and its average value is 9%. Tobin's *Q* is 1.82 on average. It varies from 0.49 to 10.67. In addition, Panel B reports that the annual number of firms increases dramatically over the research period. There are 11,127 firms in 2002 and 18,333 firms in 2015. Furthermore, the industry distribution in Panel C shows that manufacturing is the largest industry with 119,275 firm years, followed by service industry with 40,701 firm years and mineral industries with 16,155 firm years. The number of observations from other industries varies from 7,100 to 14,000. Moreover, Panel D presents country-level data. The USA contribute the largest amount of firm years to the research sample with 49,263. Japan and China have 31,119 and 20,194 observations, respectively. These three countries constitute about 46% observations of the full sample. This sample composition problem may lead to biased results, but it is present regardless of data source. Therefore, we need to use a reduced sample without these countries in order to check the robustness of our research findings.

Panel A. Firm-level data

Variables	Mean	Median	SD	25%	75%	Min	Max
INV_t	0.09	0.05	0.11	0.02	0.11	0.00	0.53
TOB_{t-1}	1.82	1.22	1.82	0.91	1.91	0.49	10.67
PRO_{t-1}	−0.03	0.03	0.23	−0.02	0.06	−1.16	0.22
CAS_{t-1}	0.17	0.11	0.18	0.04	0.24	0.00	0.76
OCF_{t-1}	0.19	0.22	0.37	0.06	0.40	−1.34	0.82
LEV_{t-1}	0.51	0.49	0.27	0.31	0.66	0.06	1.41
TAN_{t-1}	0.29	0.25	0.22	0.10	0.43	0.01	0.84
SIZ_{t-1}	12.11	12.09	2.07	10.75	13.44	7.46	16.76
NWC_{t-1}	0.01	0.02	0.20	−0.08	0.13	−0.65	0.42
DPR_{t-1}	0.01	0.00	0.02	0.00	0.02	0.00	0.10

Panel B. Annual number of firms

Year	*N*	Year	*N*	Year	*N*	Year	*N*
2002	11,127	2006	14,286	2010	16,796	2014	18,551
2003	12,675	2007	15,198	2011	16,898	2015	18,333
2004	13,180	2008	15,671	2012	17,835		
2005	13,357	2009	16,004	2013	18,439		

Panel C. Industry distribution

Industry	2-digit SIC	*N*	Industry	2-digit SIC	*N*
Mineral industries	10–14	16,155	Wholesale trade	50–51	10,346
Construction industries	15–17	7,151	Retail trade	52–59	10,788
Manufacturing	20–39	119,275	Service industries	≥70	40,701
Transportation and communications	40–48	13,934			

Panel D. Country-level data

Country	No. obs	No. firms	INV	TOB	ID	AD	CR
Australia	11,337	1,754	0.13	2.08	90	0.76	3
Austria	569	69	0.09	1.34	55	0.21	3
Belgium	832	105	0.10	1.50	75	0.54	2
Brazil	1,975	269	0.07	2.89	38	0.27	1
Canada	9,440	1,657	0.14	2.02	80	0.64	1
Switzerland	1,793	200	0.08	1.78	68	0.27	1
Chile	820	121	0.06	4.08	23	0.63	2
China	20,194	2,473	0.08	2.26	20	0.76	2
Colombia	155	25	0.05	1.20	13	0.57	0
Germany	5,191	655	0.08	1.52	67	0.28	3
Denmark	761	119	0.10	1.98	74	0.46	3
Spain	862	117	0.05	1.54	51	0.37	2
Finland	1,095	135	0.09	1.60	63	0.46	1
France	5,395	689	0.07	1.49	71	0.38	0
United Kingdom	8,944	1,397	0.09	1.83	89	0.95	4
Greece	1,949	229	0.04	1.10	35	0.22	1
Hong Kong	1,272	139	0.06	1.48	25	0.96	4
Hungary	166	24	0.09	1.37	80	0.18	1
Indonesia	2,735	373	0.07	2.51	14	0.65	2
India	15,755	2,656	0.08	1.43	48	0.58	2
Ireland	391	60	0.08	1.62	70	0.79	1
Israel	2,099	355	0.09	2.36	54	0.73	3
Italy	1,535	232	0.05	1.32	76	0.42	2
Jamaica	26	11	0.05	1.38	39	0.35	2

Table 2.
Research data description

(*continued*)

Panel D. Country-level data Country	No. obs	No. firms	INV	TOB	ID	AD	CR
Japan	31,119	3,053	0.05	1.12	46	0.50	1
South Korea	9,186	1,447	0.07	1.12	18	0.47	3
Mexico	786	98	0.07	1.32	30	0.17	0
Malaysia	7,508	840	0.05	1.14	26	0.95	3
Netherlands	1,395	176	0.07	1.58	80	0.20	3
Norway	1,512	244	0.10	2.35	69	0.42	2
New Zealand	593	120	0.09	2.09	79	0.95	4
Pakistan	1,695	257	0.07	1.33	14	0.41	1
Peru	522	74	0.07	1.44	16	0.45	0
Philippines	1,008	147	0.06	1.98	32	0.22	1
Poland	2,929	490	0.07	1.51	60	0.29	1
Portugal	434	52	0.04	1.18	27	0.44	1
Singapore	5,048	629	0.06	1.27	20	1.00	3
Sweden	2,669	476	0.07	1.93	71	0.33	1
Thailand	4,341	492	0.07	1.44	20	0.81	2
Turkey	1,512	260	0.07	2.13	37	0.43	2
USA	49,263	7,152	0.12	2.47	91	0.65	1
South Africa	1,539	203	0.08	1.52	65	0.81	3

Note(s): INV_t is corporate investment in year t. TOB_{t-1} is Tobin's Q in year $t-1$. CI_t is corruption index in year t. PRO_{t-1} is profitability in year $t-1$. CAS_{t-1} is cash holdings in year $t-1$. OCF_{t-1} is operating cash flow in year $t-1$. LEV_{t-1} is financial leverage in year $t-1$. TAN_{t-1} is asset tangibility in year $t-1$. SIZ_{t-1} is firm size in year $t-1$. NWC_{t-1} is net working capital in year $t-1$. DPR is dividend payout ratio in year $t-1$

Table 2.

5.2 Regression results

Table 3 presents pooled OLS regression results to investigate how corruption affects corporate investment efficiency. In line with Modigliani and Miller (1958), we find that Tobin's Q is positively related to firm investment at 1% of significance. This indicates that firms with more investment opportunities tend to increase their investment expenditure. Remarkably, we document that the interactions between all measures of corruption and Tobin's Q are negatively associated with investment expenditure. These findings imply that corruption reduces corporate investment efficiency across countries due to agency problem. Firms in highly corrupt countries tend to pay bribes as "grease money" (e.g. payment for lower red tape and better access to scarce resources) and/or "protection money" (e.g. payment for property right protection and tax reduction) (Cai *et al.*, 2004; Svensson, 2003; Wang and You, 2012; Wei and Kaufmann, 1999; Xu *et al.*, 2017). Therefore, their managers are more flexible in corporate liquidity decisions (Thakur and Kannadhasan, 2019; Tran, 2020a). They take this opportunity to expropriate shareholders by reducing investment in profitable projects and diverting more investment into negative NPV projects. This expropriation leads to lower investment efficiency.

Besides, we find that firms with higher cash holdings and cash flow tend to have higher investment. In line with Myers and Majluf (1984a), firms with higher leverage and lower tangibility incur higher costs of external financing; therefore, they have lower investment. Net working capital is a substitute of cash holdings and dividends are cash distribution. Consequently, they negatively affect firm investment. Moreover, the negative relationship between antiself-dealing index and investment expenditure indicates that shareholder protection may reduce overinvestment (Xiao, 2013). Consistent with Shao *et al.* (2013b), individualism positively influences firm investment.

5.3 Robustness checks

In order to ensure that our research findings are stable, we conduct the following robustness checks. First, we replicate all regression models with a reduced sample without USA, Japan and

Variables	CI is based on the Corruption Perception Index	CI is based on the Corruption Control Index	CI is based on the International Country Risk Guide
Intercept	−0.0234 (−1.20)	−0.0523*** (−3.01)	0.0203 (1.08)
$TOB_{i,t-1}$	0.0217*** (29.95)	0.0223*** (29.27)	0.0129*** (22.51)
CI_t	0.0694*** (8.61)	0.1311*** (6.06)	0.0065*** (3.37)
$TOB_{i,t-1}$*CI_t	−0.0257*** (−17.59)	−0.0300*** (−17.29)	−0.0009* (−1.91)
$PRO_{i,t-1}$	−0.1218*** (−18.27)	−0.1224*** (−18.34)	−0.1300*** (−19.28)
$CAS_{i,t-1}$	0.0719*** (10.39)	0.0716*** (10.35)	0.0759*** (10.89)
$OCF_{i,t-1}$	0.0727*** (12.03)	0.0727*** (12.01)	0.0733*** (11.99)
$LEV_{i,t-1}$	−0.0167*** (−7.49)	−0.0166*** (−7.44)	−0.0147*** (−6.56)
$TAN_{i,t-1}$	0.1070*** (46.97)	0.1070*** (46.97)	0.1067*** (46.40)
$SIZ_{i,t-1}$	0.0002 (0.66)	0.0002 (0.68)	0.0002 (0.79)
$NWC_{i,t-1}$	−0.0721*** (−10.76)	−0.0725*** (−10.81)	−0.0737*** (−10.91)
$DPR_{i,t-1}$	−0.1848*** (−10.55)	−0.1864*** (−10.63)	−0.1847*** (−10.35)
AD	−0.0254* (−1.87)	−0.0158 (−1.33)	−0.0164 (−1.21)
CR	−0.0067** (−2.48)	−0.0110*** (−3.67)	−0.0059** (−2.22)
ID	0.0006*** (8.15)	0.0008*** (8.04)	0.0005*** (8.57)
$Pcre_t$	0.0001*** (3.71)	0.0001*** (4.08)	0.0001*** (4.56)
$Mcap_t$	0.0001*** (6.98)	0.0001*** (6.78)	0.0000*** (6.24)
$Gcap_t$	−0.0035** (−2.44)	−0.0044*** (−3.03)	−0.0062*** (−4.22)
$Infla_t$	−0.0010*** (−5.64)	−0.0009*** (−5.28)	−0.0011*** (−5.97)
Rlaw	0.0102*** (10.15)	0.0107*** (10.59)	0.0073*** (5.87)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes
Clustered by firm	Yes	Yes	Yes
R-squared	0.2683	0.2681	0.2623
Number of observations	218,045	218,045	218,045

Note(s): The dependent variable is corporate investment in year t (INV_t). TOB is Tobin's Q. CI is corruption index. PRO is profitability. CAS is cash holdings. OCF is operating cash flow. LEV is financial leverage. TAN is asset tangibility. SIZ is firm size. NWC is net working capital. DPR is dividend payout ratio. AD is shareholder protection index. CR is creditor protection. ID is Hofstede's individualism dimension. Pcre is private credit to GDP. Mcap is market capitalization to GDP. Gcap is annual GDP per capita. $Inlfa_t$ is annual inflation rate in year t. $Rlaw_t$ is rule of law in year t. t-statistics are in parentheses. * is 10% of significance. ** is 5% of significance. *** is 1% of significance

Table 3.
Corruption and corporate investment efficiency

China. These countries contribute approximately 46% of firm years in the research sample. Consequently, our regression results may be driven by them. Panel A of Table 4 shows that all measures of corruption are still negatively related to corporate investment efficiency.

Since investment is measured by total capital expenditure and R&D expenditure in our baseline model, our results may be driven by capital expenditure or R&D expenditure only. Therefore, we replicate all regression models with alternative investment measures, including capital expenditure and R&D expenditure. Our robustness checks in Panel B of Table 4 indicate that our key findings remain unchanged.

Third, we use other regression approaches including weighted least squares regression and Fama and MacBeth (1973) regression. According to Chen *et al.* (2015a), the former is able to mitigate the problem of heteroscedasticity since corporate investment's variance is likely to vary strongly among a group of countries. The weight is defined as the inverse value of investment expenditure's within-country variance. Moreover, although the main tests have

Variables	CI is based on the Corruption Perception Index	CI is based on the Corruption Control Index	CI is based on the International Country Risk Guide
Panel A. Reduced sample without USA, Japan and China			
$TOB_{i,t-1}$	0.0223*** (22.81)	0.0229*** (23.31)	0.0118*** (16.64)
CI_t	0.0581*** (5.77)	−0.0085 (−0.58)	0.0065*** (2.76)
$TOB_{i,t-1}$*CI_t	−0.0272*** (−14.62)	−0.0329*** (−15.52)	−0.0005* (−1.77)
Panel B. Alternative measures of firm investment			
Capital expenditure			
$TOB_{i,t-1}$	0.0043*** (16.89)	0.0043*** (16.37)	0.0035*** (16.87)
CI_t	0.0102** (2.21)	0.0161 (1.45)	0.0032*** (3.39)
$TOB_{i,t-1}$*CI_t	−0.0032*** (−5.00)	−0.0037*** (−5.03)	−0.0008** (−2.27)
R&D expenditure			
$TOB_{i,t-1}$	0.0055*** (12.10)	0.0058*** (12.22)	0.0030*** (9.11)
CI_t	0.0338*** (8.94)	0.0423*** (3.56)	0.0042*** (4.32)
$TOB_{i,t-1}$*CI_t	−0.0078*** (−9.40)	−0.0094*** (−9.61)	−0.0006* (−1.74)
Panel C. Alternative regression approaches			
Weighted least squares regression			
$TOB_{i,t-1}$	0.0198*** (76.68)	0.0199*** (75.98)	0.0115*** (39.93)
CI_t	0.0614*** (10.89)	0.0976*** (8.04)	0.0069*** (4.39)
$TOB_{i,t-1}$*CI_t	−0.0227*** (−39.92)	−0.0258*** (−39.55)	−0.0017*** (−3.14)
Fama–Macbeth regression			
$TOB_{i,t-1}$	0.0218*** (29.62)	0.0225*** (25.16)	0.0134*** (5.96)
CI_t	0.0193* (1.89)	0.0192* (1.91)	0.0014 (0.22)
$TOB_{i,t-1}$*CI_t	−0.0262*** (−14.20)	−0.0307*** (−14.01)	−0.0024* (−1.73)

Note(s): The dependent variable is corporate investment in year t (INV_t). TOB is Tobin's Q. CI is corruption index. t-statistics are in parentheses. * is 10% of significance. ** is 5% of significance. *** is 1% of significance

Table 4.
Robustness checks

many country-level controls, we are still concerned that the research results may be determined by observations from certain years; therefore, we run Fama and MacBeth (1973) regression to control the effects of particular periods. Regression results for alternative approaches in Panel C of Table 4 show that all measures of corruption still negatively affect corporate investment efficiency.

6. The role of shareholder protection

We divide the full sample into two sub-samples of weak and strong shareholder rights in order to investigate how shareholder protection affects the relationship between corruption and investment efficiency. This classification is based on antiself-dealing index of Djankov *et al.* (2008), investor protection index La Porta *et al.* (2006) and legal origin. Antiself-dealing index and investor protection index range from 0 to 1. A country is defined as a strong (weak) shareholder protection if its antiself-dealing index or investor protection index is higher (not higher) than 0.5. Moreover, prior research also finds that most Common law (Civil law) countries are strong (weaker) in shareholder rights (Shao *et al.*, 2013a); therefore, we also consider Common law (Civil law) countries as strong (weak) shareholder protection. Comparing regression results for the two groups, we find that the interaction between Tobin's Q and corruption index is more effective in strong shareholder protection countries. These findings are consistent with the role shareholder protection in mitigating agency problem (La Porta *et al.*, 2000a; Tran, 2020c). Corporate managers in countries of high corruption may take advantage of the flexibility in corporate liquidity policy to expropriate shareholders. However, legal protection of shareholders is effective in controlling this behavior (see Table 5).

Table 5.
The relationship between corruption and corporate investment efficiency by shareholder protection

Variables	Weak shareholder protection AD ≤ 0.5	Weak shareholder protection IP ≤ 0.5	Strong shareholder protection AD > 0.5	Strong shareholder protection IP > 0.5
Panel A. CI is based on the Corruption Perception Index				
$TOB_{i,t-1}$	0.0197*** (12.17)	0.0218*** (26.27)	0.0217*** (26.20)	0.0205*** (12.82)
CI_t	0.0874*** (7.25)	0.0874*** (7.04)	0.0680*** (4.65)	0.0303** (2.41)
$TOB_{i,t-1}$*CI_t	−0.0238*** (−8.10)	−0.0251*** (−14.44)	−0.0251*** (−14.25)	−0.0260*** (−8.94)
Panel B. CI is based on the Corruption Control Index				
$TOB_{i,t-1}$	0.0196*** (12.70)	0.0199*** (13.19)	0.0227*** (25.43)	0.0228*** (25.48)
CI_t	0.1244*** (3.61)	0.1370** (2.27)	0.0290 (0.00)	0.0360 (1.39)
$TOB_{i,t-1}$*CI_t	−0.0271*** (−8.66)	−0.0284*** (−9.27)	−0.0307*** (−14.21)	−0.0308*** (−14.40)
Panel C. CI is based on the International Country Risk Guide				
$TOB_{i,t-1}$	0.0102*** (9.42)	0.0135*** (20.36)	0.0138*** (20.56)	0.0117*** (10.37)
CI_t	−0.0007 (−0.23)	0.0077*** (3.07)	0.0079*** (3.11)	0.0027 (0.86)
$TOB_{i,t-1}$*CI_t	0.0003 (0.16)	−0.0014 (−1.32)	−0.0018* (−1.68)	−0.0021 (−1.02)

Note(s): The dependent variable is corporate investment in year t (INV_t). TOB is Tobin's Q. CI is corruption index. t-statistics are in parentheses. * is 10% of significance. ** is 5% of significance. *** is 1% of significance

7. Conclusion

Corruption is one of the most challenging issues around the world. Many prior studies show that it significantly affects corporate financial decisions; however, there has been no research on the relationship between corruption and investment efficiency. With a sample of 218,350 observations from 30,074 firms across 42 countries, we find that corruption measures are negatively associated with investment efficiency. Our robustness checks with different measures of corporate investment and alternative regression approaches show consistent findings. These understandings indicate that corruption environment also reduces economic efficiency at firm level. Consequently, international investors should choose countries of low corruption when they seek for an investment destination. In addition, this empirical evidence implies that policymakers should enhance their anti-corruption activities in order to improve economic efficiency. Moreover, we also find that the effect of corruption is stronger (weaker) in strong (weak) shareholder protection countries. As a result, policymakers can reduce the effect of corruption environment on corporate investment efficiency by improving shareholder rights. This paper only investigates the country-level corruption on corporate investment efficiency; therefore, further research may focus on the effect of local corruption or bribery payment on corporate investment efficiency.

Notes

1. We also winsorize financial variables at 3 and 5% and our research findings remain stable.
2. ICI captures the spheres of illegal activity as follows: "actual or potential corruption in the form of excessive patronage, nepotism, job reservations, 'favor-for-favors', secret party funding and suspiciously close ties between politics and business".
3. Shao *et al.* (2013b) posit that individualism dimension is the best proxy for national culture since it prevails in most cultural frameworks and more relevant to risk taking. We also find consistent findings, adding other dimensions including masculinity and uncertainty avoidance.
4. We also conduct a robustness check by adding a period dummy to Equation (1) in order to control the incomparability problem of CPI. The dummy is assigned 1 for observations before 2012 and 0 otherwise. We find that our key findings remain stable.

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Appendix
Rescaling corruption indices

$$\text{CI based on Transparency International's Corruption Perception Index (CPI)} = \begin{cases} 1 - \dfrac{\text{CPI}}{10} & \text{if year} < 2012 \\ 1 - \dfrac{\text{CPI}}{100} & \text{if year} \geq 2012 \end{cases}$$

$$\text{CI based on the World Bank's Corruption Control Index (CCI)} = 5 - \text{CCI*2}$$

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