Emerald International Journal of Emerging Markets

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Journal:	*International Journal of Emerging Markets*
Manuscript ID	IJOEM-05-2020-0514.R3
Manuscript Type:	Research Article
Keywords:	Grease Effect, Sand Effect, Reverse S-Shape, corruption, Public-Private Partnerships

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Abstract

Purpose

Some scholars argue that corruption hinders economies and investment because it generates extra costs, while others suggest that it can act as a stimulus. Their mixed empirical findings have prompted our analysis of whether investors' attitude towards corruption changes depending on its degree of prevalence.

Design/methodology/approach

We examined 4,518 public–private partnerships (PPPs) located in 46 developing countries for the period 1997–2017. The data were collected from the World Bank PPP Database. We investigated the relationship between the amount of investment in PPP projects and the level of corruption using regression with multilevel mixed effects.

Findings

Corruption and the amount of investment in PPP projects are inversely related at the low and high end of the spectrum of corruption, but the relationship is positive towards the middle. Further analysis revealed that this was spurred by high investment PPP projects in less developed countries.

Originality/value

The findings allow us to reconcile the opposing positions in the literature through a "sand–grease–sand the wheels" effect between the volume of investment and corruption, which can be configured as a reverse S-shape consisting of three stages.

Keywords: Corruption; Public–Private Investments; Grease Effect; Sand Effect; Reverse S-Shape

1. Introduction

Corruption can be defined as the "abuse of public power for private benefit" (Freckleton *et al.*, 2012; Transparency International, 2020). It includes bribery, extortion, fraud, abuse of power, embezzlement, conflicts of interest, and nepotism (Anti-Corruption Resource Centre, 2020).

Research tends to suggest that the presence of corruption can negatively affect the economics and functioning of the market, especially companies' investments, because of the higher cost of operations (Rose-Ackerman, 1975, 2002). Although corruption generally has adverse effects, some theories and empirical studies argue that these unethical practices can be positive, and in fact, there are companies that invest and increase their operations in locations despite the presence of high levels of corruption (Cuervo-Cazurra, 2006). Some studies have shown that corruption does not influence investments in particular circumstances (Asiedu and Freeman, 2009). Thus, although corruption intuitively should have adverse consequences for the economy, evidence of its impact on business activities points to both negative and positive results, and this hinders an understanding of how it affects specific managerial decisions.

Furthermore, previous studies that have examined the relationship between corruption and investment flows have a number of shortcomings. On the one hand, most of them use country-aggregated data. Therefore, only a net effect, which cannot be extrapolated to general firms' behaviour, can be observed, concealing companies that might have an incentive to invest in certain environments (Cuervo-Cazurra, 2006). Consequently, the characteristics of the companies and the microeconomic foundations that might influence their investment decisions are omitted (Svensson, 2005). In addition, some studies focus

only on the most developed countries (Wei, 2000), offer few observations (Méon and Sekkat, 2005), analyse just a few years or a single year (Diaby and Sylwester, 2015), and do not ordinarily contextualise the environment where corruption occurs (Svensson, 2005), treating all countries as homogeneous units. On the other hand, in studies where different observations are combined in the same country, and where both types of macro data and the investing company are considered (Jiménez *et al*., 2017, 2018), the nested effect by groups of countries is not controlled, so this can lead to biased results because of individual idiosyncrasies (Hox, 1998; Maas and Hox, 2004).

In light of the above, an analysis of the impact of corruption on individual investments in public–private partnership (PPP) projects might be especially interesting. First, as corruption relates to public power, PPPs can be especially sensitive to the degree of corruption of the institutions involved, given that one of the partners in these relationships is a public party. Second, PPP agreements tend to be large, specific investments (European Commission, 2004; Fleta-Asín *et al*., 2020; World Bank, 2016), and are therefore more sensitive to unethical practices because they are difficult to audit (Locatelli *et al*., 2017). Third, PPPs have become widespread in a large number of economies in recent decades (World Bank, 2020). Thus, PPPs and the frameworks in which they are implemented emerge as the perfect laboratory in which to study how corruption affects sensitive economic activities.

In light of the above, the objective of the present study is to analyse how the effect of corruption on investment in PPP projects might differ across a wide range of countries over a long period, while controlling for the effect of the country where the investments are located. The remainder of the study is organised as follows. The second section

surveys the literature on the subject, which allows us to present the arguments that support an inverse or direct relationship between corruption and the volume of investment in PPPs.

The third section outlines the methodology by which the sample and the variables were arrived at. In the fourth section, we describe the sample and test the hypothesis proposed using robustness analysis and the World Bank PPP database. Section 5 comprises a discussion of the findings and a conclusion. Finally, Section 6 summarises the managerial implications and the study's limitations, and makes some suggestions for further research.

2. Literature and Research Hypothesis

2.1. Negative impact of corruption: The "sand the wheels" effect

Transaction cost theory states that firms carry out activities inside their boundaries when their costs are lower than when they operate in other markets (Williamson, 1975). Corruption generates uncertainty, which can lead to an additional transaction cost when establishing economic relations, distorting the prices of goods from their marginal costs and altering the efficiency of markets that companies participate in (Habib and Zurawicki, 2001). The more bribes investors have to be paid, the greater the time wasted negotiating with bureaucrats, which can generate an adverse effect by delaying the time at each stage due to the expectation of new and larger bribes. Thus, companies will not operate where corrupt practices have unaffordable higher costs because of the "sand the wheels" effect (Méon and Sekkat, 2005).

In this context, there is a broad consensus that the highest prevalence of corruption has a negative impact on economic activity. In the most corrupt economies, the deadweight costs are expected to be the biggest factor in discouraging investment (Bardhan, 1997; Tran, 2020), and their increase may make economic activity unsustainable once other environmental conditions have deteriorated to the extreme degree (Blackburn and

Forgues-Puccio, 2009; Fleta-Asín and Muñoz, 2020). Corrupt economies are characterised by very poor basic infrastructure, education, health, communications systems, and market efficiency (Porter *et al*., 2007; Schwab, 2018). For these reasons, investment is discouraged, and is usually based on natural resource-intensive or labour-intensive sectors with low physical capital and low-skilled workers (Dunning and Lundan, 2008).

A growth in corruption also has negative effects in markets where its usual prevalence is low. The reason for this is that those economies are characterised by greater macroeconomic stability, higher quality institutions, more qualified workers, efficient labour and goods markets, well-developed financial markets, and high technological capabilities and innovation (Dunning and Lundan, 2008; Schwab, 2018). Companies operating in highly competitive environments usually attempt to be as efficient as possible (Dunning and Narula, 2004). Thus, additional unexpected costs emerging from corruption, which would compromise their objectives, discourage them from doing business (Dunning and Narula, 2004; Dunning and Lundan, 2008).

Public–private partnerships are not exempt from these negative effects. The literature and practical experience identify corruption as a generic risk factor for PPPs in the less- and most-developed economies (Chou and Pramudawardhani, 2015, Liu *et al*., 2016). The volume, complexity, and uniqueness of PPPs are such that higher levels of corruption would make managing projects unpredictable and expensive for its promoters (Locatelli *et al*., 2017); possibly damage the procurement process (Yescombe, 2011); and provoke inefficiencies by transferring project expenditure items to activities where corruption is easier to hide (Wei, 2001). In these cases, the main actor that pays, cooperates, and

designs the institutional framework would lose credibility in the eyes of the investing agents, thus discouraging them (Cooray *et al.*, 2017).

Public–private partnership studies have indicated that corruption has a negative impact on the volume of investment (Mota and Moreira, 2015). Studies of specific countries, such as Singapore (Hwang *et al.*, 2013) and Italy (Locatelli *et al.*, 2017), have shown this to be the case. In other less developed countries, corruption is directly linked with delays and low productivity in PPPs (Niazai and Gidado, 2012). Similarly, difficulties with PPPs have been experienced in countries with the highest corruption levels, such as Liberia (Beekman *et al*., 2014), Yemen (Alley, 2010), and Venezuela, where private companies' investments were expropriated after 2005 (Hajzler, 2012).

2.2. Positive impact of corruption: The "grease the wheels" effect

According to the transaction cost theory, the positive effects of economic activity for companies become apparent when the benefits of internalising it are higher than the costs borne (Williamson, 1975). Although corruption is generally a transaction cost, in certain circumstances it can reduce others (Cuervo-Cazurra, 2016). Corruption can therefore generate benefits, because bribes can lead to the facilitation and execution of bureaucratic processes, increasing the productivity of officials and thereby saving operating costs (Leff, 1989). Thus, investors who value access to an input more than their competitors will pay more for it and will exploit corruption to improve operations (Lui, 1985).

Some scholars have shown that moderate and manageable levels of corruption can be more beneficial than low or high levels. The costs are lower (Leff, 1989), and better market conditions (such as macroeconomic stability, financial conditions, and operating

efficiency) can pertain in regions where these are found (Schwab, 2018). Corrupt officials will not push their greed so far as to destroy the economy (Shleifer and Vishny, 1993), unlike in markets with the highest levels of corruption (Zhao *et al*., 2020).

Moderate corruption can also incentivise volume investment a great deal more than in the most transparent markets. There are several reasons for this. First, corruption can act as a driver of economic activity in environments where there is weak regulation; the cost of corruption can generate efficiencies in a way that is not possible in more developed economies (Freckleton *et al*., 2012; Leff, 1989). Second, operating in these markets can offer an entry barrier and pioneer advantage (Lieberman and Montgomery, 1988; Mauro, 1998), given that companies are able to find a greater margin of future growth for subsequent operations and establish relations with a government that can assign to them greater activity (Pan and Tian, 2017). Third, the endemic nature of corruption may allow agents to normalise it and operate accordingly in these environments, influencing investment behaviour less than would be the case in most transparent markets (Freckleton *et al*., 2012). A reasonable and widespread level of corruption in a market signals to agents that these practices are usual, and they will expect them (Jain *et al*., 2017). Thus, companies that anticipate corruption costs may willingly take them on and increase the volume of investment as a result (O'Toole and Tarp, 2014).

In the case of PPPs, specific circumstances can favour greater investment in environments with medium corruption. The governments in such places have the incentive to promote large volumes of investment, whether they be optimal or suboptimal, because they improve a great many people's lives, ensuring a return on their political trajectory (Locatelli *et al*., 2017; Méon and Sekkat, 2005). Thus, the agents working in these

markets may be predisposed to increase the volume of investment in PPPs regardless of whether the economic activity is useful, because it results in a sustainable positive-sum game for them (Bardhan, 1997). Furthermore, PPPs have a higher probability of success in medium corruption environments than in the most corrupt ones (Jiménez *et al*., 2017) because the realisation of their projects is more likely, and so they are inclined to invest more (Locatelli *et al*., 2017). In addition, compared with the less corrupt environments, they can incur greater expenses in the more corrupt and therefore less efficient territories (Porter *et al*., 2007; Schwab, 2018).

Yang *et al*. (2013) found through surveys that transitional countries could increase their investment volume despite having high levels of corruption. Scholars have observed a positive relationship between corruption and private investment in the past in China (Zhao *et al.*, 2020), Vietnam (Gillespie, 2006), Brazil (May *et al*., 2019), and India (Rock and Bonnett, 2004), where corruption was previously more prevalent.

2.3. Specific factors affecting investment and corruption

According to the principal-agent theory, the opportunistic behaviour of the partners of a project increases in relation to the specific circumstances that pertain in the environment where it is carried out, its characteristics, and the process by which it is managed (Fleta-Asín *et al*., 2020). This means that some partners can locate factors that act as triggers to investment and crystallise the specific level of corruption that prevails in a society (Bahoo *et al*., 2020a; Zhao *et al*., 2020).

Investments can be favourable in less developed countries due to the future opportunities for market development, the greater marginal benefits of bribery, and more tolerance

towards corruption (Sandholtz and Koetzle, 2000). Similarly, big markets can promote investment because large demand compensates for the extra costs of bribes (Rock and Bonnett, 2004). Political stability allows companies to anticipate better the costs of corruption (Bahoo *et al.,* 2020b Méndez and Sepúlveda, 2006). Finally, some scholars have suggested that the impact of corruption depends on the individual country (Bahoo, 2020; Saha and Ali, 2017) and region (Asiedu and Freeman, 2009; Bahoo *et al.*, 2020b). Practices tending towards corruption may be subject to the idiosyncratic nature of the environment (Wu, 2014) and also the investment timeframe, because the attitude of companies toward corruption may change over time (Ko and Weng, 2012).

On the other hand, company characteristics can alter opportunistic behaviours that may affect the volume of investment. Companies that make large investments generally carry out a greater number of activities with a greater number of economic agents, in addition to being able to face the costs of corruption more easily because of the resources they have at their disposal (Rose-Ackerman, 2002). Companies that have less experience in corrupted environments have less knowledge about them, so it may be more difficult to mitigate the impact of corruption on their activities (Cuervo-Cazurra, 2006). When companies have insufficient experience, cooperation with local partners who usually deal with corrupt practices can lead to appropriate adjustments to the volume of investment (Jiménez *et al*., 2017).

Finally, the form of bidding for PPPs can also affect the level of investment and the materialisation of corruption (Schomaker, 2020). The PPPs that are established through shares owned by the public party allow for greater involvement and oversight of both the process and decision making, so that agents have to align their practices with those of the

government (Fleta-Asín *et al*., 2020). In addition, tendering through public rather than closed or negotiated procedures can involve greater numbers of competing agents, who can act as supervisors if they detect abuses or have suspicions of pre-awards (Schomaker, 2020).

Despite the influence of these factors (see Table 1), some scholars have demonstrated that the positive and negative effects of corruption depend on how it is articulated in each country, and whether it is centralised or disorganised (Shleifer and Vishny, 1993). Thus, in environments where corruption is centralised and organised, corrupt agents collude to maximise their rents as monopolists. This requires that the degree of corruption be widespread and lower than in environments where corruption is disorganised, since competition between corrupt bureaucrats can decrease the level of appropriation of rents and curtail future projects (Blackburn and Forgues-Puccio, 2009). A certain level of corruption allows its continuance when it is centralised by its agents and when it is not excessive. This encourages the investment from which the bureaucrats' bribery income derives (Zhao et *al*., 2020), and makes it more predictable (Blackburn and Forgues-Puccio, 2009). When the markets present a low degree of corruption, efficiency is encouraged; at the other extreme, markets with a high degree of corruption generally present the opposite condition, making it difficult to correct. This then leads to suboptimal investment (Blackburn and Forgues-Puccio, 2009). Therefore, the degree of corruption can positively or negatively affect investment. We therefore propose the following research hypothesis:

RH: Corruption and the amount of investment in PPP projects are inversely related at low and high spectrums of corruption, but this relationship is positive in the medium spectrum, where it is configured as a reverse S-shape curve.

[Table 1 about here]

3. Methodology

3.1. Sample

The present study's characteristics are derived from the World Bank's Private Participation in Infrastructure database (Jiang *et al*., 2015; Jiménez *et al*., 2017, 2018). Depending on the location of the project, additional information was included for each observation. Corruption levels were based on Transparency International (Habib and Zurawicki, 2001; Locatelli *et al.,* 2017; Rock and Bonnett, 2004), assessments of political stability from Henisz's (2000) index, and country data from the World Bank World Development Indicators (Habib and Zurawicki, 2001; Jiménez *et al.,* 2017). The sample included 4,518 observations from 46 countries (see Table 6 in the Appendix) on five continents: America (2,467), Asia (2,092), Europe (615), Africa (140), and Oceania (1). The average number of projects per country involved 110 observations, and the data covered the period from 1997 to 2017.

3.2. Variables

Dependent variable. Following Mota and Moreira (2015), investment was measured by applying the log over the total amount of investment in millions of current US dollars for each project. Then, we labelled the variable as **Invest**, the data for which were collected from the World Bank PPP Database for each of the projects.

Independent variables. To find the relationship between the volume of investment in each project and the level of corruption, we used the Transparency International indicator as a proxy, the values of which are between 0 and 100 (where the higher values indicate the presence of less corruption). To facilitate the interpretation of the results, we reversed the

values so that higher scores indicated a higher degree of corruption in each country (Jain *et al*., 2017; Wei, 2000). The nonlinearity of the relationship between the volume of investment and corruption required the inclusion of the latter in squared terms. If there are several increasing and decreasing tranches, the additional inclusion of a cubic term is necessary. To reduce the multicollinearity produced by including them as combinations of an existing independent variable, mean-centred variables were used (Aiken and West, 1991). Thus, three variables, **CORRUP**, **CORRUP^2**, and **CORRUP^3** were included to test the hypothesis. Values were taken from the previous year of investment (Cuervo-Cazurra, 2006).

To check further the robustness of the results, another corruption variable was included separately; Government Integrity (GovInt), which was sourced from the Heritage Foundation. The values range from 0 to 100 (from the least to the highest integrity). To facilitate the interpretation of the results, and to keep them in line with each of the corruption variables, the scales were inverted so that a higher score indicated a greater degree of corruption; the values were lagged one year and mean-centred to avoid multicollinearity. Thus, the variable GovInt was included in the base model to test the robustness of the empirical evidence.

Control variables. Several variables controlled the macroeconomic conditions and internal demand in each location. Markets attract more investment when they are more stability and when growth and demand are higher (Mota and Moreira, 2015; Ramírez and Fleta, 2016). Thus, the log of the gross domestic product in current US dollars (GDP), the gross domestic product per capita growth (GDPCap), the unemployment rate (Unemp), and the rate of population growth in percentage terms (Popul) were included in the model

(Jiménez *et al*., 2017, 2018; Mota and Moreira, 2005). In addition, we added the variable political stability (Polconv; Jiang *et al*., 2015; Jiménez *et al*., 2018). Since this index was scaled between 0 and 1, with 0 indicating the worst government and political environment and 1 indicating more stability, we reversed the variable so that it was with the corruption index. Thus, values closer to 1 meant more political instability than those nearer to 0 (Jiang *et al*., 2015). As with the rest of the independent variables, the values for each observation were taken from the previous year of investment (Ramírez and Fleta, 2016).

The dummy variables were years of worldwide financial crises: 1997 (Y1997) and 2007 (Y2007; Fleta-Asín *et al*., 2020). The variables took the value of 1 when the project was carried out in either year and 0 otherwise. Three additional variables were included to control for the sectors in which the projects were being carried out, such as water (SWater), energy (SEnergy), and transportation (STransp). The information and communication sector was excluded to avoid multicollinearity (Fleta *et al.*, 2020; Jiménez *et al*., 2018). These variables had a value of 1 when the projects were carried out in their particular sector and 0 otherwise. In accordance with Jiang et al. (2015) and Wang et al. (2019), we also controlled for the regions where the projects were carried out. They were assigned a value of 1 if they were located in Africa (AFR), America (AMER), and Europe (EU), and 0 otherwise. To avoid multicollinearity, Asia was omitted and acted as the base category.

In keeping with previous research, project control variables for each observation were also included (Fleta-Asín and Muñoz, 2020; Jiang *et al*., 2015). Thus, the involvement of local sponsors was coded as 1 or 0 otherwise (Spons). When ownership of the PPP was shared with the government through a joint venture, the project was coded with 1 and 0

otherwise (Struct). The contract age in terms of years was also considered, since this may have correlated with total investment and may have generated biased results (Age). Finally, publicly traded projects, which can attract more investment because they are more transparent and trustworthy, were coded as 1 and 0 otherwise (Public). Table 2 provides a summary of all the variables.

[Table 2 about here]

3.3. Model and estimation technique

The linear format of the specification model, including the variables where "i" is the observation for each project, is as follows:

$$\mathbf{Invest}_{i,j,t} = \beta_0 + \left(\beta_1 \mathbf{CORRUP}_{i,j,t-1} + \beta_2 \mathbf{CORRUP^2}_{i,j,t-1} + \beta_3 \mathbf{CORRUP^3}_{i,j,t-1}\right) + \beta_4 \mathrm{GDP}_{i,j,t-1} + \beta_5 \mathrm{GDPCap}_{i,j,t-1} + \beta_6 \mathrm{Unemp}_{i,j,t-1} + \beta_7 \mathrm{Popul}_{i,j,t-1} + \beta_8 \mathrm{Polconv}_{i,j,t-1} + \beta_9 \mathrm{Y1997}_{i,j,t} + \beta_{10} \mathrm{Y2007}_{i,j,t} + \beta_{11} \mathrm{Afr}_{i,j,t} + \beta_{12} \mathrm{Amer}_{i,j,t} + \beta_{13} \mathrm{Euro}_{i,j,t} + \beta_{14} \mathrm{SWater}_{i,j,t} + \beta_{15} \mathrm{SEnergy}_{i,j,t} + \beta_{16} \mathrm{STransp}_{i,j,t} + \beta_{17} \mathrm{Spons}_{i,j,t} + \beta_{18} \mathrm{Struct}_{i,j,t} + \beta_{19} \mathrm{Age}_{i,j,t} + \beta_{20} \mathrm{Public}_{i,j,t} + u_j + \varepsilon_{ij}$$

Where the Invest is the dependent variable of the investment volume of each PPP for each project, "i" (i = 1,…, n) corresponds to each of the projects carried out in a specific year, "j" (j = 1,…,l) are the group of countries where the projects are based, and "t" is each of the years analysed (t = 1,…,m). The terms in the parentheses—CORRUP, $CORRUP^2$, and $CORRUP^3$—are the variables related to the hypothesis. These allow the configuration of the S-shape, reaching the value of their original indexes reversed in the previous year of investment, t-1. The control variables related to the particular country (GDP, GDPCap, Unemp, Popul, and Polconv) are followed by the year (Y1997, Y2007), region (EU, AFR, AMER), sectors (SWater, SEnergy, STransp), and project characteristics (Spons, Struct, Age, Public). The βs are the estimated parameters. In a cubic function, to test the hypothesis that the general relationship or tendency between investment and corruption is negative, the coefficient of the term with the highest degree must be negative

CORRUP^3 ($\beta_3 < 0$). For there to be an inflection point with an increasing segment, the first-degree variable (β_1, CORRUP) must be positive and the second-degree variable (β_2, CORRUP^2) negative ($\beta_1 > 0 \cap \beta_2 < 0 \cap \beta_3<0$). In case there is no first-degree term, the second-degree term can be positive or negative ($\beta_1 \nexists \cap (\beta_2 > 0 \cup \beta_2 < 0) \cap \beta_3 < 0$). In case there is no second-degree term, then the first-degree variable must be positive ($\beta_1 > 0 \cap \beta_2 \nexists \cap \beta_3 < 0$). If the sign and the significance of these cases are met, the proposed hypothesis cannot be rejected. Finally, $u_j \sim N(0,\sigma_u^2)$ represents the unobserved country effects shared by all the projects within the same country, and $\varepsilon_{ij} \sim N(0,\sigma_\varepsilon^2)$ represents the unobserved individual effects, assuming neither are correlated.

We used regression analysis to test the hypothesis. We allowed different intercepts per country and assumed their slopes were fixed because, in this way, the nested projects in each were controlled, taking into account their particular circumstances (Fleta-Asín *et al*., 2020, Fleta-Asín and Muñoz, 2020). For this purpose, a regression with multilevel mixed-effects using a generalised linear model was applied (Hox, 1998; Maas and Hox, 2004).

The econometric equation has the same dependent variable as Mota and Moreira (2015) and the same independent variables as Jain et al. (2017) and Jiménez et al. (2017, 2018). It lags the country location variables in the previous period (Cuervo-Cazurra, 2006), considers multilevel data (Fleta-Asín *et al*., 2020; Fleta-Asín and Muñoz, 2020), uses the same public database as Jain et al. (2017) and Jiménez et al. (2018), and centres variables to avoid problems of multicollinearity (Aiken and West, 1991).

4. Data and Results

4.1. Data and main empirical findings

As was noted above, the sample comprised 4,518 observations from 46 countries during the period 1997–2017. The average number of projects per year was 251, with a minimum of 37 (2017) and a maximum of 405 (2006). Table 3 presents the descriptive statistics.

[Table 3 about here]

Table 4 displays the matrix of correlations and the analysis of the variance inflation factor (VIF) to identify potential problems of multicollinearity. Individual VIF values ranged from 1.07 to 4.61, less than the stricter limit of 5.3 in Hair et al. (1998). The results are shown in Table 5. Model 1 is the baseline, and includes only the control variables that can influence the dependent variable. Corruption is included sequentially in Model 2 (linear term), Model 3 (squared term), and Model 4 (cubic term).

Before analysing the coefficients of the models, we checked the Wald χ^2 statistic for each model. Given that the *p*-values were lower than 0.001, the Wald tests of all the models strongly rejected the null hypothesis that all the coefficients in each model were simultaneously equal to 0. This indicates the convenience of including polynomial terms in all the models proposed. Furthermore, the likelihood ratio (LR) test compared with the linear regression indicates that the multilevel models, where the country groups had random effects, were better clustered. Once we obtained these results, we performed the LR test separately to check which of the models fitted better. Thus, we were able to discover whether the extra variables together in each model substantially improved the model fit. The results of the tests showed that Models 1, 2, and 3 could be considered as successively nested in Model 4. Thus, Model 4 was the most suitable for our sample.

With regard to the control variables, most of the models had the same β parameters in terms of sign and significance. The only exceptions, which were not significant, were the

variables unemployment (Model 4) and the year 2007 (Model 4). Thus, taking Model 1 as the base, the GDP of the country ($\beta = 0.286$, $p < 0.001$) and the GDP per capita growth ($\beta = 0.028$, $p < 0.001$) were positive and significant. This is because higher income in a country depends on more economic activity, which can be provided by the government through PPP projects. As expected, the unemployment rate was negative and significant, and in accordance with its negative relationship with economic activity ($\beta = -0.032$, $p < 0.05$). Population growth was positive but not significant, suggesting that a higher rate did not necessarily mean a greater volume of investment per project ($\beta = 0.065$, $p > 0.10$). The proxy for measuring government stability had a negative and significant impact, indicating that the higher the political instability in an economy, the smaller the volume invested per project ($\beta = -0.613$, $p < 0.001$). The control variable of the year 1997 had a positive and significant impact on all models, while 2007 had a positive and significant impact on Models 1 to 3. The results are consistent with a greater use of PPPs in periods of economic crisis (Burguer *et al.*, 2009).

The majority of the control variables affected the dependent variable. The presence of local sponsors had a negative and significant impact that was perhaps the result of coordination issues and higher corruption costs ($\beta = -0.264$, $p < 0.001$). The same applied with the contract age, where higher values meant less investment volume; some service contracts can be carried out for longer periods with lower costs than mega construction projects carried out in shorter periods ($\beta = -0.044$, $p < 0.001$). In contrast, sharing ownership through joint ventures between public and private parties, which can reduce principal-agent issues, had a positive and significant impact on investment volume ($\beta = 0.182$, $p < 0.05$). Publicly traded projects had no impact on the estimations ($\beta = 0.332$,

$p > 0.10$). Different sectors had different effects on the volume of investment, but there was no such distinction in the case of region.

Where corruption was included in linear form with the control in Model 2, the relationship between the degree of corruption and volume of investment was not significant. This means that generally speaking, for our data set, the level of corruption had no linear impact on the volume of investment per project. In the same manner, Model 3 did not show a significant relationship with corruption in either of its terms (linear and square), which indicates that there was no presence of a U-shape in our sample. However, Model 4 revealed linear (Model 4: $\beta_1 = 0.034$; $p < 0.001$) and cubic terms (Model 4: $\beta_3 = -0.000164$; $p < 0.001$). We present a scatterplot of the sample showing the corruption level and volume of investment for each project in Figure 1. This illustrates the cubic fit line of the predicted investment volume. It can be seen that as the level of corruption increases, investment decreases to a certain level, at which point investment begins to increase, then decreases again. Thus, the functional form is compatible with the hypothesis proposed, showing in general and aggregate terms an increasing stretch when the levels of corruption are between 65 and 82 (the Appendix shows how the slope at each point of the model can be calculated). In addition, the figure also illustrates the investments and their paths according to continent. It should be pointed out that in each continent, the range of values that adopt the proxies for corruption and the relevance of different levels of corruption prevalence may differ, impacting the empirically observed relationship between the PPPs' volume of investment and corruption. These findings highlight the importance of performing analyses with a high number of countries' samples from different geographical areas to detect general relationships not biased by regional idiosyncrasies.

[Tables 4 & 5 about here]

[Figure 1 about here]

4.2. Robustness analyses

We also examined characteristics that can influence the relationship between corruption and the volume of investment in PPP projects. We performed Model 4, dividing the full sample into two subsamples for both volume and period of investment. The same model was also applied according to the country´s degree of development by quartiles. In general, the proposed hypothesis was confirmed by all the models, though smaller volumes of investment were not affected by the level of corruption or in countries with a higher degree of development.

The same base Model 1 (only the control variables) was used to check the robustness of the results, adding another proxy for the corruption level (GovInteg), where the variable was included from linear to the third power. Overall, the results show that there was a decreasing relationship between the volume of investment and the degree of corruption, with a positive relationship for medium degrees of corruption. This occurred when both the international transparency variable and the heritage foundation variable were used, regardless of when the investment was made. Similarly, the behaviour between investment and the level of corruption depended on the region in which the projects were carried out. For reasons of space, these unreported robustness analyses have not been presented herein, but they are available upon request from the authors.

5. Discussion and Conclusion

The findings have allowed us to reconcile both apparently opposing positions in the literature through a "sand–grease–sand the wheels" effect between volume of investment and level of corruption, which is configured in the form of a reverse S-shape consisting of three stages.

In the first (declining) stage, where economies have lower levels of corruption, any increase decreases the investments made. Public–private partnership experiences of environments where there are lower degrees of corruption match these findings. In the second (ascending) stage, for countries with average widespread corruption, some companies increase their volume of investment because they are willing to assume the associated costs. Finally, in the third (declining) stage, the degree of corruption is so extreme that it discourages investment due to related uncertainty and costs.

The results of the present study are compatible with, and complement, previous studies. They provide empirical evidence that particular economic variables behave differently with respect to the level of corruption. Some investigations have shown that economic activity can be encouraged by a certain level of corruption, but then decline (Zhao *et al*., 2020); this relationship is found in Middle Eastern and North African countries (Saha and Ali, 2017). The findings in the present study show an inverted-U relationship between corruption and investment volume in PPPs located in Africa (see Figure 1). Other research has emphasised the positive relationship between high corruption and growth in Asian countries (Asiedu and Freeman, 2009; Blackburn and Forgues-Puccio, 2009) and high corruption and foreign direct investment in Latin American countries (Subasat and Bellos, 2011). The findings in the present study are in accordance with these results also (see Figure 1).

Various studies have provided evidence of a non-monotonic relationship between economic growth and corruption. For instance, applying econometric models of corruption in quadratic terms to 130 countries, Méndez and Sepúlveda (2006) observed that low levels of corruption had a beneficial effect on economic growth, but that high levels were detrimental. Other researchers have found a non-monotonic relationship between the level of corruption and the degree of democratic development amongst certain groups of countries (Sung, 2004; Campbell and Saha, 2013). More recently, Mallik and Saha (2016) found a cubic relationship between growth and corruption.

6. Managerial Implications, Limitations, and Further Research

The influence of the level of corruption on investment volume has implications for management. From a public perspective, corrupt practices should be detected, prevented, and penalised, since they undermine the welfare of society. To this end, the development of contracting regulations that incorporate good PPP practice and control the stages of implementation can decrease the benefits for corrupt agents. *Ex ante*, at the procurement stage, corruption can influence both adjudication and accelerate administrative processes (Xu *et al*., 2017), so it is highly recommended that these are made transparent. After the work is assigned, *ex dure* and *ex post,* the quantity and complexity of activity make it difficult to monitor payments (Locatelli *et al*., 2017), and requirements imposed on the investor can be relaxed later due to lack of verifiability or the incomplete nature of the agreements (Fleta-Asín and Muñoz, 2017; Lui, 1985). At this stage, penalties for unjustified budgetary deviations, bonuses for better performance, external audits with incentives to detect fraud, and prolongation of claim times by the administration might help to limit corrupt practices.

Furthermore, and according to our results, in the case of Latin American and Asian countries with very high corruption, more mechanisms of control should be put in place and penalties increased, because the more positive relationship between high corruption and investment volume compared with other markets (such as Europe) increases the negative effect of corruption on societal well-being. At the same time, these countries should reinforce their regulations to make the acceleration of procedures resulting from bribery less attractive. Lastly, in the case of African economies, a steep decline in investment volume was observed when corruption was rife, so the proposed measures should be accompanied by economic policies that improve market conditions as a whole.

Finally, there are specific implications for companies. The level of corruption generally has an impact on the volume of investment, though this is mediated by location. Investment in locations where there is little corruption can reduce investment volume generating higher costs, as well as the distrust of shareholders if they are not aware of corruption. On the other hand, following the principal-agent theory, managers have to anticipate that in countries where there is a medium-to-high prevalence of corruption, the state can be one of the agents that exercise corruption, so it would be more difficult to mitigate its impact. This will damage the reputation of the company.

The findings of the present study should, nevertheless, be treated with caution. First, the study examined the volume of investment by companies that may have chosen to enter these environments and to shoulder the costs of corruption. This does not mean that the economic problems associated with corruption disappear or that such a practice is beneficial for the societies concerned. It would be helpful to examine whether an increase

in the volume of investment in PPPs presents the same marginal productivity as an increase in volume in countries with low levels of corruption, quantifying the negative effect produced by companies that stop investing. In addition, although the corruption index includes many countries, future research might include those with the highest level of transparency to test whether they are compatible with the lowest levels of corruption. Finally, the study investigated corruption in a broad sense, but it can crystalise into different forms, and these deserve further examination.

Appendix

[Table 6 about here]

To determine the slopes of the regression of investment on corruption for any single value of corruption, we can differentiate, as an example, Model 4 as follows: $\frac{\partial \widehat{INVEST}}{\partial CORRUP}$ $= 0.034861 + (2\ x\ 0.000054\ x\ \text{CORRUP}) - (3x(-0.000164)x\ \text{CORRUP}^2)$.

References

Aiken, L.S., West, S.G., & Reno, R.R. (1991). Multiple regression: Testing and interpreting interactions. Sage.

Alley, A.L. (2010). The rules of the game: unpacking patronage politics in Yemen. The Middle East Journal, 64(3), 385-409.

Anti-Corruption Resource Centre (2020). Access 23/01/2020. Glossary available at: http://www.u4.no/glossary/.

Asiedu, E., & Freeman, J. (2009). The effect of corruption on investment growth: Evidence from firms in Latin America, Sub-Saharan Africa, and transition countries. Review of Development Economics, 13(2), 200-214.

Bahoo, S. (2020). Corruption in banks: A bibliometric review and agenda. Finance Research Letters, 35, 101499.

Bahoo, S., Alon, I., & Floreani, J. (2020a). Corruption in economics: a bibliometric analysis and research agenda. Applied Economics Letters, 1-14.

Bahoo, S., Alon, I., & Paltrinieri, A. (2020b). Corruption in international business: A review and research agenda. International Business Review, 29(4), 101660.

Bardhan, P. (1997). Corruption and development: a review of issues. Journal of Economic Literature, 35(3), 1320-1346.

Beekman, G., Bulte, E., & Nillesen, E. (2014). Corruption, investments and contributions to public goods: Experimental evidence from rural Liberia. Journal of Public Economics, 115, 37-47.

Blackburn, K., & Forgues-Puccio, G. F. (2009). Why is corruption less harmful in some countries than in others?. Journal of Economic Behavior & Organization, 72(3), 797-810.

Burger, P., Tyson, J., Karpowicz, I., & Delgado-Coehlo, M. (2009). The Effects of the Financial Crisis on Public-Private Partnerships. International Monetary Fund Working Paper.

Campbell, N., & Saha, S. (2013). Corruption, democracy and Asia-Pacific countries. Journal of the Asia Pacific Economy, 18(2), 290-303.

Chou, J.S., & Pramudawardhani, D. (2015). Cross-country comparisons of key drivers, critical success factors and risk allocation for public-private partnership projects. International Journal of Project Management, 33(5), 1136-1150.

Cooray, A., Dzhumashev, R., & Schneider, F. (2017). How does corruption affect public debt? An empirical analysis. World Development, 90, 115-127.

Cuervo-Cazurra, A. (2006). Who cares about corruption?. Journal of International Business Studies, 37(6), 807-822.

Cuervo-Cazurra, A. (2016). Corruption in international business. Journal of World Business, 51(1), 35-49.

Diaby, A., & Sylwester, K. (2015). Corruption and market competition: Evidence from post-communist countries. World Development, 66, 487-499.

Dunning, J. H., & Lundan, S. M. (2008). Multinational enterprises and the global economy. Edward Elgar Publishing.

Dunning, J.H., & Narula, R. (2004): Multinationals and industrial competitiveness: a new agenda, Great Britain: Edward Elgar Publishing.

European Commission (2004). Green Paper on Public Private Partnerships and Community Law on Public Contracts and Concessions, COM (2004) 327, Brussels.

Fleta-Asín, J., & Muñoz, F. (2017). Determinants of contract duration in outsourced services in the defense sector. Applied Economics Letters, 24(19), 1408-1411.

Fleta-Asín, J., & Muñoz, F. (2020). How does risk transference to private partner impact on public-private partnerships' success? Empirical evidence from developing economies. Socio-Economic Planning Sciences, 72, 100869.

Fleta-Asín, J., & Muñoz, F. (2021). Renewable energy public–private partnerships in developing countries: Determinants of private investment. Sustainable Development (in press).

Fleta-Asín, J., Muñoz, F., & Rosell-Martínez, J. (2020). Public-private partnerships: determinants of the type of governance structure. Public Management Review, 22(10), 1489-1514.

Freckleton, M., Wright, A., & Craigwell, R. (2012). Economic growth, foreign direct investment and corruption in developed and developing countries. Journal of Economic Studies, 39(6), 639-652.

Gillespie, J. S. (2006). Transplanting commercial law reform: developing a'rule of law'in Vietnam. Ashgate Publishing, Ltd..

Habib, M., & Zurawicki, L. (2001). Country-level investments and the effect of corruption—some empirical evidence. International Business Review, 10(6), 687-700.

Hair J.F., Tatham R.L., Anderson R.E.. Multivariate Data Analysis. 5. Prentice Hall; 1998.

Hajzler, C. (2012). Expropriation of foreign direct investments: sectoral patterns from 1993 to 2006. Review of World Economics, 148(1), 119-149.

Henisz, W.J. (2000). The institutional environment for multinational investment. The Journal of Law, Economics, and Organization, 16(2), 334-364.

Hox, J. (1998). Multilevel modeling: When and why. In Classification, data analysis, and data highways. Springer, Berlin, Heidelberg.

Hwang, B.G., Zhao, X., & Gay, M. J.S. (2013). Public private partnership projects in Singapore: Factors, critical risks and preferred risk allocation from the perspective of contractors. International Journal of Project Management, 31(3), 424-433.

Jain, P.K., Kuvvet, E., & Pagano, M.S. (2017). Corruption's impact on foreign portfolio investment. International Business Review, 26(1), 23-35.

Jiang, Y., Peng, M.W., Yang, X., & Mutlu, C.C. (2015). Privatization, governance, and survival: MNE investments in private participation projects in emerging economies. Journal of World Business, 50(2), 294-301.

Jiménez, A., Russo, M., Kraak, J.M., & Jiang, G.F. (2017). Corruption and private participation projects in Central and Eastern Europe. Management International Review, 57(5), 775-792.

Jiménez, A., Salvaj, E., & Lee, J.Y. (2018). Policy risk, distance, and private participation projects in Latin America. Journal of Business Research, 88, 123-131.

Ko, K., & Weng, C. (2012). Structural changes in Chinese corruption. The China Quarterly, 211, 718-740.

Leff, N. H. (1989). Economic development through bureaucratic corruption. AJ Heidenheimer, 389-404.

Lieberman, M.B., & Montgomery, D. B. (1988). First - mover advantages. Strategic Management Journal, 9(S1), 41-58.

Liu, T., Wang, Y., & Wilkinson, S. (2016). Identifying critical factors affecting the effectiveness and efficiency of tendering processes in Public–Private Partnerships (PPPs): A comparative analysis of Australia and China. International Journal of Project Management, 34(4), 701-716.

Locatelli, G., Mariani, G., Sainati, T., & Greco, M. (2017). Corruption in public projects and megaprojects: There is an elephant in the room!. International Journal of Project Management, 35(3), 252-268.

Lui, F.T. (1985). An equilibrium queuing model of bribery. Journal of political economy, 93(4), 760-781.

Maas, C.J., & Hox, J.J. (2004). Robustness issues in multilevel regression analysis. Statistica Neerlandica, 58(2), 127-137.

Mallik, G., & Saha, S. (2016). Corruption and growth: a complex relationship. International Journal of Development Issues, 15(2), 113-129.

Mauro, P. (1998). Corruption and the composition of government expenditure. Journal of Public economics, 69(2), 263-279.

May, C., Nölke, A., & ten Brink, T. (2019). Public-private coordination in large emerging economies: the case of Brazil, India and China. Contemporary politics, 1-16.

Méndez, F., & Sepúlveda, F. (2006). Corruption, growth and political regimes: Cross country evidence. European Journal of Political Economy, 22(1), 82-98.

Méon, P.G., & Sekkat, K. (2005). Does corruption grease or sand the wheels of growth?. Public choice, 122(1-2), 69-97.

Mota, J.A., & Moreira, A.C. (2015). The importance of non-financial determinants on public–private partnerships in Europe. International Journal of Project Management, 33(7), 1563-1575.

Neeman, Z., Paserman, M. D., & Simhon, A. (2008). Corruption and openness. The BE Journal of Economic Analysis & Policy, 8(1).

Niazai, G.A., & Gidado, K. (2012). Causes of project delay in the construction industry in Afghanistan. EPPM2012.

O'Toole, C.M., & Tarp, F. (2014). Corruption and the efficiency of capital investment in developing countries. Journal of International Development, 26(5), 567-597.

Pan, X., & Tian, G.G. (2017). Political connections and corporate investments: Evidence from the recent anti-corruption campaign in China. Journal of Banking & Finance.

Porter, M.E.; Schwab, K. y Sala-i-Martin, X. (2007): The Global Competitiveness Report 2007-2008, World Economic Forum, Geneva, Switzerland.

Ramírez, M., & Fleta, J. (2016). Is the importance of location factors different depending on the degree of development of the country?. Journal of International Management, 22(1), 29-43.

Rock, M.T., & Bonnett, H. (2004). The comparative politics of corruption: accounting for the East Asian paradox in empirical studies of corruption, growth and investment. World Development, 32(6), 999-1017.

Rose-Ackerman, S. (1975). The economics of corruption. Journal of Public Economics, 4(2), 187-203.

Rose-Ackerman, S. (2002). "Grand" corruption and the ethics of global business. Journal of Banking & Finance, 26(9), 1889-1918.

Saha, S., & Ali, M. S.B. (2017). Corruption and economic development: New evidence from the Middle Eastern and North African countries. Economic Analysis and Policy, 54, 83-95.

Sandholtz, W., & Koetzle, W. (2000). Accounting for corruption: Economic structure, democracy, and trade. International Studies Quarterly, 44(1), 31-50.

Schwab, K. (2018): "The Global Competitiveness Report 2018", World Economic Forum, Geneva, Switzerland.

Shleifer, A., & Vishny, R. W. (1993). Corruption. The Quarterly Journal of Economics, 108(3), 599-617.

Schomaker, R. M. (2020). Conceptualizing corruption in public private partnerships. Public Organization Review, 20(4), 807-820.

Subasat, T., & Bellos, S. (2011). Economic freedom and foreign direct investment in Latin America: A panel gravity model approach. Economics Bulletin, 31(3), 2053-2065.

Sung, H. (2004). Democracy and political corruption: A cross-national comparison. Crime, Law and Social Change, 41(2), 179-193.

Svensson, J. (2005). Eight questions about corruption. Journal of Economic Perspectives, 19(3), 19-42.

Tran, Q. T. (2020). Corruption and corporate risk-taking: evidence from emerging markets. International Journal of Emerging Markets.

Transparency International (2020). Access 23/01/2021. Glossary available at: https://www.transparency.org/glossary/term/corruption.

Wang, H., Liu, Y., Xiong, W., & Song, J. (2019). The moderating role of governance environment on the relationship between risk allocation and private investment in PPP markets: Evidence from developing countries. International Journal of Project Management, 37(1), 117-130.

Wei, S. J. (2000). How taxing is corruption on international investors?. Review of Economics and Statistics, 82(1), 1-11.

Wei, S. J. (2001). Corruption in economic transition and development: grease or sand?. UN.

Williamson, O. E. (1975). Markets and hierarchies. New York, 2630.

World Bank Group (2020). Access 23/01/2021. Available from: http://ppp.worldbank.org/public-private-partnership/

Wu, J. (2014). The antecedents of corporate social and environmental irresponsibility. Corporate Social Responsibility and Environmental Management, 21(5), 286-300.

Xu, G., Zhang, D., & Yano, G. (2017). Can corruption really function as "protection money" and "grease money"? Evidence from Chinese firms. Economic Systems, 41(4), 622-638.

Yang, Y., Hou, Y., & Wang, Y. (2013). On the development of public–private partnerships in transitional economies: An explanatory framework. Public administration review, 73(2), 301-310.

Yescombe, E.R. (2011). Public-private partnerships: principles of policy and finance. Elsevier.

Zhao, W., Wang, L., Ning, X., Ju, L., & Mu, Y. (2020). The Moderating Role of Corruption in the Inverted U-Shaped Relationship Between Red Tape and Private Investment in PPP Projects: Evidence From Developing Countries. IEEE Transactions on Engineering Management.

Table 1. Effects of corruption and influencing factors

	Influence	Specific factors and authors
Effects	Negative	Direct costs (Habib and Zurawicki, 2001; Zhao *et al*., 2020), negotiating costs (Méon and Sekkat, 2005). Specific to PPPs: alters the procurement process (Yescombe, 2011, p. 77), increases uncertainty (Liu *et al*., 2016; Locatelli *et al*., 2017), less efficiency (Wei, 2001), higher direct costs (Fleta-Asín and Muñoz, 2020) and coordination costs (Tran, 2020).
	Positive	Speeds up procedures saving operating costs (Leff, 1989), gets experience dealing in the same environments (Cuervo-Cazurra, 2006).
Influencing factors	Degree	Red type (Méon and Sekkat, 2005; Zhao *et al*., 2020), centralized corruption (Blackburn *et al*., 2009; Shleifer and Vishney, 1993).
	Market	Political stability (Méndez and Sepúlveda, 2006), institutions (Méon and Sekkat, 2005), regulations (Leff, 1989; Freckleton *et al.*, 2012), degree of development (Blackburn and Forgues-Puccio, 2009; Sandholtz and Koetzle, 2000), degree of openness (Neeman *et al*., 2008), size (Rock and Bonnett, 2004), period of time (Ko and Weng, 2012), region (Asiedu and Freeman, 2009), country (Saha and Ali, 2017; Wu, 2014).
	Firm/Project	Size (Rose-Ackerman, 2002), local partners (Jiménez *et al*., 2017), sector (Mota and Moreira, 2015; Wang *et al*., 2019), previous experience (Cuervo-Cazurra, 2006), tendering process and management structure (Schomaker, 2020).

Table 2. Summary of variables, definition and source

Variable	Definition	Source
Invest	Invest collects the volume investment of the project approached by the logarithm of the total investment in millions of US dollars.	World Bank PPP Database
Corrup	International transparency scores and ranks countries/territories on how corrupt a country's public sector is perceived to be by experts and business executives. The index ranges from 0 to 100, indicating from more to less corruption. The variable is constructed by inverting the scale so that the scores reflect from less to more corruption.	Transparency International
GovInteg	The variable is an indicator that collects the degree of corruption of a government, from 0 less corruption, to 100 greater corruption.	Heritage Foundation
GDP	The log of GDP for each country where the PPP is deployed.	World Bank Indicators
GDPcap	Percentage that reflects the growth of GDP per capita of the country where the PPP is located.	
Unemp	Percentage of unemployment in the country where the PPP is carried out.	
Popul	Percentage that reflects the annual population growth of the country where the PPP is located.	
Polconv	The original Polconv index collects the assessment of the stability of the political system from lowest (values close to 0) to greater stability (values close to 1). The index is rescaled to reflect from least to greatest instability.	Henisz (2000)
Y1997 Y2007	A dummy variable adopting the value of 1 when the PPP is deployed in the year 1997 or 2007 respectively, and 0 otherwise.	World Bank PPP Database
SWater SEnergy STransp	A dummy variable adopting the value of 1 when the PPPs refer to water, energy or transport respectively, and 0 otherwise.	
Spons	A dummy variable adopting the value of 1 when local sponsors participate in the PPP and 0 otherwise.	
Struct	A dummy variable adopting the value of 1 when the PPP is a joint-venture and 0 otherwise.	
Age	The age of the project is computed as the difference between the year when the PPP was set out and the last year.	
Public	A dummy variable adopting the value of 1 when the PPP is publicly traded and 0 otherwise.	
Afr Amer Euro	A dummy variable adopting the value of 1 when the PPP is located in Africa, America or Europe respectively, and 0 otherwise.	

Table 3. Descriptive statistics †

Variables		Label	Median	Mean	Standard deviation	Min	Max
Dependent Variable							
Investment (log)		Invest	4.27	66.73	1.69	-3.51	10.48
Independent variables							
Hyp.	Corruption	Corrup	66	66.73	6.26	43	90
	Government integrity	GovInteg	34	33.05	7.43	10	70
Context	GDP (log)	GDP	27.48	27.10	1.66	21.10	29.98
	GDP per capita growth	GDPcap	4.40	4.51	4.36	-14.42	15.22
	Unemployment rate	Unemp	6.91	6.88	3.78	0.20	28.24
	Population growth	Popul	1.07	1.02	0.77	-1.01	5.37
	Political instability	Polconv	0.53	0.57	0.32	0.14	1
Time	Year 1997	Y1997	0	0.06	0.23	0	1
	Year 2007	Y2007	0	0.07	0.26	0	1
Sector	Water	SWater	0	0.12	0.32	0	1
	Energy	SEnergy	0	0.45	0.50	0	1
	Transport	STransp	0	0.16	0.37	0	1
	Informat. & Communic.	-	0	0.27	0.44	0	1
Project	Foreign Sponsor	Spons	1	0.55	0.50	0	1
	Shared Ownership	Struct	0	0.11	0.31	0	1
	Age	Age	10	10.65	4.88	1	21
	Public offer	Public	0	0.01	0.11	0	1
Region	Africa	Afr	0	0.03	0.17	0	1
	America	Amer	0	0.43	0.50	0	1
	Europe	Euro	0	0.12	0.32	0	1
	Asia	-	0	0.42	0.49	0	1
	Oceania	-	0	0.00	0.01	0	1

† N=4518 observations in all the variables.

Table 4. Correlation Matrix †

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	VIF
1. Invest																				1.26
2. Corrup	-0.03																			3.94
3. GovInteg	-0.06	0.75																		4.61
4. GDP	-0.02	-0.23	-0.18																	2.17
5. GDPCap	-0.12	0.08	0.17	0.34																2.02
6. Unemp	0.03	-0.19	-0.27	-0.37	-0.43															1.91
7. Popul	0.12	-0.30	-0.39	-0.27	-0.32	0.07														2.83
8. Polconv	-0.21	0.05	0.27	0.06	0.44	-0.29	-0.11													1.95
9. Y1997	-0.02	0.18	-0.03	-0.06	-0.06	0.07	0.08	0.02												1.63
10. Y2007	0.01	0.10	0.04	0.02	0.16	-0.04	-0.05	0.05	-0.07											1.07
11. SWater	-0.29	-0.06	0.03	0.26	0.27	-0.16	-0.13	0.28	-0.04	0.07										1.90
12. SEnergy	-0.08	-0.16	-0.19	0.14	-0.01	0.03	0.03	-0.07	-0.02	-0.04	-0.33									2.03
13. STransp	0.14	-0.02	-0.08	0.09	0.03	-0.10	0.08	-0.08	0.07	-0.01	-0.16	-0.40								1.69
14. Spons	-0.08	-0.04	-0.05	0.37	0.21	-0.18	-0.15	-0.03	-0.04	0.02	0.06	0.07	0.13							1.29
15. Struct	0.04	0.17	0.19	-0.15	0.00	0.06	-0.16	-0.04	0.01	0.03	-0.09	-0.04	-0.09	-0.11						1.16
16. Age	-0.17	0.23	-0.07	-0.19	-0.04	0.16	0.01	0.05	0.52	0.02	0.01	-0.13	0.00	0.00	0.07					1.91
17. Public	0.06	-0.07	-0.01	0.00	-0.09	0.04	0.00	-0.06	-0.03	-0.03	-0.03	0.03	0.07	-0.11	-0.04	-0.16				1.09
18. Afr	0.08	-0.03	0.03	-0.27	-0.09	0.14	0.26	0.10	-0.04	0.03	-0.05	-0.10	-0.03	-0.16	0.01	-0.07	-0.02			1.27
19. Amer	0.08	-0.18	-0.46	-0.14	-0.47	0.34	0.24	-0.45	0.08	-0.02	-0.14	0.05	0.04	-0.16	-0.09	0.16	0.12	-0.15		2.37
20. Euro	0.02	0.48	0.56	-0.14	-0.01	0.10	-0.63	-0.13	-0.01	0.03	-0.10	-0.12	-0.11	0.02	0.32	0.02	-0.03	-0.06	-0.32	3.62

† N= 4518 observations.

Table 5. Multilevel regression of investment volume †

	Model 1	Model 2	Model 3	Model 4
Variables label	**Coeff (Std Err)**	**Coeff (Std Err)**	**Coeff (Std Err)**	**Coeff (Std Err)**
Corrup		0.008531 (0.006)	0.008530 (0.006)	**0.034861 (0.009)*** **
Corrup^2			-0.000030 (0.000)	0.000054 (0.000)
Corrup^3				**-0.000164 (0.000)*** **
GDP	0.286400 (0.045)***	0.296273 (0.046)***	0.296195 (0.046)***	0.319097 (0.048)***
GDPCap	0.028857 (0.007)***	0.028223 (0.007)***	0.028231 (0.007)***	0.028310 (0.007)***
Unemp	-0.032378 (0.012)*	-0.030058 (0.012)*	-0.030006 (0.012)*	-0.024930 (0.012)
Popul	0.065061 (0.081)	0.059859 (0.082)	0.060599 (0.083)	0.024468 (0.083)
Polconv	-0.613182 (0.149)***	-0.607814 (0.149)***	-0.607251 (0.150)***	-0.661340 (0.150)***
Y1997	0.478256 (0.118)***	0.447989 (0.120)***	0.448391 (0.120)***	0.404804 (0.121)**
Y2007	0.190556 (0.086)*	0.176207 (0.087)*	0.175889 (0.087)*	0.125768 (0.088)
SWater	-1.812593 (0.093)***	-1.810965 (0.093)***	-1.811107 (0.093)***	-1.819202 (0.093)***
SEnergy	-0.892198 (0.063)***	-0.890899 (0.063)***	-0.890872 (0.063)***	-0.897269 (0.063)***
STransp	-0.232809 (0.078)**	-0.235458 (0.078)**	-0.235449 (0.078)**	-0.249946 (0.078)**
Spons	-0.264565 (0.050)***	-0.262875 (0.050)***	-0.262952 (0.050)***	-0.267853 (0.050)***
Struct	0.182511 (0.079)*	0.180246 (0.079)*	0.180421 (0.080)*	0.166682 (0.079)*
Age	-0.044697 (0.007)***	-0.045114 (0.008)***	-0.045133 (0.008)***	-0.044045 (0.008)***
Public	0.332947 (0.217)	0.340589 (0.217)	0.340842 (0.217)	0.359889 (0.217)
Afr	0.444266 (0.274)	0.471849 (0.279)	0.470494 (0.280)	0.495744 (0.283)
Amer	-0.002254 (0.205)	0.010415 (0.209)	0.009246 (0.210)	0.041058 (0.213)
Euro	-0.102699 (0.323)	-0.153899 (0.332)	-0.152621 (0.333)	-0.241540 (0.338)
Intercept	-1.610194 (1.233)	-1.879309 (1.275)	-1.876508 (1.276)	-2.452159 (1.314)
Prob > χ^2	0.000	0.000	0.000	0.000
LR test	0.000	0.000	0.000	0.000
Mean VIF	1.73	1.77	1.83	2.00
R^2	0.4912	0.4918	0.4918	0.4954
Observations (n)	4518	4518	4518	4518

† Notes: * p<0.05, **p<0.01, *** p<0.001. Standard errors are in parentheses. The number of groups in each level analysis include 5 continents, 46 countries. Bold format applied in significant results related to the Hypothesis proposed.

Appendix

Table 6. List of countries hosting projects and their main foreign investor in alphabetical order by continent

Continent	Country location (main investor origin)	Number of countries
Africa	Egypt (UK), Gabon (India), Ghana (South Africa), Kenya (UK), Liberia (South Africa), Mali (France), Namibia (Portugal), Senegal (France), Swaziland (South Africa), Tunisia (Qatar), Uganda (South Africa)	11
America	Argentina (Italy), Bolivia (Luxembourg), Brazil (Spain), Colombia (Mexico), Cuba (Canada), Dominican Rep. (Luxembourg), Ecuador (Mexico), El Salvador (Mexico), Guyana (United States), Jamaica (Mexico), Mexico (United States), Nicaragua (Mexico), Panama (Guatemala), Peru (Spain), Venezuela (Spain)	15
Asia	Armenia (Russia), Azerbaijan (Turkey), China (United States), India (UK), Iran (South Africa), Jordan (France), Laos (Vietnam), Mongolia (-), Pakistan (Unit Arab. Emirates), Syria (South Africa), Turkmenistan (Russia), Uzbekistan (Russia), Vietnam (China), Yemen (South Africa)	14
Europe	Albania (UK), Byelorussia (Russia), Russia † (Sweden), Turkey † (Germany), Ukraine (Russia)	5
Oceania	Fiji Islands (UK)	1

† It can be included in Europe or Asia because of its surface and location.

(-) Mongolia has no projects with foreign investors in the database.

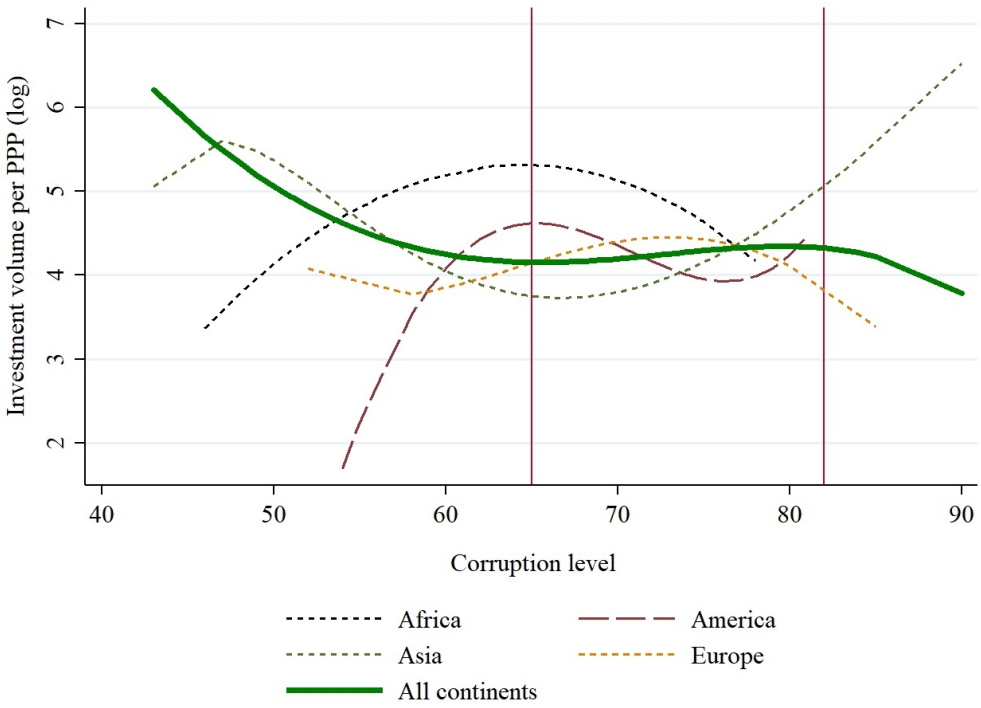

Figure 1. Reversed S-shape between corruption and investment volume

332x234mm (96 x 96 DPI)