This is an Accepted Manuscript of an article published by Taylor & Francis in **Journal of Economic Policy Reform 25(2) : 136-155 (2022)** on 11 Oct 2021, available at: https://doi.org/10.1080/17487870.2021.1973899.

ANALYSING THE LINK BETWEEN CORRUPTION AND PPPs IN INFRASTRUCTURE PROJECTS: AN EMPIRICAL ASSESSMENT IN DEVELOPING COUNTRIES

ABSTRACT

This study analyses the relationship between Public-Private Partnerships (PPPs) and corruption. To do this, several econometric analyses were developed using a sample of 92 low- and middle-income countries over the period 1995-2018. There is research in the literature that discusses the theoretical vulnerability of PPPs to corruption, but this study adds empirical evidence, considering that developing countries have more problems with corruption. The results suggest that corruption has a positive impact on the number of PPP arrangements and on the amount of investment commitments. This provides evidence of a positive link between corruption and PPP projects.

Keywords: Anti-corruption regulation; Public Private Partnerships; Corruption.

1. INTRODUCTION

In recent decades, corruption scandals have led scholars and practitioners to take a more intense interest in the accountability of public-sector entities. There are differing definitions of corruption, but most of them coincide in considering it to be the misuse of public power for private gain, either pecuniary gain or gain in terms of status (Heidenheimer and Johnston 2017).

Unfortunately, corruption appears in many areas and activities of public administrations, with frequent incidence in collaborations between the public and private sectors, or so-called Public Private Partnerships (PPPs). From a contract-based perspective (Yescombe and Farquharson 2018), a PPP is a long-term contract between a private enterprise and a public agency to provide a public service/asset, in which the private party bears significant risk and management responsibility (World Bank 2019).[1] PPPs have become a popular strategy for the provision of infrastructure services (Hodge and Greve 2018). Concretely, this study is focused on economic infrastructure (energy, ICT, transport, water and sewerage, and municipal solid waste).

PPPs have some specific characteristics that make them particularly vulnerable to corruption (Schomaker 2020). For instance, they arise in a context of incomplete contracts,[2] which generate transaction costs, and corruption may decrease these costs because it reduces uncertainty (Husted 1999). Furthermore, corruption could appear in the three stages of a PPP (Iossa and Martimort 2013). At the decision stage, public officials may decide to use a PPP because this allows them to obtain private rents, even

[1] There are multiple definitions of PPP depending on the region, the sector of activity, the distribution of risk, and the distribution of ownership (Mota and Moreira 2015). Here, the contractual perspective is used to define PPP.

[2] There is uncertainty about the physical nature of the network, or the external shocks that may affect the project in the future.

if a PPP would not be the most efficient method. At the tender stage, contractors may bribe the public officials to choose them (Auriol 2006). Furthermore, public officials may secure better conditions for the firm during the renegotiation process or may manipulate the circumstances to justify pricing changes or a lengthening of the contract.

The aim of this paper is to test the link between the PPPs and corruption. A positive link has been partially noticed in the previous literature, but this paper contributes in two ways: first, it empirically checks this link; and second, it is focused on developing countries, which are often more affected by corruption (Blackburn et al. 2010). A large part of the literature analyses PPPs in China, the USA, Australia, and Europe (de Castro e Silva Neto et al. 2016; Cui et al. 2018). There are some studies focused on specific African and Asian countries, but the majority of these are case studies (Xiong et al. 2019). Indeed, research on developing countries is on the contemporary research agenda in the PPP literature (Hodge and Greve 2018).

Concretely, this study uses a sample of 92 low- and middle-income countries over the period 1995-2018. The results suggest that countries with higher levels of corruption tend to use PPPs to a greater extent. These findings are robust, not only when the number of contractual arrangements is considered but also when the total amount of investment commitments is studied. The results are also robust for different corruption indicators, such as the Bayesian Corruption Index, which shows the general level of corruption perceived by actors in all strata of society; the Corruption Perception Index, which shows the corruption perception of businesspeople, risk analysts and the general public; and, the subindex 'control of corruption' of the Worldwide Governance Indicators, which captures perceptions that public power is exercised for private gain, and which takes into account both petty and major forms of corruption.

The rest of the study is structured as follows: section 2 summarises the most relevant findings on PPPs in the previous literature; section 3 proposes the expected relationship between corruption and PPPs on the basis of a theoretical framework; section 4 sets up the methodology by describing the sample, variables, models and analysis techniques; section 5 summarises the empirical findings; and section 6 ends with some concluding remarks, the contributions of this study and lines for future research.

1. BRIEF REVIEW OF THE PPP LITERATURE

The cooperation model of PPPs was introduced under the umbrella of New Public Management (NPM) (Pollitt and Bouckaert 2000), as an alternative to other models such as outsourcing, subcontracting and privatisation. PPPs can be considered as a governmental entrepreneurial movement (Bloomfield 2006) in which a public partner shares responsibility with a private partner (Hodge 2006). Despite some problematic issues (Hodge and Greve 2007), PPPs have become a popular strategy across the world for implementing infrastructure projects (Hodge and Greve 2014).

Accordingly, PPPs have attracted attention in the academic literature. This interest began with the study by Broadbent and Laughlin (1999), who looked at private finance initiatives (PFI) as specific cases of PPPs. From that time onwards, a large part of the literature in various disciplines has analysed different aspects of PPPs,[3] as project finance and management (Demirag et al. 2011; Konrad 2018; Owolabi et al. 2019; Greve et al., 2021), the identification, controlling, diffusion, demand, and management of risks (Tallaki et al. 2019), and several socioeconomic and political determinants, e.g. the deficit situation, economic development, political ideology, regulation quality, government effectiveness, and so on (Sharma 2012; Boardman et al. 2015; Mota and Moreira 2015;

[3] For a more detailed literature review, see Cui et al. (2018) and de Castro e Silva Neto et al. (2016).

Panayides et al. 2015; Jiménez et al. 2017; Boyer and Scheller 2018; Palcic et al. 2019; Rosell and Saz-Carranza 2019).

This study contributes to the literature by focusing on corruption. PPPs have previously been related to corruption, but the evidence is scarce and is usually focused on specific countries and sectors. For instance, Gillespie et al. (2020) suggested that rule-based anti-corruption initiatives were no match for PPPs in two case studies of compulsory land acquisition in Vietnam. Pusok (2016) concluded that sanitation coverage is rather sparse in developing countries with high levels of corruption because governments allow private actors to prioritise profit maximisation over public needs. In the transport sector, Galilea and Medda (2010) pointed out the importance for the outcome of a PPP project of the rest of the world's perception of a country's level of corruption.

Jiménez et al. (2017) concluded that higher levels of host-country corruption were associated with greater probabilities of PPP failure in central and eastern European countries. Rosell and Saz-Carranza (2019) found that the corruption perception index negatively affected the quality of PPP policies in 135 countries in 2018. However, Palcic et al. (2019) did not find the corruption indicator to have a significant impact on the length of PPP project tendering periods for a sample of developed countries; and Mota and Moreira (2015) did not find corruption to be relevant in explaining the proliferation of PPPs in European countries.

2. THEORETICAL FRAMEWORK AND RESEARCH HYPOTHESIS

According to Schomaker (2020), PPPs have specific characteristics that make them particularly vulnerable to corruption. First, PPPs arise in a context of incomplete contracts because there is uncertainty about the physical nature of the network, the future use of the network and external shocks that may affect the project in the future. Incomplete contracts

generate uncertainty, and although costs appear in all contracts (Coase 1937), they are higher as uncertainty increases. In situations where outcomes are unsure, corruption may serve to achieve a more certain result (Husted 1999). Thus, corruption is "accepted" by the public and the private parties, who want to reduce transaction costs.

Secondly, corruption may appear in each of the PPPs stages:

(i) The first stage is the decision stage ('pre-tendering'), when the decision is taken at the political level to use a PPP instead of another form for the provision of a public service/asset (Iossa and Martimort 2013). Politicians may be bribed by a contractor to commission a project as a concession even when the PPP option is not the most desirable one (Iossa and Martimort 2013).

(ii) During the tender stage ('ex-ante'), the administrative level determines the contract details and selects the private partner. Corruption may occur in very different ways: the output specifications for the contract may be modified in order to exclude some competitors, the time allowed to reply to the tender call may be modified to include or exclude certain offers, restricted tender procedures may be used in order to choose only friendly enterprises, etc. (Iossa and Martimort 2013).

(iii) During the stage of the performance of the contract ('ex-post'), the contractor may argue that there have been external circumstances that allow it to change the service quality/quantity (Knorr and Schomaker 2016). When the project is over, there is the possibility of renegotiating the contract. So, the public officials may be bribed by their private partners to offer favours in the renegotiations and better conditions. Corrupt officials may also manipulate the circumstances to allow contingency clauses to become operative, thereby justifying price revisions, changes in service quantity/quality, and contract extensions (Iossa and Martimort 2013; Estache 2014).

Thirdly, Schomaker (2020) indicates that the life-cycle model of PPPs contributes to corruption in two ways: (i) some stages of the PPP result in a high project volume, so the costs of corruption may be lower than the expected return on the investment; and (ii) the cash flow will be higher than normal if the conditions of the private partner are accepted by the public partner.

The above-mentioned characteristics of PPPs make them vulnerable to corruption. This vulnerability may result in different specific channels for bribery and render PPPs more corruption-prone than other contractual agreements between the private and the public sector (Iossa and Martimort 2016). This framework leads us to propose the following hypothesis:

H0. Countries with higher levels of corruption implement PPPs to a greater extent.

3. METHODOLOGY

3.1. Description of sample

The proposed hypothesis is tested on a sample of 92 low- and middle-income countries for the period 1995-2018. The sample selection is conditioned by the availability of data on PPPs and corruption. Data on PPPs were obtained from the Private Participation in Infrastructure (PPI) database, which is provided by the World Bank's Public Private Partnership Group. This database shows private participation in infrastructure projects in 125 low- and middle-income countries, but 33 countries were excluded because of a lack of observations[4] in the selected period (1995-2018). Data on corruption were obtained from the Quality of Government (QoG) database (Dahlberg et al. 2020), which is published by the QoG Institute at the University of Gothenburg.

[4] Fewer than four contracts are recorded for each of these 33 countries over the entire period of 1995-2018.

The results are controlled for various socioeconomic and political factors, which are described in the following section. Data on political factors were obtained from the Database of Political Institutions (DPI) (Cruz et al. 2017), and the other socioeconomic factors were obtained from the World Development Indicators (WDI) database.

3.2. Models and description of variables

The hypothesis may be formalised as follows:

$$PPP_{it} = \alpha + \gamma * Corruption_{it} + \beta_j * Controls_{j,it} + \eta_i + \varepsilon_{it} \quad (1)$$

In Model (1), *i* and *t* refer to a country and a year, respectively; PPP_{it} represents PPP projects; $Corruption_{it}$ represents the level of corruption; $Controls_{j,it}$ is the vector of the j control variables; α, γ and β_j are the parameters to be estimated; η_i refers to unobservable heterogeneity; and ε_{it} is the classic disturbance term.

PPP is represented by two variables: *PPPdeals* and *PPPproceeds*. The former indicates the number of contractual arrangements for public infrastructure projects in each year of the sample. PPP are counted in the year in which the private sponsor agreed a legally binding agreement to invest funds or provide services. The second variable refers to total investment commitments (millions of US dollars). That is, the sum of the investment in physical assets (the resources the project company committed to invest in expanding and modernising facilities) and payments to the government to acquire state-owned enterprises or rights to provide services in a specific area or to use a radio spectrum (divestiture revenues, licence or concession fees, and lease payments).

The two variables refer to infrastructure projects that are owned or managed by a private company, from obtaining the rights to operate alone or in association with a public entity, or from ownership of an equity share in the project. The PPI database covers infrastructure projects in which private parties assume at least 20% of the participation in the project

contract, except for divestitures which are included if at least 5% of the equity is owned by private parties. Regarding the sector of the activity, this study includes economic infrastructures (energy, ICT, transport, water and sewerage, and municipal solid waste).

The mean values of the two variables can be found in Table 1. There is an average of three to four contractual arrangements per public infrastructure project per year, and the mean value of the investment commitment is 811.55 million dollars. From 2000 to 2012, and especially between 2004 and 2012, the number of PPP projects was growing, as Figure 1 shows. From 2012 onwards, the number of PPP arrangements and commitments fell.

<Insert Table 1 about here>

<Insert Figure 1 about here>

Given the hidden nature of corruption, direct measures are hard to come by (Olken and Pande 2012). So, *Corruption* is represented by three proxies, which have been widely used in previous literature, despite criticism (Malito 2014):

- Bayesian Corruption Index (*BCI*), which is a composite index of the perceived overall level of corruption. It is an amalgamation of the opinion on levels of corruption from the points of view of the inhabitants of the country, the companies operating there, NGOs and social workers in both governmental and intergovernmental organisations. The BCI index values lie between 0 and 100, with a higher value corresponding to a higher level of corruption.
- Corruption Perception Index (*CPI*), published by Transparency International. This is related to the perception of businesspeople, risk analysts and the public about the level of corruption. It ranges between 100 (extremely clean) and 0 (extremely corrupt). Here, the inverse value is used to make the results easier to

understand, i.e., the values range from 0-100, from the lowest to the highest levels of corruption.

- 'Control of corruption' indicator of the Worldwide Governance Indicators (WGI), published by the World Bank (*WGIcc*). This measures perceptions of the extent to which public power is exercised for private gain, including both petty and major forms of corruption, as well as the extent to which the state is 'captured' by private interests and the elite. All the scores lie between -2.5 and 2.5, with higher scores corresponding to better outcomes; that is, to a greater control of corruption.

It is important to use all three of these variables because, although they are highly correlated, there are important conceptual and methodological differences between them (Malito 2014). In addition, *CPI* has only been available since 2012 for most of the sample countries, *WGIcc* has some gaps in 1995, 1997, 1999, and 2001, and *BCI* is not available in 2018. The mean value shown in Table 1 indicates a worse situation in the cases of *BPI* and *WGIcc*. However, *CPI* seems to represent a (slightly) better situation. Furthermore, Figure 2 shows that the three variables evolved in different ways.

<Insert Figure 2 about here>

Various control variables (*Controls*) are included in Model (1) to consider other factors besides corruption that may affect PPPs:

- The real GDP per capita (*GDPpc*): it represents the macroeconomic conditions in which a PPP arrangement takes place (Mota and Moreira 2015; Panayides et al. 2015; Boyer and Scheller 2018; Jiménez et al. 2017; Rosell and Saz-Carranza 2019). According to Sharma (2012), countries with more stable macroeconomic conditions are likely to attract many firms to enter into PPPs.

- The level of public debt (*Debt*): it represents the financial situation of the government (Sharma 2012; Boyer and Scheller 2018; Rosell and Saz-Carranza 2019). PPPs are essential in countries in which the public sector is not able to provide public goods and services because of a deficit situation and indebtedness (Mota and Moreira 2015).
- The inflation rate (*Inflation*): it represents the level of macroeconomic stability (Sharma 2012; Rosell and Saz-Carranza 2019), which is essential for the success of PPPs (Galilea and Medda 2010), because it reduce the risks undertaken by the private sector.
- The number of inhabitants (*Population*): this is a proxy for the size of the market (Albalate et al. 2015; Albalate and Bel 2020). Private investors are attracted by highly populated markets since their expectations of success are greater (Sharma 2012; Mota and Moreira 2015).
- Government ideology (*Ideology*): although privatisations have generally been implemented by right-leaning governments to a greater extent than governments of other ideologies (Bortolotti et al. 2003; Obinger et al. 2014), the use of PPPs is particularly popular with left-wing parties, because it allows them to attract the attention of conservative voters without forgetting those on the left (Mota and Moreira 2015).
- The legal origin of the country (*Region*): according to Rosell and Saz-Carranza (2019), political and administrative traditions are relevant in determining the capacity of a country to adopt and use PPPs.

Considering the variables described so far, Model (1) may be rewritten in the form of the following equations:

$$\boldsymbol{PPPdeals_{it}} = \alpha + \gamma \boldsymbol{BCI_{it}} + \beta_1 GDPpc_{it} + \beta_2 Debt_{it} + \beta_3 Inflation_{it} + \beta_4 Population_{it} + \beta_5 Ideology_{it} + \beta_6 Region_i + \eta_i + \varepsilon_{it} \quad (2)$$

$$\boldsymbol{PPPdeals_{it}} = \alpha + \gamma \boldsymbol{CPI_{it}} + \beta_1 GDPpc_{it} + \beta_2 Debt_{it} + \beta_3 Inflation_{it} + \beta_4 Population_{it} + \beta_5 Ideology_{it} + \beta_6 Region_i + \eta_i + \varepsilon_{it} \quad (3)$$

$$\boldsymbol{PPPdeals_{it}} = \alpha + \gamma \boldsymbol{WGIcc_{it}} + +\beta_1 GDPpc_{it} + \beta_2 Debt_{it} + \beta_3 Inflation_{it} + \beta_4 Population_{it} + \beta_5 Ideology_{it} + \beta_6 Region_i + \eta_i + \varepsilon_{it} \quad (4)$$

$$\boldsymbol{PPPproceeds_{it}} = \alpha + \gamma \boldsymbol{BCI_{it}} + \beta_1 GDPpc_{it} + \beta_2 Debt_{it} + \beta_3 Inflation_{it} + \beta_4 Population_{it} + \beta_5 Ideology_{it} + \beta_6 Region_i + \eta_i + \varepsilon_{it} \quad (5)$$

$$\boldsymbol{PPPproceeds_{it}} = \alpha + \gamma \boldsymbol{CPI_{it}} + \beta_1 GDPpc_{it} + \beta_2 Debt_{it} + \beta_3 Inflation_{it} + \beta_4 Population_{it} + \beta_5 Ideology_{it} + \beta_6 Region_i + \eta_i + \varepsilon_{it} \quad (6)$$

$$\boldsymbol{PPPproceeds_{it}} = \alpha + \gamma \boldsymbol{WGIcc_{it}} + \beta_1 GDPpc_{it} + \beta_2 Debt_{it} + \beta_3 Inflation_{it} + \beta_4 Population_{it} + \beta_5 Ideology_{it} + \beta_6 Region_i + \eta_i + \varepsilon_{it} \quad (7)$$

The three corruption variables are entered into the model one by one, because they are highly correlated, as is demonstrated in Table 2. The other variables are not excessively correlated (all the values are lower than 0.5), which means that multicollinearity problems do not exist.

<Insert Table 2 about here>

3.3. Analysis technique

Fixed-effects (FE) or random-effects (RE) estimators could be used to estimate the six equations, but both require homoscedastic and non-serially correlated errors. Table 3 shows the results of the Modified Wald test and the Wooldridge test for checking heteroscedasticity and autocorrelation problems, respectively. In Panel A, the null hypothesis of homoscedastic errors must be rejected at the 95% confidence level.

However, in Panel B, it is only the null hypothesis of non-serially correlated errors in equations that have the variable *PPPdeals* as dependent variable that must be rejected. So, equations (2), (3) and (4) suffer from heteroscedasticity and autocorrelation problems, while equations (5), (6) and (7) only suffer from heteroscedasticity problems. Accordingly, the Generalised Least Squares (GLS) and Panel Corrected Standard Errors (PCSE) methods[5] are used to solve these problems.

<Insert Table 3 about here>

Additionally, endogeneity problems appear in the six equations for three reasons (Wooldridge 2010): (i) the use of proxy variables to represent concepts that are difficult to represent, such as corruption; (ii) the results can be additionally controlled by other variables (e.g., deficit situation, unemployment, economic freedom, etc.) but they have been omitted because of multicollinearity problems; and (iii) the existence of reverse causality between the PPP indicators and certain variables like GDP, debt, and corruption. Reverse causality has been proved for privatisations reforms (Peña-Miguel and Cuadrado-Ballesteros 2019), so there could also be reverse causality in relation to PPPs.

Endogeneity should be addressed by using instrumental variable (IV) methods. In the presence of heteroscedasticity (as here), the conventional IV estimator is consistent but inefficient (Baum et al. 2003). Thus, we use the two-step *system* estimator of Arellano and Bover (1995), which uses the lagged values of endogenous and predetermined variables as instruments to correct endogeneity. It has been demonstrated that these instruments are uncorrelated with the error term (Arellano and Bond 1991), and they usually contain better information on the current value of the variable than external

[5] GLS is usually preferred when the number of individuals is relatively lower than the length of the period (N<T). Here, N is larger than T, but T is relatively large for a conventional panel data model, that is N<100 and T>15 (Labra and Torrecillas 2018). Accordingly, both methods, GLS and PCSE, are used.

instruments. The instrument validity is tested with: (i) the Arellano–Bond test for second order AR(2) in first differences, under the null hypothesis that there is no serial correlation between the error terms; and (ii) the Hansen test, under the null hypothesis that the over-identifying restrictions are valid. The results of these tests are shown at the bottom of the results tables.

4. EMPIRICAL RESULTS

Table 4 shows the results for equations (2), (3) and (4), where the dependent variable is *PPPdeals*; and Table 5 shows the findings for equations (5), (6) and (7), where the dependent variable is *PPPproceeds*. In both tables, Panel A shows the results by using the OLS method with panel corrected standard errors; Panel B illustrates the results for the GLS method; and Panel C displays the results for the GMM estimator.

BCI has a positive impact on the number of PPP projects, regardless of the method of estimation. This effect suggests that, the higher the level of corruption, the higher the number of PPP arrangements. However, the coefficients of the other two corruption variables are not statistically relevant in Panels A and B. *WGIcc* becomes significant in Panel C, when endogeneity is controlled, and its coefficient is negative, indicating that the number of PPP projects tends to decrease if the control of corruption increases. So, although *CPI* is not relevant, these findings hint that PPP projects are used more by countries with higher levels of corruption, which is in line with the hypothesis.

We should bear in mind that the data for *CPI* are available for a shorter period (2012-2018). This may explain the absence of statistical significance of this variable, and supports the contribution of this study, by using a with a larger sample than other studies (e.g., Mota and Moreira 2015; Rosell and Saz-Carranza 2019; Jiménez et al. 2017).

Regarding the control variables, the coefficients of *GDPpc* are positive, which suggests that PPP projects tend occur in more developed countries. The coefficients of *Debt* and *Inflation* are generally negative, although they are not statistically relevant in some equations. *Population* is positively related to the dependent variable, suggesting that the number of PPP projects is greater in more populated countries. Finally, political ideology and legal origin are also relevant in some equations, suggesting that the political and institutional context should be controlled for when analysing PPPs.

<Insert Table 4 about here>

In Table 5, *BCI* has a positive impact on the dependent variable, which suggests that the higher the level of corruption, the higher the investment commitments. The effect of *CPI* is only relevant in Panel B, but the positive coefficient suggests the same: the higher the level of corruption, the higher the level of investment commitments. *WGIcc* is significant in Panels A and C, showing negative coefficients, which indicates that investment commitments tend to go down as control of corruption increases. Again, our findings suggest that corruption has a positive effect on PPP investment commitments, which is in line with the hypothesis.

Regarding the control variables, the results are like those obtained previously in Table 4; that is, *GDPpc* and *Population* are positive and relevant in all equations, which suggests that more developed and populated countries tend to arrange PPP projects with greater investment. The coefficients of *Debt* and *Inflation* are generally negative, although they are not statistically relevant in some equations. Finally, political ideology and legal origin are also relevant, especially in Panels A and B, suggesting the political and institutional context should be controlled for in analysing PPPs.

<Insert Table 5 about here>

4.1. Checking robustness

In equations (2), (3), and (4), the dependent variable is *PPPdeals*, which refer to the number of occurrences (counts) of an event (a PPP project). Then, these equations can be estimated using the random-effects Poisson model. However, there is over-dispersion in *PPPdeals*,[6] so the Poisson model underestimates the standard errors. The negative binomial model is therefore more appropriate (Cameron and Trivedi 2010).

Another issue that should be considered is that the count variable (*PPPdeals*) shows an excess of zero counts, as Figure 3 demonstrates. *PPPdeals* is equal to zero when a country does not have any PPP projects in a given year. As PPPs are complex and long-term arrangements, it is not very common for a government to sign a PPP arrangement every year (Sharma 2012). In this situation, a zero-inflated model would be appropriate. This assumes that the excess zero counts come from a logit model and the remaining counts come from a negative binominal model.

<Insert Figure 3 about here>

Accordingly, Table 6 shows the results for equations (2), (3) and (4), in which the dependent variable is *PPPdeals*, by using the zero-inflated negative binomial model.[7] At the bottom of the table, the likelihood-ratio test that alpha[8] is equal to zero suggests that the negative binomial model is more appropriate than the Poisson model. *BCI* and *CPI* have a positive impact on the number of PPP projects, while *WGIcc* is negatively related to the dependent variable. These findings suggest that PPP projects are more probable in

[6] Looking at Table 1, the variance of *PPPdeals* (117.3) is much higher than the mean value (3.22).
[7] Although the zero-inflated negative binomial model is the most appropriate in this case, equations (2), (3), and (4) were also initially estimated using the Poisson model, the negative binomial model, and the zero-inflated Poisson model. The results are available on request.
[8] In a Poisson model, alpha is constrained to zero. Therefore, Stata finds the maximum likelihood estimate of the log of alpha and then calculates alpha from this. The alpha is therefore always greater than zero, and the negative binomial model only allows for overdispersion.

countries with higher levels of corruption. Regarding the control variables, the results match those obtained previously.

<Insert Table 6 about here>

In equations (5), (6), and (7), the dependent variable refers to the total investment commitments (*PPPproceeds*). The three equations can be interpreted as *two-part models* because the decision about PPP investment is made up of two decisions. Firstly, the way the specific infrastructure is to be provided and whether (or not) to use a PPP model is decided at the political level (decision or pre-tendering stage); then, if a decision is made to use a PPP model, the administrative level determines the conditions and specifications of the contract, including the amount of investment (in the tender or ex-ante stage). Accordingly, Heckman's two-step model is appropriate here. The first equation (the selection equation) tests whether PPP investment will be developed or not, using a dummy variable (DPPP = 1 if so; DPPP = 0 otherwise):

$$DPPP_{it} = \alpha + \gamma * Corruption_{it} + \beta_j * Controls_{j,it} + \eta_i + \varepsilon_{it} \quad (8)$$

DPPP takes the value of 1 if at least one PPP project was developed in a given year, and 0 otherwise. *Corruption* and *Controls* refer to the corruption and control variables previously described. After that, the outcome equations, which are equations (5), (6) and (7), are estimated.

The results are shown in Table 7; in Panel A, the dependent variable is *DPPP,* which takes the value of 1 if any PPP project was developed and 0 otherwise. *BCI* and *CPI* have a positive impact, and *WGIcc* is negatively related to *DPPP*. These findings suggest that PPPs are more likely to be arranged in countries with higher levels of corruption, and consequently, with lower levels of corruption control. Panel B shows the coefficients of the outcome equations, where the dependent variable is *PPPproceeds*. Here, the effects

are similar, i.e., *BCI* and *CPI* have positive coefficients, and *WGIcc* has a negative coefficient. In conclusion, PPPs are more relevant (in monetary and in number terms) in countries with higher levels of corruption and lower levels of control over unethical practices.

<Insert Table 7 about here>

Finally, Table 8 shows the effect of the first-order lag corruption variables on the two PPP indicators (*PPPdeals* in Panel A, and *PPPproceeds* in Panel B). All the equations are estimated using the GMM, because it allows heteroscedasticity, autocorrelation, and endogeneity problems to be corrected, while GLS and PCSE only correct the first two issues. The results are very similar to those obtained for the contemporary variables, that is, *BCI* and *WGI* are statistically relevant, the former has positive coefficients, and the latter has negative coefficients. These findings suggest that PPP projects are used in countries with higher levels of corruption to a greater extent.

<Insert Table 8 about here>

5. CONCLUSIONS

Our findings show a positive link between corruption and the use of PPPs, measured by the number of contractual arrangements for public infrastructure projects and by the total investment commitments. Although there is literature that shows the existence of corruption in the delivery of public infrastructure projects around the world (e.g., Fazekas and Tóth 2018; Locatelli et al. 2017), most of these cases are not delivered via PPPs.

The positive link that is found in this study adds evidence to the discussions of Schomaker (2020), Knorr and Schomaker (2016) and Iossa and Martimort (2013, 2016) about the vulnerability of PPPs to corruption. Other previous studies have related corruption and PPPs, but the evidence has been scarce and inconclusive (Mota and Moreira 2015; Pusok

2016; Jiménez et al. 2017; Gillespie et al. 2020; Palcic et al. 2019; Rosell and Saz-Carranza 2019). In addition, this study replies to the call for further research concerning the use of PPPs in developing countries (Hodge and Greve 2018), since a large part of the existing literature has been focused on Europe, the USA, Australia, and China (de Castro e Silva Neto et al. 2016; Cui et al. 2018).

As a practical implication, we may conclude that fighting corruption requires (additional) measures in addressing PPP contracts. For example, if greater use were made of standardised contracts, this would decrease the discretion of contracting authorities (Iossa and Martimort 2016). In addition, ensuring access to contractual information could be a good means of fighting the characteristic opaqueness of PPPs, as could limiting the use of revenue guarantees or monetary compensation (Iossa and Martimort 2013).

Despite these contributions, this study is not free of limitations that may be overcome in future research. The empirical findings arise from a sample of infrastructure projects, and there were no controls for the activity sub-sector or type of PPP in the econometric analyses. In addition, some contextual factors could have been considered, such as the quality of governance, the degree of economic freedom and competitiveness, and constraints on the government's resources.

REFERENCES

Albalate, D., Bel, G., and Geddes, R. R. (2015). The determinants of contractual choice for private involvement in infrastructure projects. *Public Money and Management*, 35(1): 87-94.

Albalate, D., and Bel, G. (2020). Politicians, bureaucrats and the public–private choice in public service delivery: anybody there pushing for remunicipalization?. *Journal of Economic Policy Reform*, DOI: 10.1080/17487870.2019.1685385.

Arellano, M., and Bond, S. (1991) Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2): 277-297.

Arellano, M., and Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1): 29-51.

Auriol, E. (2006). Corruption in procurement and public purchase. *International Journal of Industrial Organization*, *24*(5), 867-885.

Baum, C. F., Schaffer, M. E., and Stillman, S. (2003). Instrumental variables and GMM: Estimation and testing. *The Stata Journal*, 3(1): 1-31.

Blackburn, K., Bose, N., and Haque, M. E. (2010). Endogenous corruption in economic development. *Journal of Economic Studies*, 37(1): 4-25.

Bloomfield, P. (2006). The challenging business of long-term public – Private partnerships: Reflections on local experience. *Public Administration Review*, 66(3): 400–411.

Boardman, A. E., Greve, C., and Hodge, G. A. (2015). Comparative analyses of infrastructure public-private partnerships. *Journal of Comparative Policy Analysis: Research and Practice*, 17(5): 441-447

Bortolotti, B., Fantini, M., and Siniscalco, D. (2003). Privatisation around the world: evidence from panel data. *Journal of Public Economics*, 88: 305-332.

Boyer, E. J., and Scheller, D. S. (2018). An examination of state-level public–private partnership adoption: Analyzing economic, political, and demand-related determinants of PPPs. *Public Works Management and Policy*, 23(1), 5-33.

Broadbent, J., and Laughlin, R. (1999). The private finance initiative: Clarification of a research agenda. *Financial Accountability and Management*, 15(2): 95–114.

Cameron, A. C. and Trivedi, P. K. (2010). *Microeconometrics Using Stata*. Vol. 2. College Station, TX: Stata press

Coase, R. H. (1937). The nature of the firm. *Economica*, 4(16): 386–405.

Cruz, C., Keefer, P., and Scartascini, C. (2018). Database of Political Institutions 2017. Inter-American Development Bank. Available at: https://www.iadb.org/en [Accessed 14 April 2020]

Cui, C., Liu, Y., Hope, A., and Wang, J. (2018). Review of studies on the public–private partnerships (PPP) for infrastructure projects. *International Journal of Project Management*, 36(5): 773-794.

Dahlberg, S., Holmberg, S., Rothstein, B., Alvarado Pachon, N, and Axelsson, S. (2020). The Quality of Government Basic Dataset. University of Gothenburg: The Quality of Government Institute, Available at: http://www.qog.pol.gu.se [Accessed 14 April 2020]

De Castro e Silva Neto, D., Cruz, C. O., Rodrigues, F., and Silva, P. (2016). Bibliometric analysis of PPP and PFI literature: Overview of 25 years of research. *Journal of Construction Engineering and Management*, 142(10): 1-8.

Demirag, I., Khadaroo, I., Stapleton, P., and Stevenson, C. (2011). Risks and the financing of PPP: Perspectives from the financiers. *The British Accounting Review*, 43(4): 294-310.

Estache, A. (2014). Infrastructure and corruption: a brief survey. *Working Papers* ECARES 2014-37. Available at: https://ideas.repec.org/p/eca/wpaper/2013-174923.html [Accessed 13 April, 2021]

Fazekas, M., & Tóth, B. (2018). The extent and cost of corruption in transport infrastructure. New evidence from Europe. *Transportation research part A: policy and practice*, 113: 35-54.

Galilea, P., and Medda, F. (2010). Does the political and economic context influence the success of a transport project? An analysis of transport public-private partnerships. *Research in Transportation Economics*, 30(1): 102-109.

Gillespie, J., Van Nguyen, T., Nguyen, H. V., and Le, C. Q. (2020). Exploring a Public Interest Definition of Corruption: Public Private Partnerships in Socialist Asia. *Journal of Business Ethics*, 165: 579–594.

Greve, C., Christensen, L. T., Tvarnø, C., Nielsen, S. N., and Denta, S. M. (2021). Public-private partnerships in the healthcare sector: limited policy guidelines, but active project development in Denmark. *Journal of Economic Policy Reform*, DOI: 10.1080/17487870.2020.1855174.

Heidenheimer, A. J., and Johnston, M. (2017). *Political corruption: Concepts and contexts.* Transaction Publishers.

Hodge, G. (2006). Public private partnerships and legitimacy. *UNSW Law Journal*, 29(3): 318–327.

Hodge, G. A., and Greve, C. (2007). Public-private partnerships: An international performance review. *Public Administration Review*, 67(3): 545–558.

Hodge, G., and Greve, C. (2018). Contemporary public–private partnership: Towards a global research agenda. *Financial Accountability and Management,* 34(1): 3-16.

Husted, B. W. (1999). Wealth, culture, and corruption. *Journal of International Business Studies*, 30(2): 339-359.

Iossa, E., and Martimort, D. (2013). Corruption in Public Private Partnerships. In De Vries, P. and Yehoue, E.B. (Eds.). *The Routledge Companion to Public-Private Partnerships.* Routledge: New York.

Iossa, E., and Martimort, D. (2016). Corruption in PPPs, incentives, and contract incompleteness. *International Journal of Industrial Organization*, 44: 85-100.

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

Knorr, A., and Schomaker, R. (2016). *The potential for corruption in public private partnerships–theoretical aspects and some policy implications*. Kyiv: University Kyiv National Economic University Vadym Hetman.

Konrad, T. S. (2018). *Management Control in Public-Private Partnerships. Between International Governmental Actors and the Private Sector*. Springer Gabler.

Labra, R., and Torrecillas, C. (2018). Estimating dynamic Panel data. A practical approach to perform long panels. *Revista Colombiana de Estadística*, 41(1): 31-52.

Locatelli, G., Mariani, G., Sainati, T., and 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.

Malito, D. (2014). Measuring corruption indicators and indices. Working paper RSCAS 2014/13, Robert Schuman Centre for Advanced Studies, European University Institute.

Mota, J. A., and 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.

Obinger, H, Schmitt, C., and Zohlnhöfer, R., (2014). Partisan politics and privatization in OECD countries. *Comparative Political Studies*, 47(9): 1294–1323.

Olken, B. A., and Pande, R. (2012). Corruption in developing countries. *Annual Review of Economics*, 4(1): 479-509.

Owolabi, H., Oyedele, L., Alaka, H., Ebohon, O., Ajayi, S., Akinade, O., Bilal, M., and Olawale, O. (2019). Public private partnerships (PPP) in the developing world: mitigating financiers' risks. *World Journal of Science, Technology and Sustainable Development*, 16 (3): 121-141.

Palcic, D., Reeves, E., Flannery, D., and Geddes, R. R. (2019). Public-private partnership tendering periods: an international comparative analysis. *Journal of Economic Policy Reform*. DOI: 10.1080/17487870.2019.1657016

Panayides, P. M., Parola, F., and Lam, J. S. L. (2015). The effect of institutional factors on public–private partnership success in ports. *Transportation Research Part A: Policy and Practice*, 71: 110-127.

Peña-Miguel, N., and Cuadrado-Ballesteros, B. (2019). Is privatization related to corruption? An empirical analysis of European countries. *Public Management Review*, 21(1): 69-95.

Pollitt, C. and Bouckaert, G. (2000). *The nature of public management reform: a comparative analysis.* Oxford University Press, New York

Pusok, K. (2016). Public-private partnerships and corruption in the water and sanitation sectors in developing countries. *Political Research Quarterly*, 69(4): 678-691.

Rosell, J., & Saz-Carranza, A. (2020). Determinants of public–private partnership policies. *Public Management Review*, *22*(8), 1171-1190.

Schomaker, R. M. (2020). Conceptualizing Corruption in Public Private Partnerships. *Public Organization Review*. DOI: 10.1007/s11115-020-00473-6

Sharma, C. (2012). Determinants of PPP in infrastructure in developing economies. *Transforming Government: People, Process and Policy*, 6(2): 149-166.

Tallaki, M., Bracci, E., and Stefani, F. (2019). Risk allocation and management in PPP and PFI: Systematic Literature Review. Working Paper No. 2019038. University of Ferrara, Department of Economics, Ferrara (Italy).

Wooldridge, J.M. (2010). *Econometric analysis of cross section and panel data*. Cambridge: The MIT Press.

World Bank Group (2019). Guidance on PPP Contractual Provisions, 2019 Edition. International Bank for Reconstruction and Development/The World Bank. Available at: https://cutt.ly/nyxw6iV [Accessed 05/05/2020]

Xiong, W., Chen, B., Wang, H., and Zhu, D. (2019). Governing public–private partnerships: A systematic review of case study literature. *Australian Journal of Public Administration*, 78(1): 95-112.

Table 1. Description of variables

Variable	Mean	Std. Dev.	Min.	Max.
PPPdeals	3.22	10.83	0	129
PPPproceeds	811.55	3485.68	0	62,375.77
BCI	55.1	9.57	21.46	74.12
CPI	66.45	10.22	29	92
WGI_CC	-0.58	0.52	-1.87	1.22
GDPpc	6.91	5.51	0	282.01
Debt	50.42	28.98	3.67	175.93
Inflation	15.35	118.04	-16.12	4,145.11
Population	56.6	182	95,976	1,392,730,000
Ideology	1.18	1.3	0	3
Region	1.82	0.64	1	3

Table 2. Bivariate correlations

	BCI	*CPI*	*WGI_CC*	*GDPpc*	*Debt*	*Inflation*	*Population*	*Ideology*	*Region*
CPI	0.7466***	1							
WGIcc	-0.7133***	0.9579***	1						
GDPpc	-0.258***	0.3514***	0.3319***	1					
Debt	0.0106	0.2202*	0.1381**	-0.269***	1				
Inflation	0.0538*	-0.2218***	-0.0557*	-0.025	-0.066	1			
Population	-0.0584**	0.0457	0.0243	0.0239	-0.0126	-0.0169	1		
Ideology	-0.0236	0.0514	0.0757**	-0.0649**	0.1727***	0.0485†	0.0752**	1	
Region	0.0974***	-0.0130	-0.0319	0.1322***	-0.1645***	0.0232	0.0397†	0.0966***	1

Notes: †, *, **, and *** represent statistical relevance at 90, 95, 99 and 99.9%, respectively.

Table 3. Heteroskedasticity and autocorrelation tests

Panel A. Modified Wald test for heteroskedasticity		
	PPPdeals	*PPPproceeds*
BCI	Pr > chi2 = 0.0000	Pr > chi2 = 0.0000
CPI	Pr > chi2 = 0.0000	Pr > chi2 = 0.0000
WGI_cc	Pr > chi2 = 0.0000	Pr > chi2 = 0.0000
Panel B. Wooldridge test for autocorrelation		
	PPPdeals	*PPPproceeds*
BCI	Pr > F = 0.0000	Pr > F = 0.8141
CPI	Pr > F = 0.0000	Pr > F = 0.3785
WGI_cc	Pr > F = 0.0000	Pr > F = 0.7884

Notes: (i) Null hypothesis in Wald test for heteroskedasticity is "Homoscedastic errors"; (ii) Null hypothesis in Wooldridge test for autocorrelation is "No first-order autocorrelation";

Table 4. Effect of corruption variables on *PPPdeals*

Panel A. Panel Corrected Standard Errors						
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
BCI	0.2935***	0.0731				
CPI			0.0329	0.1418		
WGIcc					-1.9135	1.3266
GDPpc	1.0101***	0.2149	0.7636*	0.3584	0.8290***	0.2014
Debt	-0.0004	0.0140	-0.0273	0.0419	-0.0064	0.0157
Inflation	-0.0506	0.0421	0.1641	0.3427	-0.0368	0.0585
Population	0.0408**	0.0141	0.0689	0.0438	0.0347*	0.0143
Ideology	1.1214*	0.4941	3.2972*	1.3213	1.2210*	0.5178
Region	-0.3635	0.7198	0.8124	2.7136	1.3445†	0.7900
_cons	-21.5514***	5.4969	-10.2233	12.9127	-8.2916*	3.2670
Panel B. Generalized Least Squares						
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
BCI	0.0784*	0.0321				
CPI			-0.0444	0.1239		
WGIcc					-0.4104	0.6083
GDPpc	0.2641*	0.1043	0.3356	0.2378	0.2258*	0.1000
Debt	-0.0072	0.0072	-0.0145	0.0326	-0.0031	0.0082
Inflation	-0.0202	0.0182	0.0160	0.1552	-0.0151	0.0215
Population	0.0266**	0.0089	0.0612*	0.0252	0.0229*	0.0092
Ideology	0.1906	0.1548	0.3330	0.7718	0.2075	0.1881
Region	-0.1040	0.5677	1.7172	2.1172	0.7874	0.6101
_cons	-4.4035*	2.1150	-0.2937	8.7953	-2.1670	1.6361
Panel C. Generalized Method of Moments						
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
AR (1)	0.5062***	0.0127	-0.0167	0.0895	0.4101***	0.0012
BCI	0.6161**	0.2271				
CPI			0.0371	0.3006		
WGIcc					-5.1612***	0.1395
GDPpc	0.8572***	0.1858	0.2022	0.4083	0.5337***	0.0270
Debt	-0.0744*	0.0366	-0.5455**	0.1833	-0.0107	0.0068
Inflation	-0.1214**	0.0439	-0.1948	0.2105	-0.0098†	0.0054
Population	0.0192***	0.0029	0.0707***	0.0179	0.0273***	0.0002
Ideology	1.8133**	0.5951	5.0200†	2.7783	1.5090***	0.0554
Region	-1.6073	2.0013	-1.0325	4.6421	0.6261***	0.1577
_cons	-30.3112**	11.2787	21.2896	14.1855	-6.8376***	0.5978
Arellano-Bond test for AR (2) in first differences	Pr > z = 0.264		Pr > z = 0.380		Pr > z = 0.280	
Hansen test of overid. restrictions	Pr > chi2 = 0.266		Pr > chi2 = 0.709		Pr > chi2 = 0.507	

Notes: All regressions include year dummy variables; †, *, **, and *** represent statistical relevance at 90, 95, 99 and 99.9%, respectively.

Table 5. Effect of corruption variables on *PPPproceeds*

Panel A. Panel Corrected Standard Errors						
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
BCI	0.1498***	0.0338				
CPI			0.0519	0.0878		
WGIcc					-1.7199**	0.5753
GDPpc	0.6485***	0.1221	1.0319**	0.3158	0.6208***	0.1217
Debt	0.0095	0.0066	-0.0321	0.0217	0.0064	0.0076
Inflation	-0.0276	0.0437	0.7076**	0.2623	0.0107	0.0574
Population	0.0141***	0.0026	0.0164*	0.0071	0.0160***	0.0031
Ideology	1.0095***	0.2780	2.4582*	1.1442	1.1635***	0.3257
Region	0.9020**	0.3363	2.9724†	1.6408	1.4268**	0.4825
_cons	-15.1774***	3.2742	-20.8113*	9.6138	-9.1720***	2.1635
Panel B. Generalized Least Squares						
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
BCI	0.1685***	0.0206				
CPI			0.1916*	0.0929		
WGIcc					-0.8586	0.5743
GDPpc	0.6107***	0.0706	0.8079***	0.1914	0.5907***	0.0774
Debt	-0.0148*	0.0073	-0.0415	0.0290	-0.0036	0.0075
Inflation	0.0015	0.0254	0.2052***	0.1444	0.0178	0.0335
Population	0.0219***	0.0039	0.0691***	0.0145	0.0338***	0.0050
Ideology	0.9655***	0.1560	2.2396***	0.5375	1.1455***	0.1902
Region	0.0719	0.3620	-1.0617	1.5738	1.9006***	0.4030
_cons	-12.2692***	1.5768	-17.3769*	7.8050	-8.5532***	1.2567
Panel C. Generalized Method of Moments						
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
AR (1)	0.0699	0.0890	-0.1664***	0.0330	0.5359***	0.0095
BCI	1.3345***	0.2684				
CPI			-0.1375	0.1258		
WGIcc					-2.4921**	0.8328
GDPpc	1.6417***	0.2368	0.8123***	0.1608	0.7870***	0.0492
Debt	0.0867	0.0642	0.0432	0.0567	0.1974***	0.0209
Inflation	-0.1488*	0.0636	0.5387***	0.1242	-0.0254**	0.0080
Population	0.0079	0.0055	0.0257***	0.0034	0.0104***	0.0011
Ideology	2.5835†	1.3234	0.7215	0.7839	-0.0520	0.1023
Region	-3.3409	3.3080	3.4250*	1.5461	2.1104**	0.7296
_cons	-79.9297***	12.1373	-9.5317	8.2066	-20.6014***	1.9655
Arellano-Bond test for AR (2) in first differences	Pr > z = 0.111		Pr > z = 0.213		Pr > z = 0.173	
Hansen test of overid. restrictions	Pr > chi2 = 0.124		Pr > chi2 = 0.718		Pr > chi2 = 0.561	

Notes: All regressions include year dummy variables; †, *, **, and *** represent statistical relevance at 90, 95, 99 and 99.9%, respectively.

Table 6. Robustness checking 1. Zero-inflated negative binomial model

	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
BCI	0.0771***	0.0082				
CPI			0.0521*	0.0254		
WGIcc					-1.3254***	0.2407
GDPpc	1.9207***	0.1427	1.8360***	0.3264	2.0812***	0.1953
Debt	-0.0066**	0.0024	-0.0052	0.0061	-0.0031	0.0032
Inflation	-0.0113†	0.0059	-0.0251	0.0418	-0.0068	0.0092
Population	0.0032***	0.0002	0.0036***	0.0008	0.0034***	0.0003
Ideology	0.1407**	0.0507	0.2685*	0.1131	0.2647***	0.0610
Region	-0.2655*	0.1290	0.3825	0.2882	0.1468	0.1548
_cons	-4.1450***	0.4779	-4.4444*	1.8786	-1.8205***	0.4054
Likelihood-ratio test of α=0	Pr >= chibar2 = 0.000		Pr >= chibar2 = 0.000		Pr >= chibar2 = 0.000	

Notes: Dependent variable is *PPPdeals* in all equations; all regressions include year dummy variables; †, *, **, and *** represent statistical relevance at 90, 95, 99 and 99.9%, respectively.

Table 7. Robustness checking 2. Heckman's two-step model

Panel A. Effect of corruption variables on PPP dummy						
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
BCI	0.0116***	0.0006				
CPI			0.0125***	0.0007		
WGIcc					-0.1655***	0.0326
GDPpc	0.2307***	0.0139	0.1108***	0.0155	0.3184***	0.0241
Debt	0.0013***	0.0003	0.0008*	0.0004	0.0032***	0.0004
Inflation	-0.0010	0.0007	0.0051	0.0036	0.0003	0.0014
Population	0.0002***	0.0000	0.0003	0.0005	0.0029***	0.0005
Ideology	0.0203**	0.0063	-0.0017	0.0083	0.0417***	0.0097
Region	0.0326*	0.0152	0.0115	0.0184	0.1924***	0.0182
Panel B. Effect of corruption variables on total PPP commitments						
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
BCI	0.0871***	0.0059				
CPI			0.1665***	0.0245		
WGIcc					-0.8600***	0.1720
GDPpc	1.7351***	0.1313	1.1299†	0.5954	1.6542***	0.1430
Debt	0.0100***	0.0020	0.0153*	0.0061	0.0169***	0.0023
Inflation	-0.0072	0.0054	-0.0083	0.0661	0.0017	0.0073
Population	0.0011***	0.0002	0.0136	0.0145	0.0015***	0.0002
Ideology	0.1525**	0.0476	-0.0551	0.1222	0.2167***	0.0509
Region	0.2450*	0.1150	0.0744	0.2755	0.9995***	0.1097
_cons	-7.5195***	0.3365	-12.8522***	2.1069	-5.1960***	0.2511
LR test of indep. eqns. (rho = 0)	Pr > chi2 = 0.0000		Pr > chi2 = 0.0000		Pr > chi2 = 0.0000	

Notes: Dependent variable is *DPPP* in all equations of Panel A; dependent variable is *PPPproceeds* in all equations of Panel B; all regressions include year dummy variables; †, *, **, and *** represent statistical relevance at 90, 95, 99 and 99.9%, respectively.

Table 8. Robustness checking 3. Non-contemporaneous effects

Panel A. Effect of corruption variables on *PPPdeals*						
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
AR (1)	0.5174***	0.0089	0.8152***	0.1489	0.3291***	0.0113
BCI_{t-1}	0.4731*	0.1861				
CPI_{t-1}			-0.1646	0.1069		
$WGIcc_{t-1}$					-5.5882**	1.8998
GDPpc	0.7325***	0.0986	-0.4454**	0.1319	0.8166**	0.2468
Debt	-0.0269	0.0290	-0.2722†	0.1584	0.0535	0.0515
Inflation	-0.0862**	0.0294	-0.3391***	0.0897	0.0335	0.0234
Population	0.0206***	0.0017	-0.0459***	0.0128	0.0352***	0.0012
Ideology	1.3606**	0.4668	1.9578	1.5531	0.9725***	0.2686
Region	-0.4718	1.2970	-1.0799	2.3059	1.0624†	0.5725
_cons	-0.2716**	0.0867	0.3433*	0.1330	-0.1372**	0.0454
Arellano-Bond test for AR (2) in first differences	Pr > z = 0.232		Pr > z = 0.574		Pr > z = 0.261	
Hansen test of overid. restrictions	Pr > chi2 = 0.293		Pr > chi2 = 0.330		Pr > chi2 = 0.373	
Panel B. Effect of corruption variables on *PPPproceeds*						
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
AR (1)	0.2575**	0.0813	0.0605	0.0236	0.3685***	0.0093
BCI_{t-1}	0.8852**	0.2829				
CPI_{t-1}			0.8461	0.1129		
$WGIcc_{t-1}$					-5.1196***	1.0627
GDPpc	1.0650***	0.1996	1.5436	0.1711	1.1943***	0.0780
Debt	0.1018*	0.0509	-1.5777	83.4312	0.3053***	0.0267
Inflation	-0.1482***	0.0383	0.7865	0.1043	0.3820	0.3999
Population	6.5500†	3.7900	-0.3510	3.8700	0.1550***	0.0218
Ideology	1.5249†	0.8149	3.6111	1.4079	-0.2399	0.1637
Region	-1.2376	2.2817	-0.3711	2.0123	2.5939	1.9601
_cons	-0.5487***	0.1091	-0.7343	0.1145	-0.3217***	0.0394
Arellano-Bond test for AR (2) in first differences	Pr > z = 0.154		Pr > z = 0.255		Pr > z = 0.183	
Hansen test of overid. restrictions	Pr > chi2 = 0.196		Pr > chi2 = 0.615		Pr > chi2 = 0.437	

Notes: Dependent variable is *PPPdeals* in all equations of Panel A; dependent variable is *PPPproceeds* in all equations of Panel B; all regressions include year dummy variables; †, *, **, and *** represent statistical relevance at 90, 95, 99 and 99.9%, respectively.

Figure 1. PPP evolution (1995-2018)

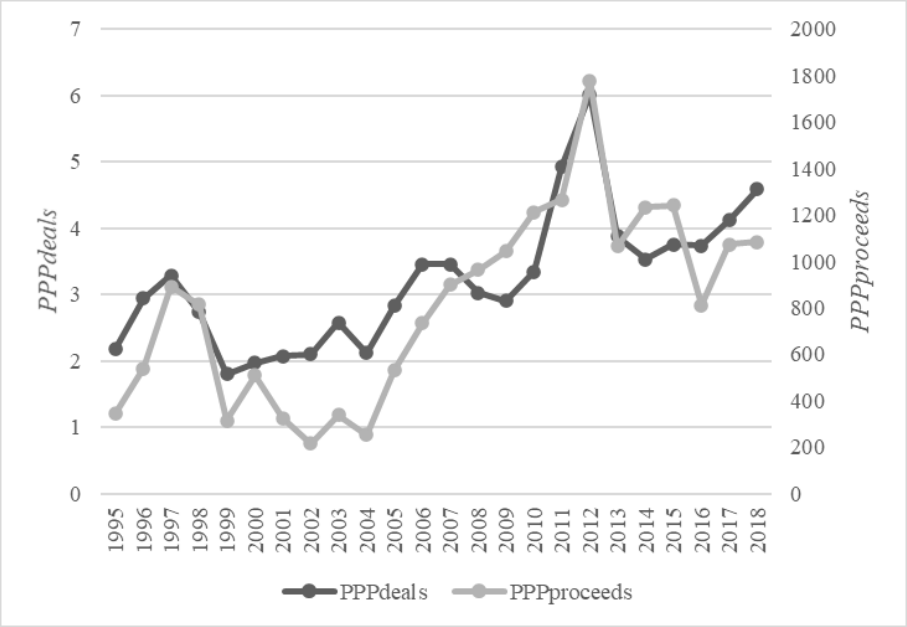

Figure 2. Corruption evolution (1995-2018)

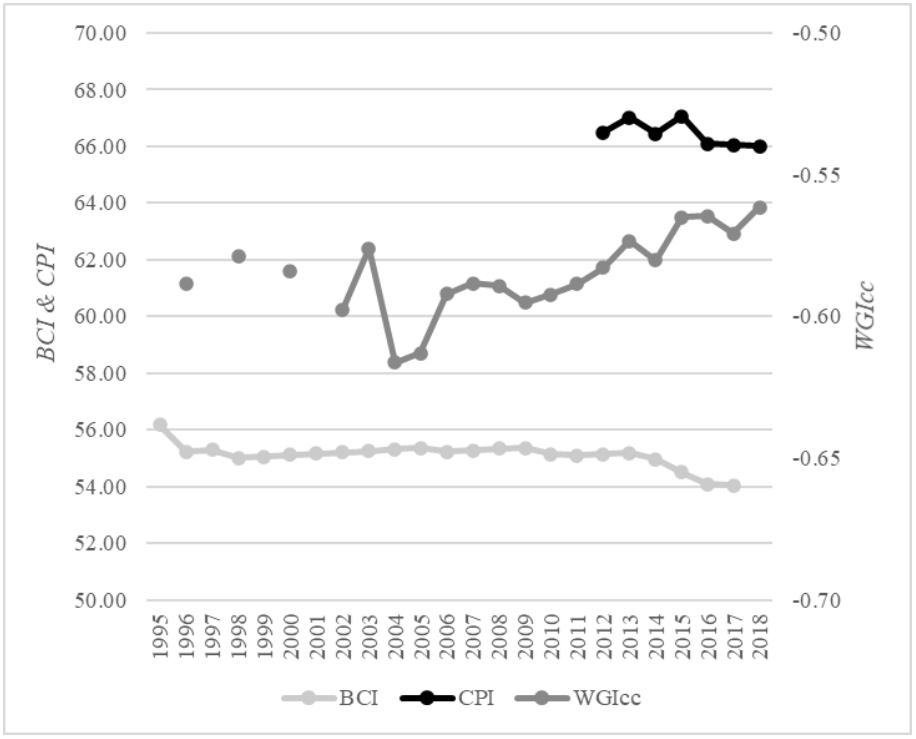

Figure 3. Dispersion of *PPPdeals* variable