Is there a relationship between Corruption and Public-Private Partnerships?

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Abstract

Despite the importance of infrastructure, a big funding gap can be seen in infrastructure procurement. Public-Private Partnerships (PPPs) were once seen as a solution, but years later the results are underwhelming. As the industry can be susceptible to corruption, concerns have emerged about PPPs. To confront these concerns, this study aims to investigate if there is a link between corruption and the usage of PPPs. To do this, a panel dataset of 147 lower-income countries was compiled with data from the Private Participation in Infrastructure database, the Worldwide Governance Indicators and the World Development Indicators. A Fixed Effects Poisson Model was then applied to the panel dataset for an empirical analysis of the data. The regressions showed that control of corruption has a positive effect on both the number of PPPs and Greenfield PPPs when there is multilateral support involved. This relationship was found to support the "sand the wheels" perspective, where corruption has a negative effect on the usage of PPPs.

Key words: Public-Private Partnerships, PPPs, Corruption, Infrastructure Procurement

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1. Introduction

Infrastructure is the backbone of modern society, it is our transportation system, our electricity network, our communications network and much more. It is also critical for the Sustainable Development Goals (Economist Intelligence Unit, 2019). Development will not happen without it and it can drive economic growth (Timilsina, Hochman & Song, 2020). However, building infrastructure is very expensive. This results in an almost constant surplus of possible projects, which are deeply needed, and a constant shortage of financial resources to make it happen. An important distinction to make is between financing and funding: financing is the money needed to start a project and funding is the money needed over the whole lifecycle of the project (PPP Knowledge Lab, 2017). McKinsey Global Institute (2016) estimated the infrastructure funding gap, in the world, to be around $350 billion a year until 2030, and three times as much is needed if the Sustainable Development Goals are to be met, which is critical for much of the development world.

To solve this financial problem, governments have searched for new ways to fund and procure infrastructure. A number of innovative solutions have come up over time, but the one getting the most interest has been Public-Private Partnerships (its acronym PPPs will be used from now on). PPP Knowledge Lab defines PPPs as:

> A long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility and remuneration is linked to performance (PPP Knowledge Lab, 2017, p.1).

PPPs was touted as the next big thing in infrastructure that would increase private investment in infrastructure. But PPPs haven't completely taken over infrastructure procurement as previously thought (Leigland, 2020). When data shows us that low income countries have struggled to attract private sector investment, compared to lower middle income and upper middle income countries (Kwame Sundaram et al., 2016), it raises some concerns about PPPs ability to bridge the infrastructure funding gap.

Infrastructure projects are large and involve a lot of money. In addition, because of their magnitude and complexity, it is difficult to evaluate the efficiency and performance of these projects (Gerrits & Verweij, 2018). These could be some of the reasons why the sector seems to attract corruption. The public works contracts and construction sector was the industry most vulnerable to bribery in Transparency International's Bribe Payer Index (2011). In addition, researchers like Bildfell (2018) have determined how PPPs can be susceptible to corruption. As corruption can be linked to poor quality of infrastructure (Tanzi & Davoodi, 1998) and costs can increase in terms of bribes, concerns can be raised regarding PPPs and corruption.

To confront these concerns, this study aims to investigate if there is a link between corruption and the usage of PPPs. This led to the formulation of two research questions: Is there a relationship between the use of PPPs and perceived corruption? And if so, does this relationship support the "sand the wheels" or "grease the wheels" perspective on corruption?

To answer these questions, data was used from three different sources. Data on PPPs were taken from the World Bank's Private Participation in Infrastructure (PPI) database. Governance indicators, including a corruption index, came from the World Bank's Worldwide Governance Indicators (WGI dataset) with additional control variables taken from the World Bank's World Development Indicators (WDI). Then a regression analysis was done, using a Fixed Effects Poisson model. The regression analysis showed that corruption leads to fewer PPPs with multilateral support, this relationship was found to back up the "sand the wheels" perspective on corruption in regards to the usage of PPPs. An important delimitation of the study was that no variable containing info about the success rate of PPPs was included to limit the study's focus.

The disposition of this study will be so that chapter 2 will include a literature review and the relevant theory for the study. Then a data section is shown in chapter 3 and the method section can be found in chapter 4. Results will be presented in chapter 5,

followed by a discussion of the results in chapter 6. Finally, chapter 7 presents the conclusions of this study.

2. Previous Literature and Theory
2.1 Literature

2.1.1 Determinants of PPP Projects

There have been many studies before who identified determinants of PPP projects. Hammami, Ruhashyankiko and Yehoue (2006) identified determinants of PPP arrangements with an empirical analysis. They find evidence that upholds the importance of institutional quality in attracting PPPs. For instance, they find that less corruption and effective rule of law are associated with more PPP projects (Hammami, Ruhashyankiko & Yehoue, 2006). Other studies, like Moszoro et al. (2014), further supports the notion that absence of corruption increases private participation in infrastructure. Percoco (2014) found that greater private participation in transportation PPPs is associated with better institutions in terms of lower corruption, civil freedom and regulatory framework. Further, Percoco found that better institutions is one determinant of PPP types in which the private party bears more risk. Wang et al. (2019) upholds this notion as they found that a better governance environment lowers the risk for private partners, resulting in more private investment. Altogether, the literature shows the importance of institutional stability and strong governance for attracting PPP projects and increasing private participation in infrastructure procurement (Moszoro et al., 2014; Hammami, Ruhashyankiko & Yehoue, 2006; Percoco, 2014; Wang et al., 2019).

Kaymak and Bektas (2015) found that emerging markets with more liberal economic policies, who invest in public infrastructure and have solid financial systems are associated with lower perceptions of corruption. Additionally, they found a negative relationship between corruption and the presence of effective government and the rule of law. Wren-Lewis (2015) found that corruption, at a national level, is negatively associated with firm productivity. Yet, the presence of an Independent Regulatory Agency reduces this negative association. Additionally, the negative relationship between corruption and productivity is smaller for private firms than public ones, which

Wren-Lewis notes could suggest that privatization may reduce the negative effects of corruption. Bertelli, Mele and Woodhouse (2021) found that when public sector corruption increases in a country, more privately financed infrastructure projects are seen in non-democracies, as opposed to no change observed at all in democracies. In contrast, Moszoro et al. (2014) found that types of legal systems did not affect private participation in infrastructure. One interesting finding by Galilea and Medda (2009), is that countries with perceived low democratic accountability can have higher performing PPPs than countries with higher perceived democratic accountability, which the authors explain could be because autocracies may have better capacity to assist PPP projects.

PPPs are more common in countries with previous PPP experiences, according to Hammami, Ruhashyankiko and Yehoue (2006). Moreover, the author's find more PPPs in countries with heavy debt burdens, a sizable aggregate demand and large markets that allow for cost recovery. These could be factors that force countries to seek private investment to build infrastructure. Additionally, similar to other studies, Hammami, Ruhashyankiko and Yehoue (2006) find that countries with low inflation attract more PPPs, once again supporting the notion that macroeconomic stability is essential for PPPs to take place.

2.1.2 Corruption and PPPs

Bildfell (2018) took a theoretical approach when examining if PPPs are more susceptible to corruption than traditional procurement methods. Bildfell found that there are factors in PPPs that can increase corruption risk, but that there are also factors in PPPs that can decrease corruption risk. The author referred to this as the "increase-decrease" tension and argued that the existence of it means that one cannot draw any conclusions that PPPs in itself are more or less susceptible to corruption, it is a matter of context in each instance. Bildfell therefore concluded that in regards to corruption risk, PPPs are not inherently bad or good. Jiménez et al. (2020) studied the relationship between corruption and the likelihood of success of private participation projects in emerging countries. The authors found a negative relationship between corruption and the success of private participation projects, which was statistically

significant. Jiménez et al. (2020) further noted that the negative relationship was weaker with the presence of other firms in the same industry, which the authors argued was linked with the development of vicarious experience. By mentioning some relevant studies the authors concluded that by looking at other projects, one can gain knowledge about local laws, norms and procedures which helps when dealing with corruption. However, the authors found that the negative relationship between corruption and the success of PPPs was stronger with the presence of firms in other industries. They argue that this is because of lesser relevance of vicarious experience, together with increased national animosity and discimination from local stakeholders.

Jiménez et al. (2020) concluded that their findings were consistent with the negative "sand the wheels" effect, previously mentioned by Cuervo-Cazurra (2008). Jiménez et al. (2017) found that the probability of success in private participation projects is lower in countries with high levels of corruption, these results are persistent across different project specifications and support the "sand the wheels" perspective on corruption. Furthermore, their findings also show that the inclusion of local investors in a project weakens the negative effects of corruption. They explain this by the fact that local investors have a greater understanding of local conditions and are therefore better able to navigate corruption that they encounter.

At the sector level, absence of corruption is statistically significant in attracting private participation in all sectors except transport, which could indicate that the transport sector lacks sensitivity to corruption (Moszoro et al., 2014). In contrast, Galilea and Medda (2009) found that the perception of a country's level of corruption has an effect on the success of PPPs in the transport sector. The explanation given is that perceived corrupt countries will have trouble finding international investors, who have a lot of experience, or even capable investors willing to construct and supply the project. Furthermore, in corrupt countries the firm who gets the contract might be the one with the highest bribe or the best political connection, instead of the most capable one (Galilea & Medda, 2009). But, Wu (2005) found some interesting results when doing a cross-country analysis on corporate governance and corruption. Wu found that good

corporate governance can reduce levels of corruption. He argued that it is in the firm's interest to improve corporate governance, as it constrains the firms' ability to pay bribes as well as it increases chances of corrupt officials getting exposed when asking for bribes. Firms are in a position to either break the vicious cycle of bribery and corruption or help reinforce it, that is why Wu declares that more focus should be directed at bribe payers instead of only bribe takers.

Moreover, Kenny (2009) noted the harmfulness of corruption in the construction sector, as it can lead to poor-quality construction, or support poor project selection and insufficient maintenance, which can reduce economic return to investments. Locatelli et al. (2017) who studied corruption in public projects and megaprojects, talks about the lack of transparency and focus in the project management community, and hopes that there will be more research on the topic because of its importance.

2.2 Theory

This study will adopt a theoretical framework previously used by Cuervo-Cazurra (2008) in his paper "Better the devil you don't know: Types of corruption and FDI in transition economies". Cuervo-Cazurra studied the relationship between corruption and foreign direct investment (FDI) in transition economies. To do this, he explained that there are two existing views of corruption: one is negative where corruption increases costs and uncertainty which reduces FDI, and the other is positive where corruption helps avoid the costs of operating in an environment with poor regulations, thereby increasing FDI. The negative view of corruption can be referred to as the "sand the wheels" perspective, and the positive view is referred to as the "grease the wheels" perspective. Cuervo-Cazurra explains that these views can be seen as opposing arguments, or compelling arguments for different situations.

The same theoretical framework can be applied to the discussion about corruption and the usage of PPPs, which will be done in this study. The negative view, the "sand the wheels" perspective, would be where the usage of PPPs is negatively affected by

corruption. While the positive view, the "grease the wheels" perspective, would be where the usage of PPPs is positively affected by corruption.

3. Data
3.1 Data Description

The panel data used in this study were taken from three different databases: The World Bank's Private Participation in Infrastructure (PPI) Database, The World Bank's Worldwide Governance Indicators (WGI dataset) and The World Bank's World Development Indicators (WDI). These will further be included by their acronyms: PPI, WGI, and WDI. The data was then compiled into a single dataset using Microsoft Excel. Data were also reformatted in Excel so that all variables had the same unit of analysis, country-year.

The PPI database is a compiled set of information about public infrastructure projects in low- and middle-income countries that have private participation and have reached financial closure. Private participation entails that a private party holds at least a share of the operating risk, which includes operating cost and associated risks (World Bank Group, 2021a). There are different types of private participation in infrastructure projects, this study will focus on PPPs (Management and Lease contracts, Brownfield, and Greenfield projects) and Greenfield PPPs in particular. The database has data on 10,421 infrastructure projects in 127 low- and middle-income countries, the data is from 1990-2019.

It should be noted that the information in the database is compiled solely from publicly available sources (World Bank Group, 2021a). Therefore, there are a few things to take in consideration when using the database. First of all, the accuracy of the public sources should be taken into consideration when using the data as the information provided may not be accurate or contain the right information (World Bank Group, 2021a). However, this study uses the database for its information on the number of projects, their financial closure year, the types of projects, their status (successful or unsuccessful) and if they included multilateral support. This is quite rudimentary information when discussing

PPPs, because the database uses a lot of different sources it is reasonable to assume that this information is right. Second of all, the database is not an exhaustive list with all PPPs in low- and middle-income countries (World Bank Group, 2021a). It is likely that some projects have been missed, especially when you consider the traditional non-transparency regarding PPPs and other infrastructure projects. Further, smaller projects may not be as widely reported in the public sources that are used for the database (World Bank Group, 2021a). Despite this, the database can still provide a good basis for the analysis. For example, when researching how governance indicators may influence the number of PPPs, large PPPs are of extra interest because of their attractiveness to corrupt individuals.

The WGI dataset reports on six aspects of governance for 214 countries from 1996-2019. These are aggregated indicators which compile the views on the quality of six aspects of governance from four different source categories: Surveys of households and firms, Commercial business information providers, Non-governmental organizations, and Public sector organizations (Kaufmann, Kraay & Mastruzzi, 2010). It is further explained that the retrieved data are combined into the aggregate indicators by using an unobserved components model. The chosen method generates a standard error for every governance estimate, which needs to be taken into account when making comparisons across countries and over time (Kaufmann, Kraay & Mastruzzi, 2010).

This study has used the governance indicators without taking the standard error into account because this study is trying to figure out if the perceived levels of corruption in a country affects the usage of public private partnerships. Both for the corruption indicator and the other governance indicators, the meaning of them is the perceived performance by countries in different governance dimensions and not the actual performance.

Control variables were taken from the World Development Indicators dataset. World Development Indicators is the World Bank's primary collection of development

indicators, which are compiled from officially recognized international sources. This dataset is broadly used and considered reliable.

3.2 Variables

3.2.1 Dependent Variables

There are four dependent variables in this study which measures the number of PPPs in different ways, they all were created with data from the PPI database (Table 1). A PPP project is counted for in the year that it attains financial closure, meaning that private sponsors have agreed to a legally binding agreement to invest funds or provide services (World Bank Group, 2021b).

The first dependent variable is the number of PPPs, which is the number of PPPs that were created in each year for a specific country. The second dependent variable is the number of Greenfield PPPs. The PPI database defines a Greenfield PPP as "A private entity or a public-private joint venture builds and operates a new facility for the period specified in the project contract" (World Bank Group, 2021b, n.p.). Greenfield PPPs are considered to be complex and large in size compared to the two other types of PPPs; Brownfield projects, where a private entity takes over an existing asset, and Management and Lease Contracts, where a private entity takes over the management of a public asset but not ownership. Because of its complexity and size, Greenfield PPPs are interesting to investigate as they could require more expertise to handle and also be more targeted for corrupt practices.

The last two dependent variables are the number of PPPs with multilateral support and the number of Greenfield PPPs with multilateral support. Multilateral support means that a multilateral bank provides financial support for a PPP project (World Bank Group, 2021b). It is interesting to include these variables because a project can gain from the knowledge and experience a multilateral bank may have from previous projects. Also, it is fair to assume that the governance environment in a country would impact the decision on which projects to pursue for a multilateral bank, because of the risk involved in a potential financial investment.

Table 1: Dependent Variables

Variable	Definition	Source
Number of PPPs	The number of PPPs that were created in each year for a specific country	Created with variables from the World Bank's Private Participation in Infrastructure (PPI) Database
Number of Greenfield PPPs	The number of Greenfield PPPs that were created in each year for a specific country	Created with variables from the World Bank's Private Participation in Infrastructure (PPI) Database
Number of PPPs with Multilateral Support	The number of PPPs with multilateral support that were created in each year for a specific country	Created with variables from the World Bank's Private Participation in Infrastructure (PPI) Database
Number of Greenfield PPPs with Multilateral Support	The number of Greenfield PPPs with multilateral support that were created in each year for a specific country	Created with variables from the World Bank's Private Participation in Infrastructure (PPI) Database

3.2.2 Explanatory Variables

This study focuses on how corruption might affect the usage of PPPs in a country. Six explanatory variables in this study were taken from the WGI dataset: Control of Corruption, Rule of Law, Regulatory Quality, Government Effectiveness, Political Stability and Absence of Violence/Terrorism, and Voice and Accountability. These variables explain the perceived levels of six different aspects of governance in a country. Each variable is an index with values ranging from -2.5 to 2.5, with high scores indicating strong governance and low scores indicating weak governance (Kaufmann, Kraay & Mastruzzi, 2010). The definitions of the six variables can be found in table 2.

In this study we hypothesize that perceived corruption negatively affects the number of PPPs and Greenfield PPPs, with and without multilateral support. While this study is focused on the control of corruption variables, other governance variables are included as it is assumed that they all have an effect on the number of PPPs.

Table 2: Explanatory Variables

Variable	Definition	Source
Control of Corruption	"capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests" (Kaufmann, Kraay & Mastruzzi, 2010, p.4).	The World Bank's Worldwide Governance Indicators (WGI dataset)
Rule of Law	"capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence" (Kaufmann, Kraay & Mastruzzi, 2010, p.4).	The World Bank's Worldwide Governance Indicators (WGI dataset)
Regulatory Quality	"capturing perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development" (Kaufmann, Kraay & Mastruzzi, 2010, p.4).	The World Bank's Worldwide Governance Indicators (WGI dataset)
Government Effectiveness	"capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies" (Kaufmann, Kraay & Mastruzzi, 2010, p.4).	The World Bank's Worldwide Governance Indicators (WGI dataset)
Political Stability and Absence of Violence/Terrorism	"capturing perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism" (Kaufmann, Kraay & Mastruzzi, 2010, p.4).	The World Bank's Worldwide Governance Indicators (WGI dataset)
Voice and Accountability	"capturing perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media" (Kaufmann, Kraay & Mastruzzi, 2010, p.4).	The World Bank's Worldwide Governance Indicators (WGI dataset)

3.2.3 Control Variables

The control variables used in this study were either taken from the WDI dataset, or created from the PPI database. See table 3 for info on all control variables.

Table 3: Control Variables

Variable	Definition	Source
GDP per capita (current US$)	"GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars" (World Bank Group, 2021c, n.p.).	The World Bank's World Development Indicators (WDI)
GDP Growth (annual %)	"Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars" (World Bank Group, 2021d, n.p.).	The World Bank's World Development Indicators (WDI)
Inflation, GDP deflator (annual %)	"Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency" (World Bank Group, 2021e, n.p.).	The World Bank's World Development Indicators (WDI)
Population, total	"Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. The values shown are midyear estimates" (World Bank Group, 2021f, n.p.).	The World Bank's World Development Indicators (WDI)
Successful PPP Experience	The cumulative number of successful PPPs that were created in the country before that year. A project is seen as successful if it is active or concluded.	Created with variables from the World Bank's Private Participation in Infrastructure (PPI) Database. Variable logged: Log (y + 1)
Failed PPP Experience	The cumulative number of failed PPPs that were created in the country before that year. A project is seen as failed if it is canceled or distressed.	Created with variables from the World Bank's Private Participation in Infrastructure (PPI) Database Variable logged: Log (y + 1)
PPP Experience with Multilateral Support	The cumulative number of PPPs with multilateral support that were created in the country before that year.	Created with variables from the World Bank's Private Participation in Infrastructure (PPI) Database Variable logged: Log (y + 1)

4. Method
4.1 Data Reliability and Handling of Data

Excel was used when compiling the data into a singular dataset. Gretl was used for all the regressions and associated tests.

4.1.1 Unbalanced Data

The panel dataset used in this study is unbalanced. A table with missing observations percentage can be seen in the appendix (Table 8). One important thing to note is that two countries (North Korea and Somalia) were removed from the dataset as they missed observations for entire explanatory variables and therefore deemed not useful for this study. The compiled dataset used for the study contains 147 countries and covers the time period 2002-2019. A list with all included countries in the study can be found in the appendix (Table 9).

4.1.2 Endogeneity and Multicollinearity

For each dependent variable, four different regressions were done. First, for two of the regressions, the corruption variable was included as the only governance indicator. For the other two regressions, all the governance indicators were included. Second, two of the regressions were done without the three experience variables, with them being included in the other two regressions. This was done to control for possible omitted variables bias and multicollinearity. If a variable is significant in one of the regressions but not the other, concerns can be raised about how robust that result is.

4.2 Regression Model

The four dependent variables that will be used in the regressions for this study are all count variables, a list of non-negative integer values. Because of the particular characteristics of a count variable, there are specific count models to use for regression analysis. In this study, we use the Fixed Effects Poisson Model (Poisson FE model) in all the regressions. To use this model, we assume that there is unobserved individual heterogeneity (individual specific effects) that affects the dependent variable and that

these individual specific effects are correlated with the regressors (explanatory variables).

One way to estimate the Poisson FE model is to include dummy variables for each individual in a Poisson regression by maximum likelihood; this estimates the fixed effects directly and is very practical to implement (Winkelmann, 2008). This allows us to control for individual heterogeneity in our model, so each dummy variable can be interpreted as the unobserved country-specific propensity to undertake PPPs. Note that there is no incidental parameters problem where the inclusion of dummy variables yields inconsistent estimates in our model, because the unconditional and the conditional estimation methods for the Poisson FE regression yield the same exact results for the coefficients (Cameron & Trivedi, 1998). Robust standard errors (QML standard errors) were used in all the regressions.

With the unconditional estimation method, in order to avoid perfect multicollinearity, one individual dummy variable needs to be excluded from the regression. Our regressions were therefore done with a Poisson model, which then included 146 dummy variables (for all except the first individual country). Important to note is that because of practicality, the 146 dummy variables are not shown in tables 4-7.

An important assumption of the Poisson FE model is the equi-dispersion property, that the conditional mean is equal to the conditional variance (Baltagi, 2021). When the variance differs from the mean, this assumption is violated. Underdispersion occurs when the variance is less than the mean and overdispersion occurs when the variance is greater than the mean. Overdispersion, in particular, is common and a negative binomial FE model, first introduced by Hausman, Hall and Griliches (1984), is often used to account for it. However, there are contrasting views on how robust the Poisson FE model is to these violations. Ismail and Jemain (2007) found that significance of regression parameters were exaggerated with overdispersion present. Whereas Wooldridge (1999) showed that the Poisson FE model is robust to every failure of the Poisson assumptions, except for having the right conditional mean. Furthermore, the

negative binomial FE model has its own problems, such as not being a true fixed effects model as it doesn't condition out the fixed effects (Allison & Waterman, 2002). As we want to estimate time-invariant characteristics in this study, the Poisson Fixed Effects model will be used and robust standard errors will be used to counter any concerns for overdispersion.

5. Empirical Results

The results are estimated with a Poisson Fixed Effects model. The results of the regressions are shown in tables on the following pages.
The coefficients are shown together with their p-values in parentheses.
Significance levels are indicated by asterisks:
- * = 90%
- ** = 95%
- *** = 99%

Table 4: Results Model 1-4

Dependent Variable: Number of PPPs	Model 1	Model 2	Model 3	Model 4
Constant	−21.696** (0.027)	−16.133 (0.157)	−19.145** (0.046)	−15.548 (0.149)
Control of Corruption	−0.136 (0.659)	−0.066 (0.824)	0.155 (0.535)	0.168 (0.473)
Rule of Law	−0.025 (0.940)	−0.237 (0.500)		
Regulatory Quality	0.541* (0.061)	0.549* (0.059)		
Government Effectiveness	0.244 (0.368)	0.095 (0.718)		
Political Stability and Absence of Violence/Terrorism	−0.329** (0.014)	−0.235* (0.060)		
Voice and Accountability	0.330 (0.218)	0.406 (0.124)		
GDP per capita (logged)	0.238** (0.019)	0.262** (0.022)	0.258*** (0.003)	0.230** (0.026)
GDP Growth	0.001 (0.922)	0.004 (0.731)	0.002 (0.855)	0.008 (0.522)
Inflation	0.010** (0.033)	0.010** (0.039)	0.012** (0.017)	0.011** (0.024)
Population (logged)	1.120* (0.058)	0.782 (0.249)	0.957* (0.099)	0.755 (0.241)
Successful PPP Experience (logged)		−0.009 (0.982)		0.111 (0.794)
Failed PPP Experience (logged)		−1.071*** (0.000)		−1.114*** (0.000)
PPP Experience with Multilateral Support (logged)		0.928* (0.087)		0.805 (0.161)
McFadden R-squared (R2)	0.803	0.805	0.801	0.804
N	2549	2549	2571	2571

Table 5: Results Model 5-8

Dependent Variable: Number of Greenfield PPPs	Model 5	Model 6	Model 7	Model 8
Constant	−44.796*** (0.000)	−42.210*** (0.002)	−41.650*** (0.000)	−37.233*** (0.004)
Control of Corruption	−0.020 (0.951)	−0.002 (0.995)	0.322 (0.203)	0.314 (0.187)
Rule of Law	−0.173 (0.581)	−0.441 (0.179)		
Regulatory Quality	0.819** (0.017)	0.861** (0.011)		
Government Effectiveness	0.263 (0.288)	0.211 (0.374)		
Political Stability and Absence of Violence/Terrorism	−0.354** (0.013)	−0.299** (0.025)		
Voice and Accountability	0.270 (0.324)	0.370 (0.170)		
GDP per capita (logged)	0.253** (0.029)	0.392*** (0.003)	0.268*** (0.005)	0.332*** (0.005)
GDP Growth	−0.020 (0.118)	−0.020 (0.136)	−0.017 (0.179)	−0.013 (0.298)
Inflation	0.013** (0.017)	0.012** (0.030)	0.015*** (0.005)	0.014** (0.012)
Population (logged)	2.466*** (0.000)	2.270*** (0.004)	2.276*** (0.000)	2.004*** (0.008)
Successful PPP Experience (logged)		−0.651* (0.087)		−0.412 (0.324)
Failed PPP Experience (logged)		−1.101*** (0.000)		−1.141*** (0.000)
PPP Experience with Multilateral Support (logged)		1.427*** (0.007)		1.278** (0.024)
McFadden R-squared (R2)	0.790	0.793	0.788	0.791
N	2549	2549	2571	2571

Table 6: Results Model 9-12

Dependent Variable: Number of PPPs with Multilateral Support	Model 9	Model 10	Model 11	Model 12
Constant	−79.202***	−98.260***	−75.640***	−92.500***
	(0.000)	(0.000)	(0.000)	(0.000)
Control of Corruption	0.778	1.065*	0.880**	0.922**
	(0.173)	(0.060)	(0.037)	(0.037)
Rule of Law	0.446	0.318		
	(0.367)	(0.525)		
Regulatory Quality	0.595	0.463		
	(0.305)	(0.430)		
Government Effectiveness	−0.106	−0.214		
	(0.835)	(0.672)		
Political Stability and Absence of Violence/Terrorism	−0.586***	−0.442**		
	(0.003)	(0.024)		
Voice and Accountability	−0.248	−0.625		
	(0.519)	(0.123)		
GDP per capita (logged)	−0.143	−0.211	−0.114	−0.230
	(0.396)	(0.281)	(0.519)	(0.247)
GDP Growth	−0.000	−0.001	−0.007	−0.004
	(0.980)	(0.940)	(0.677)	(0.805)
Inflation	0.009	0.008	0.010	0.009
	(0.417)	(0.513)	(0.366)	(0.448)
Population (logged)	4.574***	5.641***	4.393***	5.361***
	(0.000)	(0.000)	(0.000)	(0.000)
Successful PPP Experience (logged)		2.332***		2.470***
		(0.006)		(0.003)
Failed PPP Experience (logged)		−0.281		−0.353
		(0.637)		(0.556)
PPP Experience with Multilateral Support (logged)		−3.186***		−3.160***
		(0.007)		(0.004)
McFadden R-squared (R2)	0.403	0.413	0.399	0.410
N	2549	2549	2571	2571

Table 7: Results Model 13-16

Dependent Variable: Number of Greenfield PPPs with Multilateral Support	Model 13	Model 14	Model 15	Model 16
Constant	−98.174***	−113.590***	−89.506***	−103.266***
	(0.000)	(0.000)	(0.000)	(0.000)
Control of Corruption	0.925	1.185*	1.096**	1.1559**
	(0.182)	(0.081)	(0.028)	(0.025)
Rule of Law	0.245	0.090		
	(0.643)	(0.873)		
Regulatory Quality	1.230*	1.148		
	(0.067)	(0.101)		
Government Effectiveness	−0.085	−0.209		
	(0.888)	(0.728)		
Political Stability and Absence of Violence/Terrorism	−0.665***	−0.516**		
	(0.004)	(0.022)		
Voice and Accountability	−0.524	−0.840*		
	(0.252)	(0.082)		
GDP per capita (logged)	0.091	−0.052	0.163	−0.026
	(0.655)	(0.829)	(0.448)	(0.917)
GDP Growth	−0.017	−0.015	−0.023	−0.017
	(0.361)	(0.436)	(0.191)	(0.382)
Inflation	0.015	0.014	0.016	0.015
	(0.273)	(0.316)	(0.219)	(0.241)
Population (logged)	5.597***	6.487***	5.116***	5.934***
	(0.000)	(0.000)	(0.000)	(0.000)
Successful PPP Experience (logged)		2.057*		2.265**
		(0.055)		(0.029)
Failed PPP Experience (logged)		−0.307		−0.373
		(0.628)		(0.557)
PPP Experience with Multilateral Support (logged)		−2.502*		−2.587*
		(0.087)		(0.057)
McFadden R-squared (R2)	0.431	0.437	0.423	0.430
N	2549	2549	2571	2571

6. Discussion

As seen in table 4 and 5, we did not find a significant relationship between control of corruption and the number of PPPs or Greenfield PPPs. This is different to earlier mentioned studies (Hammami, Ruhashyankiko & Yehoue, 2006; Moszoro et al., 2014), who found a negative relationship between corruption and the number of PPP projects. However, our regressions found that control of corruption has a positive effect on both the number of PPPs and Greenfield PPPs when there is multilateral support involved. This could be because multilateral institutions don't want to engage with corrupt countries, as corruption increases the risk of failure (Jiménez et al., 2020), increases costs (Transparency International, 2011; Tanzi & Davoodi, 1998; Kenny, 2009) and could be bad publicity for the institution. This would point to the "sand the wheels" perspective regarding how corruption affects the usage of PPPs, as it scares away multilateral institutions who otherwise could have contributed with its wealth of experience and knowledge.

The presence of an effective government and rule of law is opposite to corruption, as established by Kaymak and Bektas (2015). Surprisingly, no significant relationship at all could be found between rule of law or government effectiveness and the usage of PPPs. This is notable, as rule of law includes an issue like contract enforcement which is specifically relevant with PPPs, and especially with the complex contracts that is common in Greenfield PPPs. In addition, government effectiveness would reasonably be thought of as an important predictor of a government's ability to undertake PPPs. But our regression couldn't find evidence for either of those claims.

Regulatory quality was found to have a positive effect on the number of PPPs, and a larger positive effect on the number of Greenfield PPPs. As regulatory quality amounts to a government's ability to formulate and implement sound regulations that promote private sector development, this result is expected. Infrastructure PPPs are big and complex projects, especially Greenfield PPPs, so there will be stress put on a country who doesn't have the necessary regulations to deal with these projects. Good regulations increase security for the involved parties, as it makes it clear how to proceed

when implementing a PPP project. As a result, it will get easier for countries to attract private entities to potential projects, as evidenced by the established positive relationship in our models and other studies (Percoco, 2014; Wang et al., 2019).

Another noteworthy result is that political stability and absence of violence/terrorism has a negative effect on the number of PPPs and Greenfield PPPs in all our models, both with and without the involvement of multilateral support. This is interesting as we thought the relationship would be positive, especially when there is no multilateral support. In general, a feasible hypothesis would be that political stability is needed for big long-term projects like infrastructure PPPs because the whole situation becomes more predictable. Also, political instability would suggest that a government could be weaker which could have an impact on the ability to formulate and implement sound regulations that are needed. On the other hand, countries with political instability may be the countries which need infrastructure the most, and PPPs could be a solution to make it happen. This view seems plausible from a multilateral institutions point of view, big infrastructure projects may solve a need which could possibly increase stability in an otherwise unstable country. This could also be the view that a regime takes in an unstable country, but it is less certain what the results might be if a country with worse conditions try this approach. A cynical point of view would be that these projects could be used to funnel money to other areas of interest, in other words, they could be prone to corruption. Regardless of which view is more correct in reality, this result raises some questions.

Voice and accountability was found to have a negative effect on the number of Greenfield PPPs with multilateral support. However, as this relationship only was significant in model 14, concerns can be raised about how robust this result is. If true, it would infer that less accountability would lead to more Greenfield PPPs with multilateral support. This is similar to the finding of Galilea and Medda (2009), who found that countries with perceived low democratic accountability can have higher performing PPPs, which was explained by the possibility of autocracies having more capacity to assist PPP projects. In contrast, more privately financed infrastructure projects are seen

in non-democracies when public sector corruption increases, according to Bertelli, Mele and Woodhouse (2021). Unfortunately, our study can't determine if this result relates to any of those two explanations. And if it does, we can't explain what role multilateral institutions would have under those circumstances.

A previous study by Hammami, Ruhashyankiko and Yehoue (2006), found that PPPs are more common in countries with previous PPP experiences. Because our study involves three different experience variables, we can draw some additional conclusions which helps with inference in relation to our research question.

Our results showed that successful PPP experiences have a strong positive effect on the number of PPPs and Greenfield PPPs with multilateral support. This would indicate that multilateral institutions would want proven track records before undertaking PPPs in a country, possibly because of the perceived lesser risk for potential projects. This is interesting as it can explain our finding that more PPPs with multilateral support are found in countries with political instability, as it implies that a proven track record is more important than any political stability. This would give support to the view that PPPs could be a solution to infrastructure needs in difficult unstable countries and possibly add security in the process.

Failed PPP experience was found to have a strong negative effect on the number of PPPs and Greenfield PPPs. Since Jiménez et al. (2020) found a negative relationship between corruption and the success of PPPs, this would mean that if corruption is one explanation for why PPPs fail, then our results imply that corruption is not allowed to continue to the same extent. This backs the argument of corruption being "sand in the wheels" in terms of the usage of PPPs.

Previous PPP experience with multilateral support was found to have two different effects. Firstly, a positive effect was found on both the number of PPPs and Greenfield PPPs. Multilateral support seems to work, likely because of the experience and knowledge that is brought with them. As a result, the country will engage in more PPPs

in the future, because the knowledge they gained translates into their ability to undertake PPPs. Secondly, a negative effect was found on the number of PPPs and Greenfield PPPs with multilateral support. This is explained by the role of the multilateral institutions, in which they act as a teacher, showing how to engage in PPPs with all their knowledge and experience. If done correctly, for each project a multilateral institution does in a country, they will be less needed for the next time, which is the case as evidenced by our findings.

7. Conclusion

The objective of this study was to investigate if there is a relationship between corruption and the usage of PPPs. This led to the formulation of two research questions: Is there a relationship between the use of PPPs and perceived corruption? And if so, does this relationship support the "sand the wheels" or "grease the wheels" perspective on corruption? To answer these questions, a Poisson Fixed Effects Model was fitted to the data. Regarding the first question, a positive relationship was found between control of corruption and the number of PPPs and Greenfield PPPs with multilateral support. Which makes us conclude that more corruption will lead to less PPPs with multilateral support. It is important to note that no such relationship was found regarding PPPs and Greenfield PPPs without multilateral support.

Regarding the second question, our findings suggest that this relationship supports the "sand the wheels" perspective on corruption. This is illustrated by a few reasons. First, corruption leads to less multilateral support. Multilateral support in itself brings knowledge which has a future positive effect on the number of PPPs in a country. Second, despite the fact that political stability was found to have a negative effect on the number of PPPs with and without multilateral support, other findings still pointed us towards the "sand the wheels" perspective. For instance, successful PPP experience has a positive effect on the number of PPPs with multilateral support, indicating that a proven track record is more important than political instability. Additionally, failed PPP experience has a negative effect on the number of PPPs, because corruption has a negative effect on the success of PPPs (Jiménez et al. 2020), this indicates that

corruption is not allowed to continue to great extent if it affects the success of PPPs. Thus, corruption would lead to fewer future PPPs in accordance with the "sand the wheels" perspective.

Despite the findings presented in this study being rather clear, more research can be done to further investigate and potentially support these findings. One potential area could be about regulatory quality. This study demonstrated the importance of regulatory quality for the future number of PPPs in a country, but it is not known how this relates to corruption. A possible research question could be if regulatory quality decreases the need for potential corruption. Lastly, for more research to happen, it is important to note the lack of available data regarding corruption, infrastructure and PPPs. Most data regarding infrastructure and PPPs are either behind a paywall or simply not available. Data regarding corruption is even less available, if it even exists. A suggestion for policy makers is to acknowledge the problem and investigate if there are ways to increase data collection in regards to these matters and to make it available.

In conclusion, this study found that corruption leads to fewer PPPs with multilateral support, and this relationship is an example that corruption "sand the wheels" in regards to the usage of PPPs.

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9. Appendix

Table 8: Missing Observations

Variable	Missing Observations
Control of Corruption	21 missing values (0.79%); 2625 valid values (99.21%)
Rule of Law	11 missing values (0.42%); 2635 valid values (99.58%)
Regulatory Quality	30 missing values (1.13%); 2616 valid values (98.87%)
Government Effectiveness	29 missing values (1.10%); 2617 valid values (98.90%)
Political Stability and Absence of Violence/Terrorism	29 missing values (1.10%); 2617 valid values (98.90%)
Voice and Accountability	17 missing values (0.64%); 2629 valid values (99.36%)
GDP per capita (current US$) (logged)	52 missing values (1.97%); 2594 valid values (98.03%)
GDP growth (annual %)	58 missing values (2.19%); 2588 valid values (97.81%)
Inflation, GDP deflator (annual %)	58 missing values (2.19%); 2588 valid values (97.81%)
Population, total (logged)	8 missing values (0.30%); 2638 valid values (99.70%)

Table 9: All Included Countries in the Sample

Afghanistan	Dominica	Madagascar	Serbia
Albania	Dominican Republic	Malawi	Seychelles
Algeria	Ecuador	Malaysia	Sierra Leone
American Samoa	Egypt, Arab Rep.	Maldives	Solomon Islands
Angola	El Salvador	Mali	South Africa
Antigua and Barbuda	Equatorial Guinea	Marshall Islands	South Sudan
Argentina	Eritrea	Mauritania	Sri Lanka
Armenia	Ethiopia	Mauritius	St. Kitts and Nevis
Azerbaijan	Fiji	Mexico	St. Lucia
Bangladesh	Gabon	Micronesia, Fed. Sts.	St. Vincent and Grenadines
Belarus	Gambia, The	Moldova	Sudan
Belize	Georgia	Mongolia	Suriname
Benin	Ghana	Montenegro	Swaziland
Bhutan	Grenada	Morocco	Syrian Arab Republic
Bolivia	Guatemala	Mozambique	Tajikistan
Bosnia and Herzegovina	Guinea	Myanmar	Tanzania
Botswana	Guinea-Bissau	Namibia	Thailand
Brazil	Guyana, CR	Nauru	Timor-Leste
Bulgaria	Haiti	Nepal	Togo
Burkina Faso	Honduras	Nicaragua	Tonga
Burundi	India	Niger	Trinidad and Tobago
Cambodia	Indonesia	Nigeria	Tunisia
Cameroon	Iran, Islamic Rep.	Macedonia, FYR	Turkey
Cape Verde	Iraq	Pakistan	Turkmenistan
Central African Republic	Jamaica	Palau	Tuvalu
Chad	Jordan	Panama	Uganda
Chile	Kazakhstan	Papua New Guinea	Ukraine
China	Kenya	Paraguay	Uruguay
Colombia	Kiribati	Peru	Uzbekistan
Comoros	Kosovo	Philippines	Vanuatu
Congo, Dem. Rep.	Kyrgyz Republic	Poland	Venezuela, RB
Congo, Rep.	Lao PDR	Romania	Vietnam
Costa Rica	Lebanon	Russian Federation	West Bank and Gaza
Croatia	Lesotho	Rwanda	Yemen, Rep.
Cuba	Liberia	Samoa	Zambia
Côte d'Ivoire	Libya	São Tomé and Principe	Zimbabwe
Djibouti	Lithuania	Senegal	