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The importance of non-financial determinants on public–private partnerships in Europe

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Abstract

In previous work regarding public–private partnership (PPP) arrangements the theoretical rationales and empirical results have mainly focused on analyzing the importance of quantitative features related to budget constraints deriving from public deficits, the existence of an infrastructure gap and the efficiency hypothesis. Thus, this study aims to identify the underlying determinants behind the proliferation and execution of PPPs, emphasizing the importance that non-financial (such as political, legal and macroeconomic) determinants have in establishing a PPP, as well as the factors that enhance the attractiveness of a country to encourage the private sector through PPPs in the European context.

The results of this study show that the macroeconomic environment – represented by economic freedom, competitiveness and the unemployment rate – is essential for PPPs, as well as the legal system, where regulatory quality and effective rule of law are associated with the effective execution of a PPP. The political environment and previous experience of PPPs are also key factors in making a country more attractive for establishing PPPs.

Keywords: Public–private partnerships; PPPs; Critical success factors; Attractiveness; Non-financial determinants; Europe

1. Introduction

While the public sector is traditionally seen as being responsible for providing public services, private sector firms have for some time been active in this area. During the 1980s globalization accelerated noticeably, and the OECD countries trended towards a reduction of the role the state has in the economy and society. Accordingly, a process began whereby the state's functions – namely the delivery of public services – were outsourced to the private sector.

Up to this point the state had held a magnanimous and almost omnipresent position in the economy, assuming full responsibility for delivering public services. Now, a paradigm shift occurred, triggered by the need for countries to cut back on their spending levels. In fact, the emergence of *New Public Management* (NPM) was primarily associated with the pressing need to downsize the public sector by delegating responsibilities to the private sector. Therefore, endorsement was given to the private sector intervening in public infrastructure projects and the delivery of related services — areas which the public sector had, up to this point, been exclusively responsible for (Khanom, 2010; Shaoul et al., 2012).

By the beginning of the 1990s there was a proliferation of public private partnerships (PPPs), establishing a new way of delivering services and triggering an entire redefinition of the roles played by the public and private sectors (OECD, 2008). In this context, PPPs asserted themselves as a key strategy in public politics.

The concept of PPP is not consensual. There are multiple models that change from country to country, applied to different sectors of activity, which undoubtedly creates a difficulty in establishing a univocal, unchallenged definition of PPP. As

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a hybrid concept, PPPs are organizational structures that use resources both from the public and private sectors (Shaoul et al., 2012), whose main goal is to de-bureaucratize the public services and to stimulate private initiative (Dunn-Cavelty and Suter, 2009).

Establishing a consensual definition of PPPs is difficult due mainly to the fact that they are applied to a broad range of models (Santos, 2006). Grimsey and Lewis (2005) also refer to the broad nature of the PPP concept, saying that they fill the space between state projects linked with traditional demand and total privatization which embodies a broad range of applications (Malone, 2005).

Some countries hold that the concept of PPP is only applicable to a concession where the services delivered in the context of that concession are paid by the public sector. However, other countries maintain a less restrictive conception, namely that PPPs include all kinds of outsourcing and joint venture between the public and private sectors (EPEC, 2010a, 2010b, 2011; DLA Piper, 2009).

While it is difficult to provide an undisputed definition of a PPP, the various definitions of the concept in literature display some characteristics which are common to all the aforementioned definitions and approaches. Firstly, there is always some form of cooperation between the state and the private sector (Dunn-Cavelty and Suter, 2009; European Commission, 2004) designed to explore synergies, resources and know-how in a bid to attain common goals, which could not be achieved without the collaboration of the other entity (EIB, 2004; Tang et al., 2010). And secondly, a contractual relationship exists where risk is shared and clearly apportioned to the entities of both parties (IMF, 2006; Shaoul et al., 2012: OECD, 2008, 2008; Sagalyn, 2007), which are established with a long-term view (Maskin and Tirole, 2008; Shaoul, 2011).

The literature on PPPs has recorded a set of factors that led to their popularity and consolidation as an alternative means to enact public sector investment policy for infrastructure construction and maintenance, as well as the provision of public services: the reduction of the infrastructure gap without compromising the tight restrictions on budgeting that countries face (Moreno, 2010); the budget restrictions, not only regarding the deficit (through temporary off-budgeting of expense), but also regarding public debt (enabling the deliverance of infrastructures and services "out of the Balance Sheet") (Cheung et al., 2009); saving the public sector's resources, avoiding projects in which the public sector has no previous experience and where its presence would not add any value (Cumming, 2007), enabling the allocation of scarce public resources to areas where no PPP style projects have previously been attempted (Guasch, 2004); and risk sharing, given that the private sector will strive to be more rigorous and strict with the public project (Shen et al., 2006) and the risk of budgetary slippage and delays in the project can be severely reduced (Cruz and Marques, 2011; Li et al., 2005).

Operational and cost-related factors are also important, such as the improvement in project efficacy/efficiency that results from the strict control and management competences provided by the private sector (Grimsey and Lewis, 2002) (given that the main goal of the private sector is profit-making) and a more effective use of financial resources (Engel et al., 2009; Guasch, 2004). A potential improvement in the project quality results from the knowledge and financial capability of the private sector (as a means of circumventing budget restrictions) (Martins et al., 2011), by using data and intellectual property in more productive ways (leading to significant improvements in the quality of public installations and the services provided) (Smyth and Edkins, 2007). Public services can also be provided more satisfactorily by using the competencies, experience, technology and innovation of private firms (Tang et al., 2010). Both total cost and the life cycle of a project can potentially be reduced by aggregating construction and operationalization, making the private entity responsible aware of the need for the operation phase to cover the large investment during the construction phase (Maskin and Tirole, 2008). Economic development depends on building infrastructures and providing inherent public services in areas such as health, water and sanitation (Brinkerhoff and Brinkerhoff, 2011).

The proliferation of PPPs is primarily a reflection of the recognized advantages they bring to the public sector. Despite these considerable advantages, PPPs encompass a set of negative features. The potential problems that can arise mainly affect the public sector. There are potentially higher costs of capital (Vitorino, 2005) and higher transaction costs (Cowen and Parker, 1997), which are proportional to the complexity and length of the partnerships. Efficiency and the quality of service may be negatively affected when the same entity is responsible for building and operating an infrastructure, as the best builder is not necessarily the best partner for operating or delivering the service (Maskin and Tirole, 2008) and contestability and competition become constrained (Brinkerhoff and Brinkerhoff, 2011; Colverson and Perera, 2012). Inflexibility, mostly associated with the contract exploration phase, is a negative aspect for the state (Government, 2005). Future generations may also be affected, as the way the PPP extends over time may considerably increase mandatory expenses and hidden debt. Transparency may also be lost, due to the difficulty in accessing information from the private sector (Colverson and Perera, 2012; Shaoul et al., 2012), and similarly there will be a loss of management control by the public sector during the time in which the service delivery is allocated to the private sector (Abadie and Howcroft, 2004).

In sum, PPPs are seen as a way of promoting added value, not only for the private partner (through the profit obtained) but also for the public partner (by reducing costs) (Martins et al., 2011). Following this perspective, Ng et al. (2012) claim that PPPs create a triple win scenario for the public sector, the private sector and the community.

Even though PPPs have been used extensively and been subject to close scrutiny, the analysis of the impelling factors in the establishment of these accords, in the perspective of both public governance agents and private agents is still very scarce, at least in what pertains to the European context. Therefore, and with the aim of mitigating this gap, the present study was realized with the objective of identifying the determinants in the execution of PPPs in the European context.

In this sense, this research is the first empirical study analyzing the motivations of both public and private sectors to establish a PPP in the European context. Thus, this study contributes to a better understanding of the reasons behind the proliferation of these partnerships and, in the same vein, of the factors that make a country more attractive to the private sector through PPPs.

The article has five sections. After this introduction, a literature review looks at the main aspects associated with establishing PPPs, bearing in mind the intrinsic and extrinsic factors. The third section presents the hypothesis resulting from the revision of the literature as well as the data description and the methodology used. In the fourth section, the results are presented and discussed. Finally, the fifth section features the main conclusions.

2. Literature review

PPPs must guarantee a win–win scenario for both the public and private sectors. As such, however unquestionable the advantages of a PPP and the difficulties associated with its life cycle – from its conception through to its implementation and management – the features which assure the success of PPPs must be identified. In fact, some authors have already studied this research line, as shown in Table 1. Their studies allowed us to understand which factors contribute to a successful PPP, and to rank them in a hierarchy of relevance. It is common practice for these studies to segment the success factors into broad groups, according to their similarity, thereby building homogenous categories.

Even if not homogenous, the list of PPP critical success factors by author allows us to draw some conclusions. Clearly, various authors have found evidence of the importance of economic and financial features, with a spotlight on the economic viability of the project, the macroeconomic conditions and the certainty that the PPP is the best approach when it comes to the costs.

Attention is also focused on the importance of forming a consortium with unquestionable technical strength, so that both parties together are well-versed in the know-how and technical skills needed to realize the project. Features such as a suitable allocation of risks and transparency and competitiveness during the search process are also important to a successful PPP.

After analyzing the conclusions of the studies carried out by various authors, a new classification and a new aggregation of the most common crucial factors of PPP success are proposed, as presented in Table 2. Thus, the crucial factors of success fit into two categories, according to their intrinsic or extrinsic nature.

Table 2
Classification of the key factors in success.

Factor typology	Success factors	
Extrinsic factors	Economic environment	– Favorable macroeconomic conditions
	Legal environment	– Institutional quality – Solid legal framework
	Political environment	– Stable political system – Government support
Intrinsic factors	Economic viability	– Financial resources – Profitability of the project
	Trust	– Commitment and responsibility among partners
	Risk management	– Suitable risk allocation – Transparent and adjusted contract
	Procurement	– Process transparency – High level of know-how from both partners

2.1. Determinants of the execution of public private partnerships

PPPs have become an appealing solution to the public and private sectors, meaning that the use of this approach is now quite widespread. However, although commonly accepted, it is still not properly understood why PPPs have become so popular (i.e. what the main factors are justifying the growing use of these partnerships, from the points of view of both the public and private sectors).

2.1.1. Budget constraints

The basic concept of a PPP appeared in the United Kingdom, when the British Government faced the need to provide infrastructure and public services without heavy reliance on the treasury (Cheung et al., 2009). According to Grimsey and Mervyn (2007), the first projects carried out in a PPP setting were primarily devised to engage the private sector in financing infrastructures and public services.

The services and infrastructures of public nature have always been considered as state assets of unquestionable importance to the population. However, as they require the expense of large amounts of capital, if they were financed only by the public sector they would create enormous pressure over the financial health of the state. Thus, the PPPs are a way the public sector found to be able to continue providing its intrinsic infrastructures and public

Table 1
Critical success factor of PPPs.

Li et al. (2005)	Zhang (2005a)	Zhang (2005b)	Ng et al. (2012)
Effective search	Economic viability	Social, political and legal risks	Technical factors
Project's feasibility	Suitable allocation of risk and reliable contracts	Economic and commercial conditions	Financial and economic factors
Government's assurances	Financial package	Public demand	Social factors
Economic conditions	Economic environment open to investment	Financial factors	Political and legal factors
Financial factors	Reliable consortium with technical strength	Problems related to the public sector	Other factors
		Problems related to the private sector	

services, without having to guarantee the whole financing (Cheung et al., 2009).

As a matter of fact, most countries face high infrastructural deficits, be it due to the deterioration of existing infrastructure or the need to meet new public needs. Besides the infrastructure gap, the state faces the imperative need to improve the efficiency and quality of public service provision, bypassing the hidden imperfections of the common practices in public management (Azevedo, 2008).

In this scenario, where structural deficits and high level of debt live side by side, PPPs have a vital role in allowing the state building infrastructures and providing public services. In this way, one of the main objectives of using PPPs lays in the reduction of the infrastructure gap without compromising the tight budget restrictions that states face (Moreno, 2010).

2.1.2. Market conditions

By resorting to PPPs instead of direct public investment, as traditionally occurred, the public sector seeks to increase and improve its delivery of public services and goods. While we can expect the public sector to choose a PPP as a way of circumventing tight budgetary restrictions and limited resources, it is also expectable that there is a clear opportunity for potential profit from the project (Hammami et al., 2006), as the latter is a crucial factor in attracting partners from the private sector (Zhang, 2005a).

Since projects for building infrastructures usually require a high initial investment and a long period to generate revenue, the commercial risks inherent to this kind of projects are high. Therefore, the market conditions of each country affect to a great extent the willingness of the private sector's agents to carry out PPP projects (Hammami et al., 2006).

Concerning market conditions, there must be a clear and perceptible need for the services to be provided. In fact, as Zhang (2005a) suggests, the level of demand of products and services to be provided on the long-term is a crucial factor of PPPs' success. Therefore, it has a vital importance towards convincing the private sector to accept the project (Cheung et al., 2009; Ng et al., 2012, Ozdoganm and Birgonul, 2000).

Supporting this fact, potential private partners from the sector see market size and purchasing power as inextricable factors in the attractiveness of PPP projects. In fact, the larger the market the greater the potential for considerable returns, given that large markets have a bigger number of potential consumers and are thus potentially more attractive. In the same way, the population's purchasing power is also an important influence on the attractiveness from the point of view of the private sector (Aliouche and Schlentrich, 2011).

2.1.3. Macroeconomic environment

The stability of the macroeconomic environment of a country plays a major role as a catalyst or inhibitor in attracting investors from the private sector (Chan et al., 2004; Galilea and Medda, 2010; Ozdoganm and Birgonul, 2000; Zhang, 2005a, 2005b). This feature is endorsed by Grilo et al. (2005) who consider that the committal of the private sector to investing in infrastructure projects is largely affected by the economic stability of a country. Therefore, it is to be expected that a stable economic situation is an essential factor for the success of a PPP and for engaging the private sector in these projects (Qiao et al., 2000).

According to Galilea and Medda (2010), a macroeconomic environment characterized by some volatility and instability might diminish the likelihood of success of PPPs while a satisfactory macroeconomic environment might enable a PPP to have positive results.

A stable macroeconomic environment is important to reduce the risks the private sector will undertake. Therefore, the economic policy established by governments greatly contributes to the creation and maintenance of a stable macroeconomic environment. The government contributes to a healthy economic environment through policies that promote a balanced budget and consistency of prices, thus creating a trust-based environment where the private sector can rely on (Li et al., 2005). As the macroeconomic conditions improve, the public sector acquires a bigger capacity to attract financing from the private sector (Dailami and Klein, 1998).

Two features should be highlighted on a macroeconomic level: competitiveness and economic freedom. Competitiveness can be defined as the level in which a country, given fair and free market conditions, can produce goods and services to international markets that increase the income per capita of its citizens, improving their quality of life (Castells, 1996). Competitiveness is closely related to structural elements which affect economic performance over the medium to long-term, such as productivity, innovation and competences (Fagerberg, 1996). Therefore, competitive economies lead to improvements in productivity and the available income of the citizens (Schwab and Sala-i-Martin, 2012).

When there is economic freedom, governments will allow free circulation of goods, capital and work and adopt a governmental posture which is not coercive or restrictive beyond what is strictly necessary to protect and maintain the economy (Miller et al., 2012).

One of the obstacles to establishing PPPs lays precisely in the existence of a clear ideological antipathy from the state to engage the private sector in its projects (Zhang, 2005b). It is clear that the higher the number of PPP projects, the higher the level of economic freedom, since this kind of agreement underscores the role played by the private sector in areas traditionally exclusive to the public sector.

2.1.4. Institutional quality and legal system

The willingness of the private sector to embrace PPPs depends upon the environment where the project is set (Zhang, 2005b). Therefore, investors see institutional quality as being particularly relevant, given its influence on the risks linked with the country.

The sustainably of PPPs depends heavily on the quality of institutions. To investors, countries where the quality of institutions is poor carry a high level of underlying risk. In these circumstances, investors will be less likely to participate in a PPP (Hammami et al., 2006).

Zhang (2005b) emphasizes the importance of creating a legal regulating framework in increasing the attractiveness of private partners to the investment. Non-existence of such frameworks may lead to a large proliferation of corruption.

It is pointed out that corruption is a feature which could have a negative influence in the economic growth of a country, since it leads to a decrease in the propensity of private entities to invest (Mauro, 1995; Mo, 2001). This scenario results not only from the disastrous concept of corruption, but also because it goes hand in hand, almost in symbiosis, with other forms of institutional inefficiency, such as excessive bureaucracy and a weak legal and judicial system (Mo, 2001).

The consequences of corruption in a given country can be noticed not only at the level of domestic investment, but also at the level of foreign investment. According to Wei (2000) and Morrissey and Udomkerdmongkol (2012), there is a verifiable relationship between corruption and direct foreign investment, where the level of corruption of a given country will usually diminish the willingness of foreign companies to invest.

To Galilea and Medda (2010), the more perceptible the level of corruption is in a given country, the harder it will be finding investors with the willingness to support a PPP (especially those with more experience in this kind of projects). Moreover, even if there are investors interested in a PPP project, there's a strong possibility that the selected private partner is the one with the highest disposition to bribes and collusion with the political power instead of the most capable one.

2.1.5. Political environment

In recent decades there has been a paradigmatic change in the way responsibilities for delivering services and public goods have been shared out between the public and private sectors (Besley and Ghatak, 2001).

The need to encourage the investment in public infrastructure projects unavoidably brings more financial pressure over governments, which makes private financing a viable alternative, therefore engaging private partners in an area typically bound to the public sector (Hammami et al., 2006).

After reaching the conclusion that the state did not have, per se, the capacity to guarantee the delivery of some public services and necessary infrastructures, the Conservative Party government in the United Kingdom introduced PPPs. However, it was under the Labour Party, with a left-wing orientation, that PPPs increased in the United Kingdom (Shaoul, 2011).

In fact, the use of PPPs is particularly popular with left-wing parties, since this approach allows them to explore the obvious political advantage of being able to invest in support structures to public services – especially defended by left-wing politicians – while at the same time avoiding ideological and political confrontations provoked by a complete privatization. Savas (2000) suggested that expressions such as subcontracting and privatization immediately generate some controversy. Instead, the term PPP is seen as more acceptable, mainly in those constituencies with a left-wing bias.

2.1.6. Previous experience in public private partnerships

The proliferation of this kind of partnership meant that there were inevitably some unsuccessful cases. Studying these cases allows the identification of problems and practices which lead to failure. Therefore, the knowledge acquired over various PPP projects provides a learning experience for the entities engaged in those projects. It is hoped that this will help avoid previous mistakes recurring, increasing the probability of success for new PPPs (Meunier and Quinet, 2010).

However, the previous experience when it comes to PPPs serves not only as an important learning asset but also as a reveling feature of the public sector's reputation in honoring its responsibilities when participating in PPP projects (Galilea and Medda, 2010). In fact, the credibility acquired by the public sector through previous and well succeeded projects – through a responsible behavior capable of honoring the established commitments – is unquestionably important to attract private partners to new PPPs (Hammami et al., 2006).

Previous experience in PPPs as a learning catalyst element is an important factor in the success of the projects (Hammami et al., 2006; Ng et al., 2012). This experience is relevant not only to attract private investment to new projects, but also to increase the confidence in the success of the ongoing projects (Galilea and Medda, 2010). In this way, countries with few experience in using PPP and even without any experience, feel more difficulties in successfully completing projects and attracting investment from the private sector.

On the other hand, the experience with PPP projects demonstrates that failures can occur. Even though these projects may provide a valuable learning experience, Hammami et al. (2006) defend that failed projects have the potential to discourage the investment of the private sector in future projects and even, investors.

3. Hypotheses, data and methodology

Examining the literature relating to the subject under study helped identify a set of factors which may influence the use of PPPs as a means of financing public infrastructure projects. Therefore, Table 3 summarizes the main hypotheses proposed, the corresponding independent variables and the source used to obtain the data.

The PPP value in euros was used as the dependent variable. Even though studying PPPs is very popular, there is no source that allows us to quantify the value invested in PPPs per country and per year in Europe. With the objective of building a database to study PPPs, the following procedure was implemented: whenever possible, data from the official sources of each country were used (given their proximity to the subject, they should be more in touch with the reality of their country). When that was not possible (i.e. when the country did not have an entity which recorded data regarding their PPPs or that data were not available), an individual survey of the projects executed in each year was performed. To do so, we used the information found on the available European PPP Reports, where this list of projects is based on data from the European PPP Expertise Center (European Investment Bank) and Infranews. We considered the projects which were financially concluded each year.

By using this methodology of gathering data, we mean to guarantee a sample with as many countries as possible, taking into account: a) the availability of data and b) countries present consistent values throughout the sampling period. Table 4 presents

Table 3
Hypotheses and explanatory variables.

	Hypotheses	Explanatory variables	Source
Budget constraints		Public Deficit in percentage of Gross Domestic Product (GDP)	EUROSTAT
	H1. There is a positive relationship between budget constraints and PPPs' execution.		
Market conditions		per capita GDP in PPPs	EUROSTAT
	H2. There is a positive relationship between purchasing power and PPPs' execution.		
		Population (log)	EUROSTAT
	H3. There is a positive relationship between market size and PPPs' execution.		
Macroeconomic environment		Unemployment rate	EUROSTAT
	H4. There is a negative relationship between unemployment rate and PPPs' execution.		
		GDP growth rates	EUROSTAT
	H5. There is a positive rate between GDP growth rate and PPPs' execution.		
		Index of Economic Freedom	*Index of Economic Freedom — Wall Street Journal and The Heritage Foundation*
	H6. There is a positive relationship between economic freedom and PPPs' execution.		
		The Global Competitiveness Index	*The Global Competitiveness Index — The World Economic Forum*
	H7. There is a positive relationship between competitiveness and PPPs' execution.		
Legal system		*Regulatory Quality Index*	*Regulatory Quality — The Worldwide Governance The World Bank's Indicator*
	H8. There is a positive relationship between regulatory quality and PPPs' execution.		
		Rule of Law Index	*Rule of Law — The Worldwide Governance Indicator*
	H9. There is a positive relationship between rule of law and PPPs' execution.		
Institutional quality		*Corruption Perceptions Index*	*Corruption Perceptions Index (CPI) — Transparency International*
	H10. There is a negative relationship between corruption and PPPs' execution.		
Political environment		Political Orientation of the Government Party	Database of political institutions of the World Bank
	H11. PPPs are more frequent in countries with left wing governments.		
Experience in PPP		*Dummy* for year–country with previous experience in PPP	
	H12. The establishment of PPPs is more prevalent in countries with previous experience in PPPs' execution.		

Note: The period (2000–2011) and the countries (Austria, Belgium, Denmark, Spain, Finland, France, Germany, Greece, Holland, Hungary, Ireland, Italy, Norway, Poland, Portugal, Sweden, UK) included in the sample were established to guarantee a balanced panel (with data for all the countries and all the years in the sample) for the explanatory variables.

the source used to obtain information regarding the dependent variable of each country in the sample.

The sample definition and the sampling period are related to the availability of data regarding PPPs' value. Thus, in this study the sample is composed of 17 European countries and pertains to the period comprised from years 2000 to 2011. The countries used in this study are mentioned in Table 4.

The empirical study used panel data analysis, which allows us to simultaneously account for the time series and cross-sectional nature of our data (Gujarati, 2006).

When specifying the econometric model, fixed and random effects models were considered (two estimation methods inside the panel data models). The difference between the two lays in the fact that the error term in the random effects model has two

Table 4
Source of the data to the dependent variable per country.

Countries	Sources
Germany	*PPP Projektdatenbank*
Austria, Belgium, Denmark, Spain, Finland, France, Greece, Holland, Hungary, Italy, Poland and Sweden	*European PPP Reports*
Ireland	*Central PPP Policy Unit*
Norway	*Nordic Investment Bank*
Portugal	Monitoring Office of the State's Business Sector, PPP and Concessions (GASEPC)
UK	*HM Treasury*

distinct components: one originating from the specificities of the entities and another originating from the temporal dimension. On the other hand, in the fixed effects model, the error term is only related to the temporal dimension (Hsiao, 2003; Gujarati, 2006).

Therefore, the fixed effects model is appropriate for analyzing the impact of variables that change over time. This model is suited to studying the causes of change inside an entity (Hsiao, 2003; Gujarati, 2006). In the random effects model the variation across entities is understood as being random and not correlated to the regressors included in the model. This model, by default, assumes that the error term is not correlated with the regressors, allowing the variables that do not change over the long term to play an important role as explanatory variables, which the fixed effects models does not allow (Johnston and Dinardo, 2001).

The commonly accepted way to decide whether to use a fixed-effects or random-effects model is by running the Hausman test. Its null hypothesis states that the random effects estimator is the most adequate (Johnston and Dinardo, 2001).[1]

Panel data models can be estimated even when there are severe deviations from the classical assumptions and "upon complex error compositions" (Marques and Fuinhas, 2012, p. 11). Inadequately addressing the existence of heteroskedasticity, panel autocorrelation, and contemporaneous correlation phenomena (in panel data models) can lead to inefficiency and biased estimates of coefficients and standard errors.[2]

Then, the panel data model should be complemented by carrying out some tests to verify the presence/absence of *heteroskedasticity*, cross-section independence and contemporaneous correlation. Furthermore, whenever there are divergences regarding the classical assumptions of the aforementioned cases, it is necessary to introduce the respective corrections, in order not to compromise the suitability of the results.

The procedure should be as follows: after testing for the presence of heteroskedasticity, panel autocorrelation, and contemporaneous correlation, if any deviation from the classical assumptions is detected, the Beck and Katz (1995) correcting factor – the Panel Corrected Standard Errors (PCSEs)[3] – should be applied. The PCSE estimator performs well in the presence of panel-level heteroskedasticity and contemporaneous correlation of observations among panels.[4]

Marques and Fuinhas (2012), who studied the robustness of the results obtained by the PCSE estimator in comparison to the results obtained by standard panel data estimators (fixed and random effects), concluded that the use of the PCSE model is indeed the most adequate one, providing the best results.

To empirically test the formulated hypothesis and taking into account the defined methodology, the following model was defined[5]:

$$\begin{aligned}\text{PPPvalue}_{it} = {} & \beta_0 + \beta_1 \text{Bdef}_{it} + \beta_2 \text{UmRat}_{it} + \beta_3 \text{GD\_pc}_{it} + \beta_4 \text{Pop}_{it} \\ & + \beta_5 \text{GDP}_{it} + \beta_6 \text{Efreedom}_{it} + \beta_7 \text{Comp}_{it} + \beta_8 \text{Reg\_qual}_{it} \\ & + \beta_9 \text{Rul\_Law}_{it} + \beta_{10} \text{CI}_{it} + \beta_{11} \text{PO}_{it} + \beta_{12} \text{Exper}_{it} + \mu_{it}.\end{aligned}$$

The designation of each of the variables expressed in the model and the identification of its sign can be found on Table 5.

4. Main results and discussion

The econometric analysis was performed using the Stata 11. Table A.1, in the appendix, reports the descriptive statistics.

Following the established procedure, an initial analysis of the data is made. The simultaneous use of several explanatory variables reveals some collinearity among them. Table A.2 (in the appendix) shows the correlation matrix for all of our explanatory variables. As expected, almost all the correlation coefficients among the different variables are significantly below 0.9, suggesting the absence of multicollinearity.

The Wooldridge test was carried out to test the presence of autocorrelation. The null hypothesis of no first-order serial correlation is not rejected. Following Baum (2001), the Modified Wald test was run to test for groupwise heteroskedasticity in the residuals of a fixed effects regression model. From Table 6 the null hypothesis is rejected and one can claim that the errors exhibit groupwise heteroskedasticity.

The existence of cross-section independence was tested by applying both the parametric testing procedure proposed by Pesaran (2004, 2007) and the semi-parametric tests proposed by Frees (1995, 2004) and Friedman (1937) either to the fixed-effects estimator (FEE) or random effects estimator (REE). In the REE and FEE models there is no unanimous agreement among the tests. The null hypothesis of cross-sectional independence in both the models (under an assumption of fixed and random effects) is rejected by Frees' test but accepted by Pesaran's and Friedman's

[1] See also, among others, studies from Ozcelik (2010) and Tarziján and Brahm (2014), for more information on the empirical methodology structure and degree of detail.

[2] "*Cross sectional dependency, in particular, has not merited specific attention and the most commonly used panel data, Random Effects Estimator (REE) and Fixed Effects Estimator (FEE), are far from appropriate in handling a context of both serial correlation and contemporaneous correlation*" (Marques and Fuinhas, 2012, p. 11).

[3] Which is the most efficient when the data do not have serial correlation (autocorrelation), comparing its results with those achieved from the classical panel data estimators (fixed and random effects).

[4] Additionally, it allows: the error term to be correlated over the countries, the use of a first-order autoregressive process for error term over time, and the error term to be heteroskedastic (Marques and Fuinhas, 2012; Cameron and Trivedi, 2009).

[5] In this model, β_k values represent the coefficients of the independent variables, i represents the entity (country) and t represents the temporal unit (year). μ_{it} represents the error term.

Table 5
Designation of the variables and expected signs.

Variable	Variable's designation	Expected sign
PPPvalue	Total value investment in realized PPP	
Bdef	Budget deficit	+
UmRat	Unemployment	−
GDP_pc	Purchasing power	+
Pop	Market size	+
tx_GDP	GNP growth rate	+
Efreedom	Economic freedom	+
Comp	Competitiveness	+
Reg_Qual	Regulatory quality	+
Rul_Law	Rule of law	+
CI	Corruption index	−
PO	Political orientation	+
Exper	Previous experience in realized PPP	+

tests (i.e. the balance of evidence from these tests suggests that residuals are spatially independent). On this basis, we assume that there is no evidence of contemporaneous correlation across the countries.

Through the Hausman test (the null hypothesis poses that the individual-level effects are adequately modeled by a random-effects model) it is possible to conclude that there is not enough evidence to reject the null hypothesis and that the random effects model is the most adequate for this study.

Table 7 displays the results of the model using the fixed effects and the random effects and applying the PCSE estimators. For the first two models, the results are presented without any model correction. In addition, the results are shown following a correction due to the existence of heteroskedasticity as detected in the preliminary tests.

The comparison between expected and obtained signs is presented on Table 8. Of all hypotheses empirically analyzed, only three are not to be statistically significant: H_2 and H_5, which considered the existence of a positive relationship between the execution of PPPs and the purchasing power and the GDP growth rate, respectively; and H_{10}, which considered the existence of a negative relationship between the levels of corruption and the PPP execution.

Budget constraints influence the execution of the PPPs (H_1). However, contrary to what was expected the sign for the estimated coefficient of the variable is negative (−50.421).

There is a significant literature supporting the idea that budget deficits encourage the use of PPPs as a way for the state to keep investing in public infrastructures — in fact, this is a scenario which is inseparable from the very origin of the PPP. However, it is also true that some studies conclude that this relationship does not exist. For example, Engel et al. (2013) showed that the high budget deficits which some countries face are not a determining factor in choosing to opt for PPPs but rather it is the efficiency gains that this option brings.

Table 6
Preliminary test results.

	Pooled	Random effects	Fixed effects
Modified Wald test (χ^2)			1974.12***
Pesaran's test		−0.236	−0.006
Frees' test		0.786***	0.958***
Friedman test		12.332	10.727
Wooldridge test F(N(0,1))	0.059		
Hausman test		12.78	

Note:
*** Significance level of 1%.

This negative relationship between budget deficit and the value of executed PPPs may be justified by the break of credibility of the government. In fact, Brunetti et al. (1997) tested the contribution of credibility in investment levels and countries' economic growth and concluded that investment and credibility of the government are largely correlated. Moreover, the larger the rating of the public debt of a country, the larger the capability of the government to attract private investors for infrastructure projects (Dailami and Klein, 1998).

As Brunetti et al. (1997) claim, the negative growth of public spending has a negative effect on the growth of the economy and, beyond that, the consolidation of public accounts encourages investment. Therefore, the lack of credibility of the government will affect the likelihood of the private sector to enter in into a PPP since the government is associated with an increased likelihood of not fulfilling contracts. This fact is in line with the results obtained with the rule-of-law indicator (law fulfillment), stressing the importance of confidence in the quality of the execution of the contracts.

For H_3 we concluded that market size is an important positive (1771.411) factor in carrying out a PPP. This may be explained by the fact that large countries have a bigger number of potential consumers and that they are more attractive to private investment given the opportunities they shape. As Albalate et al. (2011) and Hammami et al. (2006) concluded, the larger the population, the larger the number of PPPs.

On the other hand, it is understandable that countries with large number of inhabitants need more public infrastructures since it is supposed that those countries have to provide services to a larger number of people. Moreover, Zhang (2005a) and Ng et al. (2012) indicate that the level of demand of products and services to be provided by public projects is a crucial factor to the establishment of a PPP and to the engagement of the private sector in this kind of projects.

Only one of the hypotheses related to the macroeconomic environment (4 to 7), was not found to be statistically significant, which confirms the importance of stability in the economic environment of a country when implementing a PPP. This result shows that the macroeconomic stability of a country is an important factor for the success of a PPP, as well as for engaging the private sector (Galilea and Medda, 2010; Hammami et al., 2006; Ozdoganm and Birgonul, 2000; Qiao et al., 2000).

As expected, the existence of a negative (−129.841) relationship between the unemployment rate (H_4) and the execution of PPPs was confirmed. A country with a high rate of unemployment will naturally face an environment of socioeconomic instability, which will act as a discouraging factor to the engagement of the private sector in financing PPPs.

The level of economic freedom (H_6) of a country has a positive (120.594) impact on the execution of PPPs. As expected, and according to Heybati et al. (2011), the more economic freedom there is, the better conditions will be for deploying PPPs. This is firstly explained by the fact that countries with economic freedom

Table 7
Results of the application of the fixed effects and random effects models.

Dependent variable	PPPvalue						
Independent variables	Fixed effects		Random effects		PCSE		
	CSE	RSE	CSE	RSE	Corr(AR1)	Corr(psar1) rhotype(tscorr)	Hetonly
Bdef	−8.183	−8.183	−40.943	−40.943	−34.485	−37.010	−50.421
	(−0.24)	(−0.34)	(−1.53)	(−2.54)**	(−1.45)	(−1.81)*	(−2.28) **
GDP_pc	−0.021	−0.021	0.008	0.008	−0.0188	−0.0037	−0.017
	(−0.36)	(−0.26)	(0.25)	(0.35)	(−0.71)	(−0.18)	(−0.88)
Pop	24,381.01	24,381.01	1809.314	1809.314	1877.791	2109.15	1771.411
	(1.71)*	(1.18)	(3.12)***	(2.56)***	(4.70)***	(4.14)***	(5.30)***
UmRat	−118.994	−118.994	−109.695	−109.695	−126.401	−114.23	−129.841
	(−2.30)**	(−1.90)*	(−2.45)**	(−2.50)**	(−2.88)***	(−2.83)***	(−3.64)***
tx_GDP	33.914	33.914	35.307	35.307	30.321	14.456	35.640
	(0.82)	(1.03)	(0.93)	(1.52)	(1.33)	(0.67)	(1.08)
Efreedom	95.907	95.907	94.493	94.493	112.934	82.700	120.594
	(1.89)*	(1.21)	(2.33)**	(1.60)	(2.68)***	(2.43)**	(3.51)***
Comp	866.389	866.389	810.994	810.994	872.540	808.043	942.376
	(1.66)*	(1.31)	(1.62)	(1.23)	(2.13)**	(1.97)**	(1.80)*
Reg_qual	−63.204	−63.204	−79.766	−79.766	−137.483	−109.880	−145.940
	(−1.35)	(−0.99)	(−1.85)*	(−1.33)	(−3.34)***	(−3.25)***	(−3.91)***
Rul_Law	12.559	12.559	24.049	24.049	79.825	91.661	66.464
	(0.25)	(0.22)	(0.60)	(0.54)	(2.44)**	(2.60)***	(2.68)***
CI	23.988	23.988	151.379	151.379	284.279	394.684	202.757
	(0.09)	(0.12)	(0.71)	(0.88)	(1.57)	(2.29)	(1.29)
PO	65.581	65.581	114.152	114.142	199.639	167.055	221.349
	(0.61)	(0.46)	(1.12)	(0.77)	(1.59)	(1.49)	(2.22)**
Exper	600.840	600.840	725.595	725.595	764.843	932.737	855.319
	(1.97)*	(1.46)	(2.69)***	(2.02)**	(2.77)***	(4.23)***	(3.84)***
_cons	−180,361	−180,361	−18,416.91	−18,416.91	−19,999.28	−23,418.95	−18,096.27
	(−1.77)*	(−1.21)	(−2.92)***	(0.049)**	(−3.85)***	(−3.83)***	(−4.17)***
Observations	203	203	203	203	203	203	203
R^2/Pseudo R^2	0.1891	0.1891	0.3523	0.3523	0.2503	0.3363	0.3741
Ftest N(0,1)	2.76	10.54					
Wald (χ^2)			43.90	68.56	82.77	69.65	92.2

Notes: Between parentheses are the values of the Z and T statistics, for the random and fixed effects models, respectively.
***, **, and * refer to levels of significance of 1, 5 and 10%, respectively.
CSE: Conventional Standard Errors; RSE: robust Standard Errors; Corr(ARI): first degree autocorrelation AR (1) in which the coefficient of AR (1) is the same to all panels.
Corr(psarl) rhotype(tscorr): autocorrelation of the first degree in which the coefficient is AR (1) is specific to each panel. rhotype(tscorr) — calculus of autocorrelation time series; Hetonly: says that disturbances are usually understood as being only heteroskedasticity.

allow free circulation of goods, capital and work and, secondly, they do not have any ideological antipathy against the engagement of the private sector in projects of a public nature (Zhang, 2005b),

Table 8
Expected and obtained signs of the independent variables.

Variable	Expected sign	Obtained sign
Budget deficit (Bdef)	+	−
Unemployment rate (UmRat)	−	−
Purchasing power (GDP_pc)	+	+
Market size (Pop)	+	+
GDP growth rate (tx_GDP)	+	−
Economic freedom (Efreedom)	+	+
Competitiveness (Comp)	+	+
Regulatory quality (Reg_Qual)	+	−
Law fulfillment (Rul_Law)	+	+
Corruption index (CI)	−	−
Political orientation (PO)	+	+
Previous experience in executed PPPs (Exper)	+	+

which is an obstacle to the implementation of PPPs. Lastly, the level of competitiveness (H_7) also positively contributes (942.376) to the use of PPPs. This means that prosperous economies and with a high level of productivity influence the execution of PPPs.

These last two features, despite their macroeconomic nature, were analyzed with indexes which are based on a non-economic component, much more attuned with institutions, politics and factors that contribute to the productivity of the country. This fact supports the conclusion that the reasons for choosing a PPP are heavily related to features that go beyond mere financial indicators.

As expected, there is a positive (855.319) link between having previous experience in the execution of PPPs (H_{12}) and the establishment of new deals. In fact, having previous experience with PPPs is an important source of learning that contributes to the success of future projects (Hammami et al., 2006; Jefferies et al., 2002; Ng et al., 2012; Ozdoganm and Birgonul, 2000). This may also represent a valuable feature of the public state reputation, showing evidence of honoring their responsibilities, increasing the confidence of the private sector (Galilea and Medda, 2010).

The political orientation of the party in power (H_{11}) is also a determinant of the execution of PPPs (221.349). In this study, we find that governments with left-wing ideologies show a preference for using PPPs. This reality might be explained by the fact that PPPs provide the political advantages inherent to investment in infrastructures and public services (as particularly supported by left-wing parties), without creating political and ideological confrontations associated with total privatization. In fact, as Savas (2000) suggests, the term privatization immediately generates some negative public opinion. On the contrary, the term PPP is more easily accepted.

Finally, both hypotheses (H_8 and H_9) regarding the legal system are supported by the results — regulatory quality and rule of law are determining features in the execution of PPPs, as Hammami et al. (2006) concluded. When it comes to rule of law (H_9), it is understandable that countries that defend and value contractual fulfillment are more attractive to private sector investors (66.464). However, and contrary to what was expected, regulatory quality (H_8) is negatively (−145.940) related to the implementation of PPPs. Encouraging a favorable environment in the private business sector does not necessarily lead to increased cooperation between the private and public sectors (i.e. the introduction of favorable policies to promote the private sector does not increase the predisposition or necessity of the private sector to engage in PPP projects since this sector already has conditions to act with full autonomy).

5. Conclusion

While PPPs are a fairly recent solution, they have already been embraced as an alternative method of carrying out public projects. Their multi-sector and transversal character has popularized this approach to financing public infrastructures with governments.

The origin of PPPs lays with the state's need to reorient and restructure the public sector. Additionally, awareness has grown of the importance of encouraging the involvement of the private sector under the action of public governance, particularly when it comes to building infrastructures and providing public services using the financing capacities and the management of the private sector.

Even if the expansion of PPPs is a well-accepted reality, the study of the supporting factors of these deals, regardless of the private or public sector point of view is still scarce at least in the European context.

This study was carried out in order to mitigate this gap, i.e. to try to identify which are the determinants of PPPs' execution in the European context.

The results of this study provide an interpretation of the motivations which drive agents from both the public sector and the private sector to establish this kind of partnership, contrary to those usually accepted.

In fact, the largest part of the literature on the subject concentrates on analyzing the importance of quantitative features, mainly related to budget constraints deriving from public deficits. However, this study reveals the importance that political, legal and macroeconomic features have in establishing PPPs. Moreover, one of the central contributions of this study relates to the fact that several important variables which are enablers of PPPs had not been previously considered in studies related to this subject.

Historically, the literature on this subject predominantly studies PPPs following a financial perspective. Taking into account that this study provides evidence of the relevance of non-financial determinants, it would be particularly interesting if future research or studies in this area could explore new variables of a political, legal, macroeconomic and even cultural nature.

Conflict of interest

There is no conflict of interest.

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Appendix A

Table A.1
Data: descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum
Total value investment in realized PPP	204	858.4877	1619.6380	0	11,000.00
Public Deficit in percentage of GDP (Gross Domestic Product)	204	−1.7270	5.8099	−31.20	18.80
per capita GDP in PPPs	204	1.8280	2.6918	−8.54	9.30
Population (log)	204	7.7216	3.5699	2.50	21.70
Unemployment rate	204	30,911.4500	8947.9150	10,570.18	61,869.79
GDP growth rates	204	7.2000	0.4350	6.58	7.92
Index of Economic Freedom	204	7.2250	1.7773	3.40	10.00
The Global Competitiveness Index	204	1.9853	0.9441	1	3
Regulatory Quality Index	204	68.8706	6.1978	57.40	82.60
Rule of Law Index	204	5.0306	0.4913	3.92	6.03
Corruption Perceptions Index	204	88.5702	10.1222	64.08	100
Political Orientation of the Government Party	204	89.0513	8.0094	69.67	100
Dummy for year–country with previous experience in PPP	204	88.0748	11.3423	60.10	100

Table A.2
Correlation matrix.

	Public Deficit in percentage of GDP (Gross Domestic Product)	per capita GDP in PPPs	Population (log)	Unemployment rate	GDP growth rates	Index of Economic Freedom	The Global Competitiveness Index	Regulatory Quality Index	Rule of Law Index	Corruption Perceptions Index	Political Orientation of the Government Party	Dummy for year–country with previous experience in PPP
Public Deficit in percentage of GDP (Gross Domestic Product)	1.000											
per capita GDP in PPPs	0.2764***	1.000										
Population (log)	−0.4932***	−0.1193*	1.000									
Unemployment rate	0.4291***	−0.2081***	−0.4829*	1.000								
GDP growth rates	−0.3236***	−0.034	0.3629***	−0.2862***	1.000							
Index of Economic Freedom	0.4868***	0.005	−0.5492***	0.6188***	−0.3453***	1.000						
The Global Competitiveness Index	−0.039	0.025	0.096	−0.1827***	0.001	−0.087	1.000					
Regulatory Quality Index	0.1205*	−0.068	−0.3901***	0.5473***	−0.2953***	0.6719***	−0.002	1.000				
Rule of Law Index	0.5155***	0.1175*	−0.5330***	0.4895***	−0.2578***	0.8978***	−0.090	0.5568***	1.000			
Corruption Perceptions Index	0.4693***	0.035	−0.5316***	0.5873***	−0.3559***	0.9253***	−0.1281*	0.6179***	0.8840***	1.000		
Political Orientation of the Government Party	0.3052***	0.005	−0.5667***	0.5499***	−0.3265***	0.8902***	−0.035	0.8211***	0.8327***	0.8656***	1.000	
Dummy for year–country with previous experience in PPP	0.4287***	−0.012	−0.5137***	0.6248***	−0.4042***	0.9335***	−0.049	0.6584***	0.8661***	0.9558***	0.8825***	1.000

* $p < 0.1$.
*** $p < 0.01$.

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