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Does EU support contribute to economically successful Public-Private Partnerships (PPPs)? A panel data analysis of road PPP projects in Spain

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Abstract: The EU infrastructure policy has relied on Public-Private Partnerships (PPPs) as a means to successfully deliver infrastructure of benefit for the EU. To reach its infrastructure policy objectives, the EU has implemented support mechanisms aimed at facilitating the delivery of PPPs. This article is aimed at evaluating to what extent these mechanisms have actually contributed to improving the economic performance of PPPs. To that end, we have selected the case of Spanish road PPPs for empirical analysis. The main result shows that EU support positively influences the economic performance of PPP projects. This is caused by the fact that the EU conditions its financial support on a project's meeting a set of requirements that help assure the success of the project. From this result, we obtain a set of conclusions that may be generalised to other cases, and provide a contribution to the body of knowledge on PPPs.

Key words: European Union, financial support, infrastructure financing, panel data, public-private partnerships

Introduction

The relationship between infrastructure and economic development is well established and shows that infrastructure may positively contribute

to economic growth and productivity (Estache and Garsous 2012; Garsous 2012; Égert 2015). Public-Private Partnerships (PPPs) are an acknowledged model to deliver infrastructure that has been privately financed and to encourage private sector technology and innovation to improve the efficiency and quality of public services. Even though there is no single internationally accepted definition of PPP (Klijn and Teisman 2003; Bovaird 2004), a recent update of the Public-Private Partnership Reference Guide conducted by the World Bank (2017) 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".

Over the past few decades, this mechanism has gained popularity worldwide partly because of the large benefits it provides to governments (Lawther 2000; Osborne 2000; Nisar 2007). As a consequence, a great number of projects have been delivered through PPPs in countries with different levels of development with very diverse results. Although many PPP projects have been successfully developed, providing greater value for money, many others have encountered problems (see Esty and Kane 2001; Ragazzi 2005; Clifton and Duffield 2006; Athias and Saussier 2007; Guasch et al. 2008; Bain 2009; Chung 2009; Chung-Yuang 2010; de Brux 2010; Evenhuis and Vickerman 2010; Meunier and Quinet 2010; Vassallo and Pérez de Villar 2010; Vassallo et al. 2011; Iseki and Houtman 2012) that led to poor performance or even bankruptcy. This fact has drawn attention to the importance of determining the factors that may affect the future performance of this type of project, so as to be able to guarantee their success over time and protect the public interest (see Hardcastle et al. 2005; Zhang 2005; Kwak et al. 2009; Chan et al. 2010; Ryan 2012; Liu et al. 2015; Sabry 2015).

This article will focus on public support as one of the means to promote the success of PPPs. The success of PPP projects includes a set of different criteria, including economic, technical (quality, transfer of technologies, technical innovation and so on), social (jobs creation, health improvement, congestion reduction and so on) and environmental aspects, among others. In this article, we decided to evaluate only the economic performance for several reasons. First, other performance characteristics, such as environmental and social aspects, are difficult to handle as there are scarce data available about these indicators for infrastructure projects over time. Second, the economic performance of PPP projects is an essential aspect for avoiding bankruptcy, which in many cases poses great difficulties for the government and taxpayers.

The research presented in this article intends to evaluate whether European support is acting as an enabler for the proper evolution and

sustainability of the PPPs' economic performance over time. Since the establishment of the EU common transport infrastructure policy in the 1990s, there has been a clear policy from the European Commission to support the use of the PPP mechanism to boost the development of the Trans-European Transport Networks (TEN-T) (European Commission 2008). To ease the development and financing of PPPs, the EU has been gradually facilitating the blending of PPP projects with existing EU grants for transport projects and has been implementing new support mechanisms especially designed for developing projects according to these schemes.

The analysis is applied to the Spanish road PPP projects, which represent a very interesting case in the EU context. Spain is one of the Member States with the longest tradition in the use of private financing for the promotion of infrastructure, being one of the countries in Europe with the highest volume and number of PPP projects in operation. Spain has been one of the biggest beneficiaries of EU support ever since its accession to the EU. Finally, nine road PPPs are now about to be bailed out by the Spanish government, and this may lead to negative consequences for the public budget and for society. This problem has generated heated debate on how to prevent this from happening, having a big impact on the media as well.

Some authors have studied public support for PPP projects from different points of view. Irwin (2007), for instance, conducted a thorough compilation of government guarantees and their effects in mitigating risks in infrastructure projects. Wibowo (2006), in his turn, provided a theoretical analysis of how different government support mechanisms – in-kind grants, subsidised subordinated loans and minimum income guarantees – can affect the expected rates of return by debt and private equity investors. At the time of the writing of this article, the scholarly literature dealing with EU financial support has been mostly focused on exploring their potential in attracting investors to finance infrastructure projects in Europe (Jacobsson and Jacobsson 2012; Scannella 2012; Zaharioaie 2012; Hellowell 2013). However, these studies have barely examined to what extent the EU aid actually influenced the ultimate outcome of PPP projects.

The article is structured as follows. Second section, right after the Introduction, explains the European support mechanisms for PPP projects. Third section defines the hypothesis we intend to demonstrate, sets out the objectives of this research and explains the reasons why we selected the variables included in the model and the selected case. Fourth section summarises the data we collected to conduct this research and establishes the methodology by explaining the panel data specifications. Fifth section displays the results. Finally, last section sets out the main conclusions, policy recommendations and suggestions for further research.

EU financial support for PPP projects

Ever since the Trans-European Networks (TEN) policy was founded in the 1990s for transport, energy and telecommunication, the EU has been promoting financing mechanisms to support projects of common interest. Originally, these mechanisms were mostly of two types: grants provided by the budget of the EU, either through the so-called TEN-T line or through regional policy instruments such as the Cohesion Fund (CF) or the European Regional Development Fund (ERDF), and loans provided by the European Investment Bank (EIB).

Since the mid-1970s, the EU has been channelling financial aid through structural funds, mostly ERDF and CF, in order to assist the least favoured regions and countries, with the aim of narrowing their development gap and achieving a higher economic and social cohesion within the EU. The cofunding rates and budget allocation offered by the grants from the ERDF and the CF depend on how far below the European average is the region/Member State's gross domestic product (GDP)/gross national income (GNI). Financial aid to PPPs from ERDF and CF may be channelled in two ways: (i) as a defined percentage of the construction cost of shadow toll and availability payment projects, or (ii) as a variable grant to cover the funding gap of real toll projects. The funding gap refers to the maximum subsidy that an economically viable project that is unable to meet its total costs from user payments can benefit from, and it is equal to the value that is sufficient to make the project financially viable (European PPP Expertise Centre (EPEC) 2011).

The EIB is the largest multilateral lender and borrower in the world, and it provides financing for sustainable investment projects, which contribute to promoting EU policy objectives: the increase of growth and employment potential, the improvement of economic and social cohesion and the furthering of environmental sustainability (EIB 2011). Projects applying for EIB's cofinancing are assessed and graded according to the level of value added by the EIB's potential investments, as needed for each project. To that end, three aspects are assessed: (i) a project's quality and soundness – it must be viable from an economic, financial and technical point of view and meet strict environmental and social standards (EIB 2017); (ii) a project's contribution to EU objectives; and (iii) the financial and nonfinancial impact of the EIB support on the project. Then, projects that pass this multiple screening assessment are studied individually. A funding decision on a case-by-case basis is taken, depending on the circumstances of the individual projects. Moreover, projects have to be tendered according to the EU procurement rules, thereby ensuring publicity and real competition. Regarding the project financing, the Bank has flexible financing structures for PPPs, which adapt to the needs of each project,

strengthening their economic viability (European Economic and Social Committee 2005).

The debate concerning the funding of long-term projects has grown considerably in the past few years in Europe. Good connections are essential for Europe's growth and competitiveness (Christophersen et al. 2014). However, two strong concerns characterise European infrastructure investment in the context of the current financial crisis.

First, there are a number of constraints limiting long-term financing for large-scale infrastructure in Europe (Medda et al. 2013; Christophersen et al. 2014). After the financial crisis, banks have become both more risk averse and less willing to provide long-term financing, owing to the increase in macroeconomic risks and the greater capital and liquidity requirements imposed under the Basel III regulation. As for the capital markets, they were seriously affected after the demise of the "monoline" insurance companies and the introduction of the new Solvency II Directive, which reduces incentives for long-term loans (Rosales and Vassallo 2012). In addition, the sovereign debt crisis in some Member States has led to a drastic reduction in public sector investments in infrastructure and in the number of projects that reach the market.

Second, many European countries still need to improve the quality of their infrastructure to boost their competitiveness. Although the infrastructure gap between the original and the new EU members has been reduced in the past few years, some important differences still remain. Moreover, in some western EU countries, the quality of the infrastructure has deteriorated owing to the lack of maintenance.

As a consequence of the two aforementioned points, the EU has renewed its interest in PPPs as one of the vehicles to increase investments in infrastructure (European Policy Centre 2012), considering crucial providing support for promoting PPP projects to deliver infrastructure. Therefore, the European Commission has created innovative financial instruments to facilitate long-term financing for European infrastructure. Among these financial instruments, the most important ones are the Loan Guarantee Instrument for the Trans-European Transport Networks (LGTT), the Project Bonds Initiative (PBI) and the Marguerite Fund (MF).

The LGTT was designed jointly by the European Commission and the EIB with the aim to attract the private sector in the financing of the TEN-T through PPPs. The private sector financing is considered to be crucial to the success of the TEN-T development. The purpose of this financial instrument is to improve the ability of the borrower to service senior debt during the initial operating period (ramp-up) by covering the demand risk that is inherent to PPPs. Thus, the implementation of these projects can be accelerated (EIB 2014).

On the basis of the experience of the LGTT, the EU launched the PBI in 2010. The idea behind the PBI consists of using EU funds for credit enhancement to increase the appetite of institutional investors – such as pension funds and insurance companies – to finance large-scale infrastructure of Europe-wide benefit. Institutional investors seem to be potential buyers of securities that finance long-term projects (European Commission 2011; Scannella 2012; Vassallo et al. 2016).

In 2010, the MF (2020 European Fund for Energy, Climate Change and Infrastructure) was launched. This instrument was promoted by Europe's leading public financial institutions (EIB, Caisse des Dépôts et Consignations, Cassa Depositi e Prestiti, Instituto de Crédito Oficial, Kreditanstalt für Wiederaufbau, PKO Bank Polski). It is a pan-European equity fund that acts as a catalyst in the implementation of strategic European policy objectives and the development of primarily greenfield infrastructure in the European transport, energy and mature renewable sectors.

The essential objectives of the financial EU support are to contribute to economic growth, to the sustainability of public finances and to creating jobs (Scannella 2012; Zaharioaie 2012; Christophersen et al. 2014). Therefore, the financial instruments previously described play an important role in the economic development of EU countries by promoting European integration and sufficient connection among infrastructure networks.

Hypothesis, selection of variables and description of the selected case

Hypotheses

Receiving EU financial support provided by either the EU or the EIB depends upon a project's strict fulfilment of economic, social and environmental requirements (EIB 2004; EPEC 2011). The EIB, for instance, not only conducts a thorough and rigorous analysis and assesses in detail each project, but, once a project is selected, is closely involved in all stages of its life cycle, from design to procurement, and subsequent monitoring during its operation (Thomson et al. 2005). Because of this fact, projects receiving EU support are expected to be better structured by, for instance, having a more reasonable risk allocation matrix, and experiencing a more rigorous follow-up. Moreover, EU-supported projects are required to undergo strict feasibility studies, which are intended to prevent decisions based only on political criteria of the national and regional governments.

In addition, projects supported by the EU have to be tendered in accordance with EU procurement rules ensuring publicity and real competition. Competition not only makes collusion and corruption less likely to occur, but it leads to lower procurement costs, which benefit the public sector. As the number of bidders increases, the winning bid should tend to the lowest possible

procurement price (Estache and Iimi 2008). This point, together with the fact that the EIB tends to work with all bidders during the procurement phase, assures that the tender selected is economically the most advantageous and that the benefits of EIB involvement are passed to the public sector. Furthermore, there is an "excessive profit principle" regarding EU funding, whose main objective is to avoid the creation of excessive profits for their beneficiaries. Therefore, a balance between financial sustainability and maintaining project costs at reasonable levels is mandatory for a project to receive EU funds.

The hypothesis we adopt in this article is that those projects supported by the EU will have *ceteris paribus* a higher economic performance than those that did not receive economic support. The hypothesis is based not only on the fact that EU financing has a positive influence on the project's stability and bankability, but also on the fact that the EU requirements provide a clear added value to the project, both enhancing and assuring its economic feasibility and resiliency.

Dependent variable

The dependent variable that we chose for this article is the evolution over time of the economic profitability (EP) of PPP projects. The EP measures the earnings before interests and taxes (EBIT) of the concessionaire, calculated for every project, divided by the total assets (all financial resources) of the company at a certain time.

Burja and Burja (2009) indicate that EP is an important indicator for financial analysis as it reflects the level of economic viability of the firm necessary for highlighting, planning and controlling its performance and competitiveness. There is a burning academic debate about the effectiveness of EP as a good proxy for measuring economic performance. Harris (1988) reports gross measurement errors in accounting-based measures of EP. Feenstra and Wang (2000) and Fisher and McGowan (1983) in their turn criticise the fact that EP is based on published economic statements that may hide the real economic performance of a certain company. Holian and Reza (2011) suggest using other metrics, such as economic value added (EVA), as an alternative measure.

The EP is measured after the construction phase, when the final account is settled and the financial and economic results can be ensured, and it is not affected by the different financial structures (equity versus debt) of the projects. For PPP projects, it is a relevant criterion, given the clear incentive to hasten the construction phase so as to accelerate the rate of return (Chan et al. 2002). Moreover, as a performance measurement, profitability can be used as a key indicator of the project's evolution over time and acts as a management tool for continuous improvements (Takim and Akintoye 2002).

Another performance indicator available in many databases is the financial profitability, which measures the EBIT of the concessionaire divided by the equity of the firm at a specific time. However, in our view, this performance indicator is not suitable for the analysis, as it is highly influenced by strategic decisions of the firm, such as dividend distribution, capital increase, accumulated losses and so on.

In the end, we decided to use EP as the dependent variable for this research as, unlike other metrics such as EVA, EP is available in many databases that record the information in a homogeneous manner. Moreover, when EP is recorded in companies using the same accounting rules, most of the shortcomings previously mentioned are minimised.

EP has been used before with the same purpose in the literature (Kangari et al. 1992; Horta et al. 2012). Profitability is a proper measure of the economic performance of projects, and concessionaires are well aware that, in a context of increasing competition, the project must be successfully managed to be profitable. In addition, project managers consider profitability as a critical indicator for a project to successfully perform (Menches and Hanna 2006).

Explanatory variables

Regarding the explanatory variables, they have been selected based on a review of the literature on success factors for PPP projects, the specific characteristics of the selected case and the availability of data. The most important variable of our analysis will be a dummy showing whether the project received EU financial support.

As we intend to study the evolution of the EP over time, it is necessary to include a control variable capturing the evolution of the economy. Economic performance may be measured through variables, such as GDP or employment, either at the national or regional levels. However, when PPPs are demand-based, traffic is likely to be the most accurate factor for controlling economic performance (Liyanage and Villalba-Romero 2015). We will test these variables in our analysis, even though they are expected to be correlated to each other, and thus we would probably have to choose one of them. The expected sign for these variables is clearly positive.

Time may have also a clear impact on economic performance as, regardless of the evolution of the economy, EP tends to increase over time. This is because of the fact that project costs tend to increase at a slower rate than road demand volumes, causing the project's cash flow, and thus the EP, to increase gradually over time. The sign of this variable is expected to be positive.

Other variables that might explain the evolution over time of the EP are supply-side factors. In this research, we will consider (i) the average toll per

kilometer, as higher tolls tend to deter road users; (ii) the location of the road in the country with respect to interior and coastal roads, as the latter are expected to be greatly influenced by tourist demand; and (iii) the urban/interurban nature of the road, as changes in general transport costs tend to discourage long-distance trips to a greater extent than the shorter ones.

In addition to this, it makes sense to add some explanatory variables referring to the institutional environment. Stable macroeconomic conditions and sound economic policies have been found relevant for PPP projects in both developed and developing countries (Hardcastle et al. 2005; Zhang 2005; Chan et al. 2010). Moreover, the government experience in PPP schemes has been proved as an important driver of the success of PPPs (Ng et al. 2012). In our analysis, we will control for the different level of expertise between the central and the regional Governments of Spain by including a dummy variable that should be more favourable to the central Government.

A variable that may be worth studying is the type of EU support. Unfortunately, we were not able to make this distinction in the selected case, as the sample is not balanced enough to provide conclusive results about the different financial instruments. Our database includes 20 projects financed by the EIB, one project by the EIB + LGTT, one project by the EIB + MF and one project financed by the ERDF.

Finally, the literature (see e.g. Hardcastle et al. 2005; Zhang 2005; Abdel Aziz 2007; Ng et al. 2012) points out other success factors, such as the stability of the political environment in the country, the existence of mature and adequate legal and regulatory frameworks and the effectiveness of the procurement process (in terms of transparency and competitiveness). However, in our research they are not considered, as all projects are located in Spain and are subjected to the same regulatory context.

Reverse causality

One of the aspects that may arise in our hypothesis is the issue of potential reverse causality. Is EP supposed to be higher over time because the project is supported by the EU? Or does the EU support projects with a higher expected EP?

The fact of receiving EU financing does not imply that the project receiving it is better than the others. However, the PPP may end up being sounder and a better fit because every project financed by the EU must contribute to meeting one or more of the EU policy objectives. If the project does not meet these requirements, it will never be eligible for being supported by the EU regardless of its soundness and quality. On the other hand, the EU has a limited budget and, consequently, not all the projects

that comply with the EU requirements are able to be funded. For instance, projects that pass the EIB's assessment are presented individually to the Bank's Board of Directors, which decides on a case-by-case basis whether to provide financing as far as the budget allows.

Another important point to consider regarding reverse causality is that all PPPs in Spain were awarded in a competitive way, so the bidder who ultimately won the tender and ended up being the sponsor of the project estimated a rate of return according to the cost of capital of the project. This implies that all projects are supposed to be promising for investors at the beginning, regardless of whether the EU supported the project or not. The cost of capital of road PPP projects in Spain may be considered similar for all the projects of the sample, although there might be slight differences regarding risk perception. Consequently, no reverse causality is envisaged as the expected EP for investors will be similar for all projects regardless of whether they have been supported by the EU.

Moreover, neither the EIB nor any commercial bank would invest in a PPP project that does not foresee certain profitability. Every bank or investor conducts extensive due diligence work regarding different aspects (technical, legal, financial and so on), in order to assure that the project is sound and able to comply with the original requirements.

Selected case

We selected the case of road PPP projects in Spain for several reasons. First, data are homogeneous enough to be comparable across projects. Second, Spain has a big number of road PPP projects. Third, Spain is the European country with the longest total length of such roads, followed by Germany and France (SEOPAN 2015). Fourth, Spain has been one of the biggest beneficiaries of EU support ever since its accession to the EU.

With a total of 16,705 km, Spain has currently the longest high-capacity road network within Europe (SEOPAN 2015), and the third longest one in the world after China and the United States. Two main facts made possible the construction of a great part of this network: the large amount of EU financial support received ever since Spain joined the European Community, and the country's long tradition and extensive experience in developing PPPs.

Not only has Spain been one of the largest beneficiaries among EU members of both Structural and CFs – the largest amount of financing potentially open to PPPs – but it has also received financial aid from almost every European source available to PPPs, including TEN-T grants, EIB loans and financial engineering instruments such as the LGTT or the MF. Spain has received a great deal of EU financial aid because for a long period

of time the country has been eligible for receiving money from the structural funds (both CF and ERDF). Structural funds are redistributive funds, and thus less wealthy regions and Member States receive most of the support. Spain is a country with a large population and has been one of the less wealthy regions within the EU until its major enlargement in 2004 with new members from Eastern Europe. As a consequence, it has been one of the largest beneficiaries of EU funds during the first two programming periods (1994–1999 and 2000–2006). Since then, Spain has still been receiving Community funds in the form of grants, although to a minor extent, and especially EIB funding in the form of loans.

In addition, Spain is one of the countries with the longest tradition in the use of private financing for the promotion of infrastructure, especially in the field of transport. At the time of the writing of this article, road concessions represented 32.5% of the high-capacity network currently in operation (Vassallo and Pérez de Villar 2010; Ministerio de Fomento 2015), which gives an idea of the great extent to which this kind of financing has been used within the country over time. Moreover, the variety of the Spanish projects enables a more detailed study, which is useful to carry out, as project success often varies across type of project, type of contract and project characteristics, among others (Müller and Turner 2007; Liyanage and Villalba-Romero 2015). All this provides us with a sufficiently large database of road PPP projects to carry out the statistical analysis selected.

Definition of the model

To analyse the influence that EU financial support has had on the economic performance of road PPP projects, we built a panel data corresponding to 54 Spanish highways observed between 2009 and 2013. The sample includes highways with different degrees of maturity, all of them having an historic data set long enough for the statistical approach adopted in this article.

Econometric specification

Panel data models have many advantages over conventional cross-sectional or time-series models. They can take the individual heterogeneity into account allowing for more information, more variability and therefore less collinearity among variables in order to produce parameters that are more precise (Baltagi 2005).

Panel data involve two dimensions: a cross-sectional and a time-series dimensions. It refers to data containing time-series observations (time effects) of a number of individuals (individual effects). These effects are

either fixed or random. The fixed effects model assumes differences in intercepts across individuals by building a set of dummy variables included as regressors. Each individual has its own characteristics that may or may not influence the predictor variables. We use fixed effects models when something within the individual may affect the predictor variable and we need to control this. This implies that we cannot include group-level covariates among predictors in fixed effects models because they vary across the sample. Fixed effects estimators are often called "within estimators" because they remove all between-group variation and rely only on within-group variation. Therefore, the fixed effects method is not appropriate when the objective is to analyse the effect of group-level variables.

The random effects model, unlike the fixed effects model, is derived from both within-group and between-group variations. The random effects model captures the individual difference through error variance, assuming the same intercept across the individuals. In this model, the individual effects are uncorrelated with the explanatory variables. The main difference between fixed and random effects is whether the individual effect is correlated with the regressors in the model (Green 2008). Both models have advantages and limitations: the fixed effects model will produce unbiased estimates of the coefficients, but those estimates can greatly vary depending on the sample analysed; on the other hand, the random effects model will produce smaller standard errors, leading to more accurate estimates, but will probably introduce at least some bias in those estimates owing to omitted variables (Clark and Linzer 2015).

The fixed effects model does not seem suitable for our analysis, as we have two variables that are constant within a group (time invariant variables): *Contracting authority* and *EU support*. Therefore, we apply a random effects model. The selection between the fixed and the random effects model is given by the Hausman (1978) test.[1]

Final model

We have analysed several models with different explanatory variables before deciding the final one. In this section, we describe and explain all variables included in the previous and final model.

The dependent variable representing the project's economic performance is the annual EP of each concessionaire. These data have been collected from the unconsolidated annual accounts of every concessionaire obtained

[1] The null hypothesis underlying the Hausman test is that the fixed effect model and the random effect model do not differ substantially. If the null hypothesis is accepted, the conclusion will be that the random effect model is more appropriate than the fixed effect model. However, if a significant p-value is found, the fixed effect models should be considered.

from the SABI database. The most important explanatory variable of the model is a categorical variable showing whether the PPPs have received financial support or not.

We tested four potential explanatory variables to control for the evolution of the economy: (i) provincial employment, (ii) provincial GDP, (iii) provincial GDP per capita and (iv) annual average daily traffic (AADT). The variables were correlated with each other so in the final model we decided to include only the AADT because traffic is directly linked to the revenue obtained by all the projects (both real and shadow toll ones). AADT data were collected from the statistics of both the Spanish Ministry of Transportation (Ministerio de Fomento 2013) and of regional governments.

Another issue that has been considered in the model, given the common evolution of the financial flows of PPP projects and the variety of maturities among the sample, is the year of operation. Once a road PPP project is awarded, there is a period of time – which can vary depending on the type of project and its funding mechanism – comprising the construction or upgrading of a road section and the early years of operation during which project income is either very low or nonexistent. First, the road is being built and cannot hold any traffic, or is being upgraded and the traffic might be restricted. Second, in the case of new toll roads, there is the so-called ramp-up period comprising the first years of their operation. During this period, users get familiarised with the new toll road, change their travel patterns and recognise the potential time-savings of using the new infrastructure (Kriger et al. 2006). This period is therefore characterised by great instability of road demand levels and, consequently, of the project's EP. Because of these reasons, in the model, we did not include any greenfield project based on toll rates with less than six years of maturity. Table 1 shows a descriptive analysis of the continuous variables of the model.

To consider the experience of the contracting authority in delivering PPP schemes, a categorical variable distinguishing between projects awarded by the Spanish Government and the regional governments was considered. The Spanish Government has extensive experience in arranging this type of contracts, dating back to the 1970s. However, since the Law 13/2003 on works concessions was passed, many regional governments have launched a large amount of PPPs. The proportion of PPP projects awarded by each authority in the sample selected can be observed in Table 2.

We also tested the three supply-side variables mentioned in the previous section (the average toll per kilometer of the concession, the location of the road – interior or coastal – in the country and the urban or interurban nature of the road). However, neither of them were ultimately considered in the final model adopted, because previous calibrations demonstrated that they were not statistically significant.

Table 1. Descriptive analysis of continuous variables

	Economic profitability	AADT	Years of operation
Mean	0.027	21,219	13
Median	0.019	16,131	8
Variance	0.004	381,000,000	154.583
SD	0.065	19,523	12.433
Minimum	–0.423	2,737	1
Maximum	0.248	90,566	47

Note: AADT = annual average daily traffic.

Table 2. Share of financed road Public-Private Partnership projects in the sample according to the contracting authority

	EU financed		
Contracting authority	Yes	No	Total
Central Government	15	11	26
Regional Governments	11	17	28
Total	25	28	54

Table 3 summarises the information on the continuous variables for all the PPP projects selected and provides an overview of their evolution in the time period considered in the analysis.

The final model includes four explanatory variables: (i) the AADT volume of each PPP project; (ii) the number of years of operation until the year in which the EP is measured as a control variable of the projects' maturity; (iii) a categorical variable indicating whether the PPP project has been awarded by the central Government or by one of the regional governments; and, finally, (iv) the parameter of greatest interest for the study, a dichotomous variable indicating whether the project has received support by the EU or not.

$$\text{EP} = f(\text{AADT},\ \text{maturity},\ \text{contracting authority},\ \text{EU support}) \qquad (1)$$

In terms of econometric method, the random effects model can be estimated by the generalised least squares procedure, and in our study it is written as follows:

$$Y_{it} = \alpha + \beta_1 \ln AADT_{it} + \beta_2 NY_{it} + \beta_3 CA_{it} + \beta_4 EUF_{it} + \nu_i + \varepsilon_{it} \qquad (2)$$

where Y_{it} is the EP of concessionaire i at year t; α the single constant term; $AADT_{it}$ the average annual daily traffic in the road section awarded to

Table 3. Average values for Spanish Public-Private Partnership projects (2009–2013).

	Economic Profitability		AADT		Years of operation	
Concessionaires	2009	2013	2009	2013	2009	2013
ACESA	0.226	0.248	39,330	30,676	43	47
Accesos de Madrid	–0.003	–0.006	12,936	8,295	10	14
AP1-Europistas	0.115	0.121	21,553	17,586	36	40
AUMAR S.A.C.E.	0.213	0.213	21,554	16,166	41	45
Autoestrada do Salnes	0.004	0.000	14,774	13,129	5	9
Autoestrada Ourense Celanova	–0.002	0.005	.	3,315	1	5
Autoestradas de Galicia	0.050	0.111	11,404	8,977	15	19
Autopista Central Gallega (ACEGA)	0.007	0.002	5,865	5,559	10	14
Autopista Concesionaria Astur Leonesa (AUCALSA)	0.031	0.011	9,956	7,511	35	39
Autopista de la Costa Cálida (AUCOSTA)	–0.015	–0.036	3,174	2,737	6	10
Autopista de la Mancha	–0.001	0.005	21,461	18,762	2	6
Autopista del Atlántico (AUDASA)	0.077	0.049	26,500	20,658	37	41
Autopista del Sol (AUSOL)	0.041	0.025	29,471	25,229	14	18
Autopista del Sureste (AUSUR)	–0.002	–0.011	16,919	17,329	12	16
Autopista Eje Aeropuerto	–0.006	–0.014	19,609	17,880	7	11
Autopista Madrid Levante	0.002	–0.008	4,471	3,389	6	10
Autopista Madrid-Sur	0.002	0.005	8,835	4,652	9	13
Autopista Vasco Aragonesa (AVASA)	0.086	0.068	13,681	11,223	37	41
Autopistas de León, S.A. (AULESA)	0.008	–0.007	5,115	3,656	10	14
Autopistas de Navarra (AUDENASA)	0.095	0.064	19,657	17,186	37	41
Autovía del Camino	0.031	0.037	11,848	11,395	8	12
Autovía Conquense	0.002	–0.423	22,167	18,614	2	6
Autovía de Aragón	0.006	0.060	29,217	26,476	2	6
Autovía de Aragón-Tramo 1	0.017	0.031	85,030	88,450	2	6
Autovía de la Mancha	0.060	0.052	9,297	7,323	7	11
Autovía de los Llanos	–0.001	0.048	22,651	20,031	2	6
Autovía de los Pinares	0.008	0.011	6,491	7,629	4	8
Autovía de los Viñedos	0.026	0.028	5,844	4,652	7	11
Autovía del Arlanzón	0.000	0.026	19,000	17,860	2	6
Autovía Del Barbanza	0.002	0.024	11,717	11,469	4	8
Autovía del Eresma	0.009	0.026	5,831	6,528	4	8
Autovía del Pirineo	0.000	0.017	6,975	7,193	1	5
Carretera Palma-Manacor	0.010	0.034	13,425	13,565	6	10
Castellana de Autopistas	–0.034	–0.019	7,280	6,478	10	14
Cedinsa D'Aro	0.020	0.021	8,335	13,523	4	8
Cedinsa Eix del Llobregat	0.019	0.025	26,740	24,070	6	10
Cedinsa Eix Transversal	–0.004	0.036	11,364	10,400	3	7
Cedinsa TER	0.013	0.014	21,149	21,509	4	8
Concesionaria Santiago Brión S.A	0.014	0.017	14,390	15,800	5	9
Concesiones de Madrid, S.A.	0.073	0.077	72,424	67,877	11	15
Eix diagonal	–0.004	0.025	9,353	14,796	1	5

Table 3. *Continued*

Concessionaires	Economic Profitability 2009	Economic Profitability 2013	AADT 2009	AADT 2013	Years of operation 2009	Years of operation 2013
Euroglosa 45	0.072	0.038	74,429	75,605	11	15
Iberpistas	0.056	0.061	31,325	24,430	42	46
Madrid 404 Sociedad Concesionaria	–0.006	–0.015	11,959	11,268	1	5
Madrid 407 Sociedad Concesionaria	0.020	0.018	32,157	32,409	5	9
Puente del Ebro S.A.	–0.021	–0.017	3,536	.	1	5
Reus Alcover	0.016	0.022	19,986	22,638	4	8
Ruta de Los Pantanos	0.056	0.071	35,713	35,747	10	14
S.C. Autovía A-4 Madrid	–0.001	0.044	70,517	69,819	2	6
Sociedad Concesionaria A2, Tramo 2	–0.084	–0.039	20,767	18,341	2	6
Trados-45	0.082	0.085	67,546	64,700	11	15
Túnel de Sóller	0.083	0.091	7,861	7,606	21	25
Viario A-31, S.A	–0.228	0.057	33,183	26,174	2	6
Viastur	–0.003	0.015	18,227	17,961	5	9
Total	**0.023**	**0.027**	**21,774**	**20,307**	**11**	**15**

Note: AADT = annual average daily traffic.
Source: SABI database, Spanish Ministry of Transportation and regional governments' statistics

concessionaire i at year t; NY_{it} the number of years that concessionaire i has been in operation at year t; CA_{it} the contracting authority that awarded each road PPP project to concessionaire i at year t. This is a dummy variable, which takes 1 when the project is awarded by the central Government and it takes 0 otherwise; EUF_{it} indicates whether the road PPP project awarded to concessionaire i at year t has received European financial support. This is a dummy variable, which takes 1 when the concessionaire of the specific project did not receive European financial support, and it takes 0 when the concessionaire received any European support; v_i the unobservable random component that varies among the concessionaires; ε_{it} the error term that varies across each concessionaire i and year t.

Estimation results

In this section, we summarise the results of the random effects model applied to capture the differences across the 54 road PPP projects over time. Then, we analyse and compare the influence of the explanatory variables on the EP of the concessionaires.

We have analysed the Wooldridge test for autocorrelation in panel data and the results indicate that the data do not present serial correlation. We

Table 4. Estimation results and goodness of fit of the model

Variables	Random effects model		
	Coefficient	Robust standard error	p-value
ln(AADT)	0.019	0.004	0.000
Years of operation	0.003	0.001	0.000
Contracting authorities (Central Government)	−0.038	0.009	0.000
No EU support	−0.020	0.009	0.025
Constant	−0.178	0.043	0.000
R^2	0.7		
Observations	263		
Hausman test*	2.61		
	p-value > 0.05		

Note: AADT = annual average daily traffic.*The fixed effects model is rejected by the random effects model.

also have calculated the robust standard errors to correct for the possible presence of heteroscedasticity and to ensure valid statistical inference, as proposed by Baltagi (2013).

The Hausman test was used to determine the preferred model. This test shows that the random effects model is an appropriate specification compared with the fixed effects one (p-value > 0.05). Therefore, the results indicate that the random effects model performs better than the fixed effects model.

The estimation results are presented in Table 4. The random effects model indicates that all variables were statistically significant. The coefficient of determination $R^2 = 0.7$ demonstrates good model fit. The AADT and the years of operation have a positive influence on EP as expected, suggesting that larger AADT and years of operation are associated with a higher EP of the concessionaire. As stated previously, the EP of a PPP project tends to increase over time with the maturity of each PPP project.

Against our expectations, the results also indicate that PPP projects awarded by the central Government are associated with lower EP. The explanation behind this result seems to be external to governance issues and more related to the types of projects procured by the central Government compared with the regional ones. Although most of the projects delivered by the Spanish Government were financed through users' contributions, almost every project developed by the regional governments was financed through shadow tolls. Both types of financing are demand-based. However, the revenue of the shadow toll mechanism is less sensitive to traffic evolution.

Finally, the negative sign of *No EU support* provides evidence that PPP projects without European support are associated with lower EP. It means

that EU financial support positively influences the economic performance of road PPP projects.

Conclusions, policy recommendations and further research

As was already mentioned in the introduction, this article intends to evaluate, on the basis of the experience of road PPPs in Spain, whether EU support is actually an enabler for the good economic performance of PPPs, which is an important public policy goal for any government. Even though the results are obtained on the basis of the information coming from the case of Spain, they provide lessons that are broadly generalisable to other governments; they also provide additional knowledge to the field of research concerning public support for PPP.

The main conclusion of this research is that the public support to PPPs coming from an independent supragovernment authority, such as the EU, plays a positive role in promoting more economically resilient infrastructure PPPs. In the authors' view, there are two related reasons explaining this positive influence. First, the authority (the EU in this case) is neither the owner of the infrastructure nor does it have political pressure from the voters regarding the early completion of the project. Second, the supragovernment authority conditions the approval of the financial support to the fulfilment of a set of requirements – such as the socio-economic justification of the project, the completion of a set of procurement rules and so on – that will probably promote more rational PPPs.

In the case of Europe, this goal is achieved through the participation of the EU institutions (such as the EIB and the Commission) in all the stages of the project life cycle, thereby guaranteeing an independent view that may prevent national or regional governments from adopting decisions mostly based on political criteria. These facts make sure, at least to a certain extent, that the projects receiving support from a supragovernment authority are reasonable from the economic, environmental and social point of view. As a consequence of that, the larger the degree of politicisation in a certain country, the bigger will be the positive impact of the financial support provided by an independent entity.

As is well known, infrastructure policy in Spain has been highly dependent on political decisions, where key aspects such as location, size, governance model, funding approach and so on have been much more a consequence of discretionary decisions than of technical information (Benito et al. 2008; Ortega et al. 2016). This approach has implied that many road PPPs end up failing, with very negative consequences for the government and the society (Baeza and Vassallo 2011; Vassallo et al.

2012). In our view, the interpretation of the main conclusion of this article is not that projects supported by an independent supragovernmental authority (the EU in this case) have a better economic performance over time for the sole reason of being supported by them. Rather, it is because that supragovernmental authority ensures an independent supervision and evaluation of the project that prevents wrong decisions.

The main policy lesson of this article, which also contributes to theoretical discussions, is the fact that the support by an independent supragovernmental entity that conditions financial aid on the socioeconomic rationale of large infrastructure projects will effectively contribute to the economic stability of PPP projects over time. A practical message that may contribute to the better design of PPPs in many countries and regions is making sure that the entity in-charge of providing public financial aid to a certain PPP project does not have a direct political interest in promoting the project at any cost regardless of whether it makes sense or not. The incentive of this entity should be aligned, rather, with the achievement of the greatest added value for society as a whole.

Finally, some limitations of the article can be fruitfully addressed in future research. First, the results obtained are limited to the selected case of Spain and should be validated, especially considering the potential omitted variable bias derived from the use of the random effects model. The next step would be to extend this analysis to other European countries, and also to other cases worldwide, to evaluate whether the results are or are not similar to the ones obtained in Spain, and to determine why. Second, the limited sample did not allow for the analysis of the different types of EU support. Considering a bigger sample within the EU would enable that analysis and would shed greater light on the importance of the specific financing mechanisms. Finally, the unavailability of certain data limited the scope of the article. Given the fact that success should not be measured only by economic performance, this analysis could be applied to other key noneconomic criteria of success for infrastructure projects, such as environmental, social and quality aspects.

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Supplementary material

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