UNIVERSIDAD POLITÉCNICA DE MADRID
ESCUELA TÉCNICA SUPERIOR
DE INGENIEROS DE CAMINOS, CANALES Y PUERTOS

**IMPACT OF PUBLIC SUPPORT
MECHANISMS ON THE PERFORMANCE
OF PUBLIC PRIVATE PARTNERSHIPS**
An empirical analysis of road projects in Spain

DOCTORAL THESIS

LAURA GARRIDO MAZA

Ingeniero de Caminos, Canales y Puertos
Máster Universitario en Sistemas de Ingeniería Civil

Madrid, 2019

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LAURA GARRIDO MAZA

Ingeniero de Caminos, Canales y Puertos
Máster Universitario en Sistemas de Ingeniería Civil

Director:

José Manuel Vassallo Magro

Dr. Ingeniero de Caminos, Canales y Puertos

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EL PRESIENTE

LOS VOCALES

EL SECRETARIO

"You have to make it happen"

Denis Diderot

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Summary

Budgetary constraints are prompting many governments to encourage private financing of transport infrastructure through Public Private Partnerships (PPPs). In this context, financial support has been broadly used by both supra-governmental institutions and governments to improve the financial feasibility of these projects and attract private investors. Moreover, governments have also commonly resorted to this type of support either as a means to re-establish the economic balance of PPP contracts or help those projects facing financial distress. In this respect, the extent to which this support is being used wisely is a matter of public interest, given the high cost that the use of support mechanisms can entail and has entailed in the past, and the great uncertainty over the future performance of PPP projects. For these reasons, improving the knowledge of PPPs performance and the factors that may positively influence is key for governments implementing these schemes. Furthermore, assessing both the potential benefits and risks that these mechanisms may entail is crucial for governments considering their support to PPP projects, especially when they involve long-term liabilities.

The scientific literature analysing the impact of public support is scarce, particularly at the project level. Previous research intended to explore the effects of public support on the outcomes of PPP projects has relied mainly on experts' responses to questionnaires or surveys, but empirical analyses have been barely conducted beyond a few individual case studies. Moreover, very few *ex post* evaluations have been conducted to analyse the performance of PPP projects receiving support, and thus the effectiveness of the support provided. In addition, only few of them have incorporated sufficient perspectives in the analysis to evaluate the overall sustainability of the PPP projects or the adequacy of the support provided. Finally, little attention has been devoted to analysing governmental support for PPP projects, which, unlike that provided by supra-governmental institutions, risks being more discretionary.

Based on the above considerations, the objective of this thesis is about providing empirical knowledge on the impacts that the public support granted to PPP projects may have on the projects, the contracting authority and the society, taking Spain as case study. The research involves analysis at both the macro and the micro level to provide insight regarding the possible positive effects of public support on projects performance, and also the potential risks that poorly designed public support mechanisms can pose to governments and the society.

Particularly, a macro analysis is developed aimed at identifying those variables influencing the economic performance of road PPP projects, with a special focus on the impact of the public support received from the EU and the EIB. Based on a multiple regression and a panel data methodology, this analysis is applied at the national level, but analysing the impact of EU support at the project level. Likewise, a micro analysis is conducted aimed at evaluating the social and financial impacts of the public support provided by the Spanish government to a set of road PPP projects through subordinated loans. Based on a thorough *ex post* evaluation, the sustainability of the government's decision to support the projects is analysed taking into account the social benefits, the financial feasibility of the loan and the public interest. The thesis yielded some interesting conclusions and useful policy lessons and recommendations for governments when providing public support to PPP projects.

Resumen

Las restricciones presupuestarias están impulsando a muchos gobiernos a fomentar la financiación privada de las infraestructuras de transporte a través de asociaciones público-privadas (APP). En este contexto, tanto instituciones supranacionales como gobiernos han utilizado mecanismos de apoyo para mejorar la viabilidad financiera de estos proyectos. Muchos gobiernos también han recurrido a estos mecanismos, bien como medio para restablecer el equilibrio económico de los contratos, bien para ayudar a proyectos con dificultades financieras. En este sentido, la medida en que el apoyo público se está utilizando adecuada y racionalmente es una cuestión de interés público, dado el alto coste que el uso de estos mecanismos puede suponer y ha supuesto en el pasado, así como la gran incertidumbre que existe sobre el rendimiento futuro de los proyectos APP. Por estas razones, un mejor conocimiento del desempeño de las APP y de los factores que pueden influir en el mismo es un aspecto clave para los gobiernos a la hora de implementar estos esquemas. Además, la evaluación tanto de los beneficios como de los riesgos potenciales que los mecanismos de apoyo pueden conllevar resulta crucial para los gobiernos al respaldar proyectos APP, especialmente cuando implican compromisos a largo plazo.

La literatura académica en el ámbito de las ayudas públicas es por el momento escasa, especialmente en lo que se refiere a la evaluación de sus impactos a nivel de proyecto. Las investigaciones previas han basado sus análisis principalmente en las respuestas de expertos a cuestionarios o encuestas, pero apenas se han realizado análisis empíricos más allá de algunos casos de estudio. Asimismo, se han llevado a cabo muy pocas evaluaciones *ex post* del desempeño de APPs financiadas con ayudas públicas y, por tanto, de la eficacia de la ayuda prestada. Además, en muy pocas ocasiones se ha evaluado la sostenibilidad global de los proyectos o la idoneidad del apoyo proporcionado. Por último, se ha prestado poca atención al análisis del apoyo gubernamental a este tipo de proyectos, el cual, a diferencia de aquel que proporcionan las instituciones supra-gubernamentales, corre el riesgo de ser más discrecional.

Teniendo en consideración todo lo anterior, el objetivo de esta tesis es mejorar el conocimiento empírico actual sobre los impactos que el apoyo público concedido a los proyectos APP puede tener en los propios proyectos, la administración y la sociedad, tomando España como caso de estudio. La investigación comprende dos análisis diferenciados, a nivel macro y a nivel micro, con el objetivo de proporcionar una mayor comprensión de los posibles efectos positivos del apoyo público en el desempeño de los proyectos, pero también de los potenciales riesgos que un mal diseño de los mecanismos de apoyo puede conllevar para los gobiernos y para la sociedad.

En concreto, se realiza un análisis a nivel macro con el objetivo de identificar aquellas variables que influyen en el desempeño económico de los proyectos APP de carreteras, incluida la ayuda financiera recibida de la UE y del BEI. Basado en sendas metodologías econométricas de regresión múltiple y de datos de panel, este estudio se ha circunscrito al ámbito español. Asimismo, se ha efectuado un análisis micro para evaluar los impactos sociales y financieros del apoyo público otorgado por el Gobierno español a un conjunto de APPs de carreteras a través de préstamos subordinados. Sobre la base de una rigurosa evaluación *ex post*, se ha analizado la sostenibilidad de la decisión del Gobierno de apoyar los proyectos teniendo en cuenta los beneficios sociales, la viabilidad financiera del préstamo y el interés público. La tesis obtiene conclusiones relevantes para la administración, encaminadas a garantizar el interés público a la hora de respaldar APPs.

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PART I **INTRODUCTION:
FUNDAMENTALS AND OBJECTIVES OF
THE RESEARCH**

1 INTRODUCTION

This first chapter presents the introduction to the Thesis and the motivation that drives the research. At the end of this chapter, the structure of the doctoral thesis is presented in detail.

1.1 Motivation of the research

Different studies have shown the importance of infrastructure in promoting economic growth, social equity and productivity (Égert, 2015; Estache and Garsous, 2012). However, many countries in both developed and developing regions around the world face ageing or lack of infrastructure while, at the same time, deal with public funding constraints to control public deficit. This situation has led many governments to implement new mechanisms to encourage the participation of the private sector in the financing of transportation infrastructure (OECD, 2008). In this respect, PPPs and concession approaches have acquired a special prominence, particularly regarding the construction and operation of transport facilities. Through these schemes, the private sector delivers transport infrastructure and/or transport services that have traditionally been provided by the government. That way, governments can benefit from the expertise and efficiency of the private sector, and focus instead on policy, planning and regulation (Mcgroarty et al., 2015). In the last few years, many developed countries are also implementing this approach to upgrade and maintain brownfield projects.

Over the last few decades, this mechanism has gained popularity worldwide partly due to the large benefits it provides to governments (Lawther, 2000; Nisar, 2007; Osborne, 2000). As a consequence, a great number of projects have been delivered through PPPs in countries with different levels of development, with very diverse results. While many PPP projects have been successfully developed, providing greater value for money, many others have encountered problems (see Athias and Saussier, 2008; Bain, 2009a; Chung, 2009; Clifton and Duffield, 2006; de Brux, 2010; Evenhuis and Vickerman, 2010; Guasch et al., 2008; Iseki and Houtman, 2012; Meunier and Quinet, 2010; Ragazzi, 2005; Vassallo et al., 2011; Vassallo and Pérez de Villar, 2010) 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 projects (the so-called success factors), so as to be able to guarantee their success over time and protect the public interest (see Chan et al., 2010; Hardcastle et al., 2005; Liu et al., 2014; Sabry, 2015; Zhang, 2005).

Public support has been broadly used to encourage the participation of private investors in the financing of public infrastructure through PPPs. As an example, almost 63% of all PPP infrastructure projects that reached financial closure in the period from 2010 to 2014 had some form of government support (World Bank, 2016). Governments often provide support to PPP contracts through different fiscal support measures such as subsidies, capital contributions, traffic or exchange guarantees, to mention just a few examples. These measures have two main goals.

The first one is to ensure the financial feasibility of projects that, because of their positive externalities, are beneficial for society. The second aim is to mitigate risks that otherwise would be unmanageable by private stakeholders (Vassallo and Sánchez-Soliño, 2007). However, this form of government intervention may transfer significant risk of the project to the public sector, especially if the support mechanism or the conditions under which it is granted are not properly designed.

Supra-governmental institutions, such as the European Commission (EC) or the European Investment Bank (EIB) at the EU level, have actively promoted the use of PPP arrangements to boost the development of the infrastructure projects of interest for both the EU and the Member States. To that end, EU financial resources have been made available to the Member States for the development of PPP projects, either in the form of grants, loans or innovative financial instruments (Zaharioaie, 2012). In this respect, analysing whether this support is being used wisely is a subject of growing interest within the EU (European Court of Auditors, 2018).

PPPs usually involve the construction of large transport infrastructure projects, which are very sensitive to governments and the society for several reasons. They are costly, have great visibility to the public, and bring about great social benefits and large impacts on efficiency and competitiveness. In addition, termination payments constitute a common feature of many PPP contracts, which imply compensations to the PPP contractor in case of project default (EPEC, 2011a). These facts have made ensuring adequate performance of PPP projects an important public policy goal for many governments, given the potential costs for the society that the opposite may entail. In some cases, public support is provided to PPP projects experiencing financial distress in order to make them feasible again. In this context, it is equally important to guarantee that the public funds allocated to these projects are efficiently and effectively used in achieving their targets.

The literature aiming at studying the success factors for PPP projects has mainly focused on identifying the perceived factors that influence the performance or success of this type of projects. However, these studies show great differences in their approach and very little consensus on what these factors are (Effah and Chan, 2016). Furthermore, very few contributions have evaluated the impact that these factors may have on the perceived performance of the projects (Gunathilaka et al., 2013). On the other hand, the literature on public support to PPP projects have hardly examined the extent to which the support provided actually influenced the final performance of the projects. In addition, little attention has been paid to evaluating the overall impact that this support may have taking into consideration different perspectives.

The motivation for this doctoral thesis arises from the need to empirically analyse the impact of public support on the performance of PPP projects. On the one hand, it seeks explore to what extent this support, among other factors, is contributing to improving the outcomes of these projects. On the other hand, it intends to analyse both the negative and positive impacts from a global perspective that includes the performance of the projects, the social benefits and the financial feasibility of the support provided. The results can be considered of great interest for both governments and supra-governmental institutions that provide support to PPP projects. Finally, this research will identify relevant policy implications arising from the use of public support to help PPP projects and provide guidelines to governments that may implement these mechanisms in the future.

1.2 Thesis structure

The research is structured in 3 main parts and 7 chapters, which are identified with the necessary phases defined by the proposed methodology (see Chapter 3). The structure of the document and the research process is presented below.

PART I Introduction: fundamentals and objectives of the research

Chapter 1 presents the background and motivation for the doctoral thesis. **Chapter 2** introduces the PPP concept and the public support mechanisms available for these approaches. It also details the state of knowledge regarding the methods and approaches undertaken when attempting to measure PPPs performance and the impact of public support. **Chapter 3** shows the research objectives and questions, the hypotheses adopted by the author and the research approach. This chapter concludes with the selection of the case studies to be analysed in Part II.

PART II Methodological development of the case studies: analysis, results and discussion

Part II shows the Spanish context in which the case studies selected are framed, and shows the methodological development and analysis of the case studies, as well as the main results obtained. **Chapter 4** presents the Spanish context in which the case studies selected are framed. It summarizes the country's experience with PPPs and analyses the public support provided at governmental and supra-governmental level to PPP projects in Spain. Next, **Chapter 5** develops a macro approach towards analysing the impact of public support on road PPPs performance. It also identifies key factors influencing the performance of this type of projects. **Chapter 6** develops a micro approach towards studying the positive and negative impacts of public

support from a global perspective, taking into account the performance of the PPP projects, the financial feasibility of the support provided, the social benefits stemming from its use, and the public interest.

PART III Conclusions, policy lessons and recommendations, and further research

Based on the results of the previous chapters, **Chapter 7** shows the conclusions of the research carried out. First, the review of the degree of compliance with the objectives and research questions is presented. Then, the main conclusions and policy recommendations for governments providing public support to PPP projects are displayed. Finally, future research lines are shown.

REFERENCES AND ANNEXES

The references section includes all the scientific articles, documents, project reports, etc. consulted during the investigation. The final part of the document includes three annexes comprising the publications derived from the research and clarifications on the estimation of different parameters used in the micro approach.

2 STATE OF KNOWLEDGE

This chapter introduces the context in which the objectives of this thesis are framed. First, it includes an introduction to the PPP model, its main advantages and disadvantages. Secondly, it analyses the types of public support mechanisms available for PPP projects. Thirdly, it reviews the main variables previously considered when measuring the performance of this type of projects. Finally, it contains a literature review of the studies attempting to measure the impact of public support, with a special focus on those aimed at analysing its effects on the performance of PPP projects.

2.1 Public-private partnerships

2.1.1 What are PPPs?

Public private partnerships (PPP) 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. There is no single internationally accepted definition of Public-Private Partnership (Bovaird, 2004; Klijn and Teisman, 2003). Moreover, the concept of PPP may vary from country to country, since it is adapted depending on the country's needs, institutional framework and legislation. 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.»* This definition highlights some of the inherent features of this type of contract that differentiate it from traditional public procurement, which in general are:

- (i) The long duration of the relationship between the public and private parties.

PPP projects are granted for a relatively long but limited period of time, fixed or variable, that may vary depending on the country's regulation of this type of contracts. During this period, the private sector has the right to use the assets and exploit the facilities that has either built or rehabilitated, but they remain state-owned at all times. The greater duration of this type of contract reflects the time needed for the private sector to amortize the investments made with a rate of return appropriate to the risks assumed in the project (Guasch, 2004).

- (ii) The private involvement in the financing of the project.

In this type of arrangements, the private sector is responsible for raising the financing needed to carry out the investments required to develop the project according to the tendering specifications of the contract under the public sector supervision (Guasch, 2004). Notwithstanding the above, the government may also get involved in the funding of the project in order to make it financially viable, as will be explained in the following chapter.

The level of investment required from the private sector can greatly vary depending on the type of project to be delivered. In this respect, a distinction can be made between greenfield and brownfield projects. Focusing on road infrastructure, a greenfield project involves the construction of a new road from scratch whilst a

brownfield project comprises the rehabilitation or upgrading of an existent road. The main differences between both types of projects are the magnitude of the investment required and the level of risk assumed by the private sector. Greenfield transport projects not only require a larger amount of resources given the greater construction works they entail, but also face higher risks in the construction (expropriations, geotechnical, etc.) and operation (greater traffic risk due to uncertain demand) phases. As a consequence, this type of PPP projects requires greater rates of return.

- (iii) The private involvement during the main stages of the life cycle of the project.

Through PPP contracts, different life cycle phases of a project are bundled and, thus, developed by the same consortium of private companies. This bundling structure allows the private sector to optimize resources with a global and integrated vision. The degree of bundling of project phases during the contract period, and therefore the risks assumed by the private sector, may greatly differ from contract to contract. PPP arrangements may involve some combination of design (D), building (B), rehabilitation (R), financing (F), operation (O) and maintenance (M), which are always followed by the transfer (T) of responsibilities to the public sector at the end of the contract term. Thus, based on the different tasks and risks that are transferred to the private sector, different PPP models can be developed such as BOT, DBOT, ROT, DBFM, DBFMO, etc.

- (iv) The sharing of project risks between the public and private parties.

An essential feature of PPP projects is the distribution of risks between the public and the private sectors. A proper allocation of risks has been found essential for a PPP project to be successful (Hwang et al., 2013; Qiao et al., 2001; Zhang, 2005). One of the basic principles of the classical theory of risk allocation is that risks should fall on the party who is best able to manage or control them, and ultimately reduce them. The capacity to manage a certain risk must be understood from a threefold perspective: firstly, the capacity of the party to influence the risk behaviour; secondly, the ability to determine and control the likelihood of the risk occurring; and, lastly, the capacity to absorb the risk at the lowest cost (Irwin, 2007). The academic literature on risk allocation in PPP contracts agrees that global or unpredictable risks —force majeure, political and legislative risks— should be assumed by the public sector whilst project or market risks —financial risk, construction risk, operation risk or availability risk— should be borne by the private sector (Bing et al., 2005; Ke et al., 2010; OECD, 2008). It should be noted that the greater the risks allocated to the private sector, the higher the financial cost of the

project. A disproportionate allocation of risk to the private sector can even threaten the financial viability of the project, which might in the end require public support in order to guarantee its ultimate feasibility at the expense of greater risk being assumed by the public sector (Vassallo et al., 2012b).

(v) The compensation to the private party according to the services provided.

The private sector is remunerated during the contract term according to the specifications set out in the contract, which may be linked either to performance or demand, allowing the company to obtain a reasonable rate of return on its investments.

Based on the remuneration mechanism of the private sector, PPPs can be divided into three different models: real toll, shadow toll and availability payment projects. The risk assumed by the private sector greatly varies among the different approaches. The first two mechanisms transfer demand risk to the PPP contractor, which is remunerated according to demand levels. On its part, the third mechanism transfers availability risk to the private sector since its compensation is related to the performance of the project according to the criteria set out in the contract. These models are also differentiated according to the source of revenues, which may come from users, from the contracting authority or a combination of both. Thus, real toll PPPs are funded by the users of the infrastructure through the collection of fares whilst shadow toll and availability payment PPPs are ultimately funded by taxpayers since it is the public sector who remunerates the PPP contractor through budgetary resources. This fact makes shadow toll and availability payment PPPs more socially acceptable than real toll ones since users are not internalizing the toll component that is present in the generalized transport costs of explicit toll PPP users. Finally, there are also hybrid models in which the remuneration mechanism may depend on a combination of the service provided, the availability and/or the usage of the infrastructure (Aziz, 2007).

2.1.2 Advantages of PPPs

There are several reasons that have led many governments to resort to the PPP model as an alternative to the traditional public procurement for the delivery of infrastructure. Nisar (2007) points out three broad reasons why PPPs may be beneficial for the government: i) the benefit to the Treasury of undertaking public sector projects without increasing government debt or triggering the need for tax increases; ii) the fact of being a competitive and cost-attractive alternative to traditional public procurement; and, iii) the fact that they bring in proven project management expertise that frees up time and resources of public authorities that

may concentrate on more pressing policy issues (Lawther, 2000; Osborne, 2000). Many other arguments have been also used in favour of the PPP model such as improved quality of service, better risk allocation, better assessment of the infrastructure needs and its future usage, greater innovative capacity of the private sector, road safety improvements, intergenerational equity, etc. (European Commission, 2003; Harris, 2004; Rangel and Vassallo, 2015)

One of the main advantages of PPPs is that they allow accelerating the implementation of infrastructure. This model reduces the need to commit national budget resources, laminating (in the case of shadow toll or availability payment PPPs) and even reducing or eliminating (in the case of real toll PPPs) public expenditure, and allowing the social benefits arising from the project to be anticipated. Furthermore, in some cases, the alternative to the PPP model is not the delay in a project implementation, but the non-implementation of the project at all.

Another argument used in favour of the PPP model is that it is more time and cost-efficient than traditional procurement (HM Treasury, 2003; Liu et al., 2015). These efficiency gains stem from the integration of the project cycle in the same private consortium. In a PPP, the private sector manages the entire life cycle of the project, which normally involves design, construction, financing, maintenance and operation. This combination provides significant incentives to the private sector to shorten the construction phase and fasten the commissioning of the project and the delivery of the service in order to generate income. It also incentives the private sector to minimise costs over the whole life of the project (Fernandez et al., 2016; Iossa and Martimort, 2012). This does not occur in public procurement since each milestone in the life cycle is assigned to a different company, which therefore has partial objectives. As a result, PPP projects tend to generate fewer deviations in both schedule and budget.

One of the greatest benefits of the PPP model compared to the conventional model is the higher quality of service provided to users during the contractual period (Delgado Quiralte et al., 2007). This fact may be motivated by several reasons: i) the better allocation of incentives between the public and private sectors; ii) the greater flexibility of the private sector, which favours a more efficient management; and iii) the possibility of encouraging the concessionaire through performance-based contracts. This type of contracts allows the public sector to concentrate on planning, supervision and regulation, leaving the private sector in charge of providing the service as efficiently as possible. This separation of roles encourages each of the parties to perform the task they know best. The public sector supervises the service and watches over the interests of users and society. The private sector optimizes the

management of the service, reducing costs for society and improving the quality of the service.

PPPs are definitely an advantageous option when they produce a synergy value greater than the value that any party—public or private— can provide alone (Weihe, 2008). In this respect, the value for money produced by private sector management throughout the infrastructure life cycle is often mentioned by the literature as one of the key benefits of PPPs (Morillos et al., 2009; Nisar, 2007). Value for money is achieved insofar as risks are allocated to the party best able to manage and price them, which means that this party needs to have a certain ability to quantify, influence and mitigate these risks. However, in practice the main reason why many countries have relied on PPPs has been to circumvent budgetary constraints. One of the crucial challenges of PPPs nowadays is to assess their effectiveness compared to alternative procurement methods (Panda, 2016). In this sense, Hodge and Greve (2007) question that PPPs are always more effective and draw attention to the need of strengthening *ex post* evaluations.

2.1.3 Disadvantages of PPPs

PPPs may also experience important problems. The literature points out issues such as: opportunistic behaviour (de Brux, 2010); high levels of renegotiations (Guasch et al., 2008, 2007); unprotected public interest (Iseki and Houtman, 2012; Meunier and Quinet, 2007; Vassallo et al., 2011); asymmetries of information that might lead the PPP contractor to capture the regulator (Meunier and Quinet, 2010; Ragazzi, 2005); biased demand forecasts (Bain, 2009a; Chung, 2009; Evenhuis and Vickerman, 2010; Vassallo et al., 2011); rigidity of the contractual framework (Athias and Saussier, 2008; Clifton and Duffield, 2006); and over-commitment of budgetary resources for future generations (Vassallo and Pérez de Villar, 2010). Ryan (2012) explains that some of these problems may be solved through certain public sector guarantees and intervention.

One of the most distinctive features of PPP contracts is their incompleteness, as it is not possible to establish contractual clauses *ex-ante* that take into account all the circumstances that may occur over the life of the contract (Vassallo and Izquierdo, 2010). This fact has been identified as a starting point for parties' opportunism and rent seeking, and thus, one of the main sources of renegotiations in PPP contracts (de Brux, 2010). At this point, a difference should be made between renegotiations seeking to address the incomplete nature of PPP contracts as different contingencies not included beforehand arise over time, which may enhance the welfare of both parties; and opportunistic renegotiations, which enhance the welfare of one of the

parties to the detriment of the other. It is important to note that renegotiations imply significant additional costs for both parties that may include additional public support, contract term extensions and increasing rates among others, with the subsequent cost for the society. Thus, these costs may be only justified if the renegotiation outcomes improve the overall welfare of all stakeholders involved (Guasch, 2004).

Opportunistic behaviour, by either party, may arise at any stage during the contract term (de Brux, 2010). At the bidding stage, opportunism from the private sector may arise due to poor tendering specifications and award criteria, as well as to high levels of competition. When bid selection is mainly based on the price offered and there is high competition, bidders are highly incentivized to underestimate capital costs and overestimate demand forecasts in order to win the auction (Baeza and Vassallo, 2010), even by submitting offers that are not financially sustainable with the expectation of future renegotiations. Opportunistic behaviour during bidding processes, either because of poor estimation of construction costs or traffic demand, seems to be one of the main causes of renegotiation in PPP contracts since the majority of contract renegotiations take place within the first years after projects are awarded (Baeza and Vassallo, 2008a; Guasch, 2004). During the operational phase, the private sector may also misbehave by prioritizing its economic interest ahead of the public interest, for example, by underinvesting in maintenance and rehabilitation, leading to facilities in poor condition and even with safety deficiencies. Finally, governments have also behaved opportunistically and breached contract clauses, forcing PPP contracts to be renegotiated (Guasch, 2004).

Once the project is awarded, renegotiation takes place in a non-competitive context. On the one hand, the private sector may try to renegotiate the contract in order to increase its profits with respect to its original bid. On the other hand, the government may change the terms initially established in the contract by, for example, requesting additional works to the PPP contractor, which may alter the economic balance of the project. However, it should be noted that in these negotiations, the public sector is usually in a disadvantage position, given the greater termination and political costs that the failure of a PPP project may entail for the government.

Another drawback of PPP projects that has been greatly appointed in the academic literature is the inaccuracy of demand forecasts (Baeza and Vassallo, 2012; Bain, 2009a; Chung et al., 2009). Bain (2009a) analysed traffic deviations from forecasts of a sample of 104 international toll road projects over a four-year period. He found that there is a systematic tendency towards over-forecasting in this type of projects. Baeza and Vassallo (2012), on their part, analysed the inaccuracy of traffic estimates

in Spanish toll road PPPs. They found higher levels of overestimation than those obtained by Bain (2009a). Different factors have been suggested as common drivers of forecasting inaccuracy in toll road projects such as economic downturns, lower-than-expected time savings and willingness-to-pay of users, improvement of alternative roads, or larger ramp-up periods than expected, among others. However, there seems to be considerable consensus that optimistic bias is considered part of the strategic behaviour of bidders to win the contracts (Baeza and Vassallo, 2012; Bain, 2009a).

The rigidity of the contractual framework has been also pointed out as another shortcoming of PPP projects (Athias and Saussier, 2008; Clifton and Duffield, 2006), as it may restrict the public sector capacity to attend to the public interest. This is due to the fact that, in order to ensure fair competition, it is necessary to clearly define the rules from the outset and respect them during the life of the contract. However, as previously mentioned, this is no easy task since it is very difficult to regulate changes correctly from the outset in such long contracts. Thus, one of the main challenges in designing PPP contracts is achieving the proper level of flexibility that discourages opportunistic renegotiations, while allowing renegotiations that improve welfare (Clifton and Duffield, 2006). In this sense, there is a trend worldwide towards the definition of more flexible contracts and to ease their modification to incorporate specific needs over time (Domingues et al., 2014). At the EU level for example, a Directive¹ extending the grounds for contractual modification without the need for a new tender was passed in 2014. The aim is to ensure that this type of contract can evolve over time, adjusting in each case both to the changing circumstances that may affect the concession and to the specific needs of the general interest.

Finally, another disadvantage of PPP contracts, specifically those ultimately funded by the public sector (shadow tolls and availability-based PPPs), relates to the limitation of the public sector's long-term budgetary commitment as a consequence of the future obligations they entail (Vassallo and Pérez de Villar, 2010). As it was previously mentioned, in this type of projects, the granting authority commits itself to the payment of a fee, based either on demand or availability, throughout the entire contract term, which allows the rolling of the investment over this period. However, deferral of payment compromises expenditure for future years and reduces the margin available for contracting new works, giving rise to pressure to increase the budget in order to maintain the volume of works tendered at the levels of previous years (Puerto Cela, 2006) or to meet unexpected needs. This has great

¹ Directive 2014/23/EU of 26 February 2014

repercussions insofar as the future actions of a government are constrained by obligations acquired in the past.

2.2 Public support to PPPs

Public support has been broadly used to encourage the participation of private investors in the financing of public infrastructure through PPPs. These schemes are very appealing for governments since they allow building or modernizing infrastructure without unduly compromising public budgets, and benefiting from the experience and technology innovation of the private sector. As a consequence, this model allows governments to free up resources and optimize their investments in public infrastructure.

Although public incentives are not perceived as essential by private investors for their participation in infrastructure financing², the role of the public sector in subsidizing and/or incentivizing private sector participation may be crucial to raise confidence in the PPP market and to demonstrate government commitment. This is particularly important in emerging PPP markets where public entities still play a dominant role (OECD, 2014a), or even in mature PPP markets where an individual program is emerging or about to be launched (EPEC, 2011a). However, the difficulties in obtaining long-term financing for large-scale infrastructure projects in the aftermath of the financial crisis has hampered the implementation of PPP projects, increasing the need for public sector involvement and support even in mature PPP markets.

For instance, in the EU, the number of banks operating in the market decreased considerably after the crisis. In addition, they were less willing to take on the long-term financing of large projects due to increased macroeconomic risks and the restructuring in the banking market required under Basel III regulation (European Investment Bank, 2011). The new regulation imposes much higher capital and liquidity requirements on banks that intend to lend to projects that are too risky in the long term, limiting their ability to structure complex project finance offers. As far as capital markets are concerned, these were seriously affected by the demise of monoline insurance companies, until then responsible for providing credit enhancement insurance for financial products (loans, bonds, future cash flows, already structured securitisations, etc.) in exchange for a premium, and the

² See for example the case study conducted by Vassallo & Sanchez-Soliño (2007) of a set of Spanish motorways that were offered participative loans in the tender.³ Financial sustainability shall be understood as the capacity to finance current and future expenditure commitments within the limits of deficit, public debt and delinquency of commercial debt in accordance with the Law.

introduction of the new Solvency II Directive. The new regulatory framework requires higher capital charges, which increase with longer maturities and lower rating levels, thus reducing incentives for long-term borrowing, especially in those assets considered risky (Rosales and Vassallo, 2012). In addition, the sovereign debt crisis in some Member States led to a drastic reduction in both public sector investment in infrastructure and the number of projects reaching the market.

As a result, loan financing in Europe became more difficult, given the small number of active banks, and more expensive, because the cost of borrowing increased while loan maturities declined; bond financing became very limited due to the loss of confidence in the markets and the lack of incentives; and funding through public resources also declined due to continued tightening of fiscal constraints in many EU countries (Kappeler, 2012). Thus, many governments and supra-governmental institutions have implemented different policies and financial instruments intended to attract private capital for the development of large-scale infrastructure projects through PPPs and cope with the long-term financing gap in the sector.

2.2.1 Types of public support

Public financial support can be provided through different measures (Irwin, 2003): cash subsidies, in-kind grants, tax breaks, capital contributions and guarantees against risks inherent in this type of projects.

Cash subsidies or grants aim at either reducing the capital requirements of the project or increasing the return of an otherwise unprofitable project, and they can be provided both during the construction or the operational phase (OECD, 2014a). Grants provided at the construction stage decrease the need of private capital from lenders and equity holders, which results in higher returns for the private sector. These grants can be disbursed either at the contract stage or during works implementation, usually on a milestone-basis (Caselli et al., 2015).

On their part, grants awarded during the operational phase are usually intended to either increase the private sector's revenues or reduce its costs (OECD, 2014a). The first objective can be addressed through different means: the provision of revenue grants, which can be either in the form of periodic fixed amounts that protect the private sector against traffic shortfalls —thus mitigating part of the demand risk assumed by the private partner— or subsidies to the fare paid by the users, which can be partially or totally covered by the government (shadow toll) —thus leaving demand risk on the private sector—; and the implementation of availability payment schemes whereby the private sector is remunerated according to the level of service provided to the users; among others. Regarding the second objective, it is

usually achieved through public contributions to debt service, thus reducing the amount of interests paid by the private partner to its lenders. Some examples are provided in Table 2.1 below:

Table 2.1 Examples of public support mechanisms in the form of grants available to PPP projects worldwide

Country	Support Mechanism	Description
India	Up-front and performance-based grants	The Viability Gap Funding scheme (VGF) launched by the Government of India in 2005 provides capital grants (one time or deferred) at the construction stage to make PPP projects commercially viable. The amount of the grant is determined by a competitive bidding process but subject to a maximum of 20% of the project cost. Grants are only disbursed provided that the required equity contribution has been made. From 2005 to 2009, 23 PPP projects with a total investment of \$3.5 billion have received grants (3% of total private investment in core infrastructure)
Mexico	Grants for project studies and viability gap funding.	FONADIN is a VGF implemented in Mexico, managed by the national development bank of the country BANOBRAS, that provides grants to PPP projects so as to make them commercially viable for investors. Grants cannot exceed 50% of total investment, private investor equity must be at least 20% of total investment and revenues must be generated through user fees. The fund has made multiple contributions to PPP projects, especially in the transport sector. In 2010–2012, the Fund had a multiplier effect of 7, that is for every USD1 subsidised, USD7 of private investment in infrastructure were leveraged.
Pakistan	Outcome-based grants for capital and/or operational expenses	The Infrastructure Project Development Facility (IPDF) was implemented in 2006 to address the country's deficit in infrastructure funding by subsidizing PPP projects so that socioeconomically disadvantaged users can afford the services. Thus, the grant is used only to reduce the tariff charged to this group of users and its disbursement is conditional on the delivery of measurable outcomes by the private sector. Although it has been barely used at federal level, great results have been obtained at the provincial levels.

Source: Schur (2016)

In-kind grants are usually provided during the construction phase in the form of public assets, rights-of-way at subsidized prices or free of charge, or transfer of public land for their freely use during the concessional period. There are two main benefits for the private sector arising from this type of support (World Bank and Ministry of Construction of Japan, 1999): first, it allows the private party to avoid significant capital investments during a period where no revenues are perceived, and potential land acquisition delays that may defer the project's overall schedule; and second, to avoid different taxes and duties that may be imposed, depending on the country, on the acquisition and ownership of the land.

Some governments provide support by undertaking the construction of either part of the works or of related facilities —such as connecting or access roads, access ramps, etc.— that may be critical for the proper operation of the project and will be

transferred back to the government by the end of the contract., This support, however, entails three main risks for the private partner: delays in the acquisition of the land needed, construction delays and potential defects in the facilities carried out by the government (World Bank and Ministry of Construction of Japan, 1999).

The goal of **tax breaks or credits** is to reduce the tax burden of infrastructure projects, thereby increasing the cash flow of the projects and the return on investment of the private sector. Tax reliefs and breaks have been used in different countries such as Brazil, India, Italy and Spain to promote PPP projects. In Spain, for example, Law 8/1972 comprised a large set of tax benefits and exemptions from which concessionaires would benefit in order to attract the private sector and implement a PPP market. The road PPP projects developed under this law still benefit from these tax privileges. Regarding Italy, the “To Do” decree approved in 2013 introduced, in the context of the country’s recession, a tax credit and a reduction in the concession fee paid to the public sector for PPP projects worth more than EUR 200 million not benefiting from public subsidies in order to enable the private sector to reach the expected economic profitability of its investments (OECD, 2014a). Another example of tax incentives for PPP projects is that represented by the Private Activity Bonds (PABs) in the US. PABs are tax -exempt bonds issued by or on behalf of a local or state government intended to provide special financial benefits for projects that primarily benefit private entities, such as PPP projects. This type of bond reduces the private sector’s financing costs due to the federal tax exception, and have been greatly used to finance real toll PPP projects in the country (Perez et al., 2016).

Governments can also provide support through **capital contributions** or co-investment agreements —either in the form of equity, subordinated debt or any other type of debt contribution— by virtue of which, unlike subsidies, they seek to receive a level of return proportional to the size of the contribution and the risks taken in the project. Senior debt can be provided either at market conditions or at more favourable terms. In the first case, the loan is intended to meet the liquidity needs of the project whilst, in the second, it aims to enable the project meet the capital market expectations (Caselli et al., 2015). Subordinated debt on its part is aimed at improving the risk profile of the senior debt, mitigate liquidity risks and improve the project financing structure. Finally, equity contributions are intended to fill the equity gap that projects of such a big scale often face in meeting gearing requirements. Some examples are provided in Table 2.2 below:

Table 2.2 Examples of public support mechanisms in the form of capital contributions, either through the provision of debt or equity, available to PPP projects worldwide

Country	Support Mechanism	Description
US	Subordinated debt / Debt	The Transportation Infrastructure Finance and Innovation Act (TIFIA) program provides direct loans to qualified infrastructure projects of national and regional significance, with at least USD 50 million of eligible costs. TIFIA loans usually have low interest rates, offer flexible repayment terms and are limited to 49% of the project eligible costs. TIFIA loans can be subordinated, but in the event of bankruptcy they have the same lien that senior creditors.
UK	Debt	The first experiment was introduced in 2004, under the Credit Guarantee Finance (CGF) initiative. In March 2009, The UK Treasury established The Infrastructure Finance Unit (“TIFU”) to help financing PPP projects unable to raise sufficient debt finance at acceptable conditions during the financial crisis. The unit, wholly funded by the Treasury, was intended to provide state loans under market conditions to projects alongside with commercial lenders and the EIB. Both measures were abandoned shortly after their implementation, having made very few loans. Both measures were used in few cases.
France	Debt	The French government also implemented a debt instrument as a measure to mitigate the financial crisis. In this case, it was established an EUR 8 billion loan facility funded by saving accounts (“fonds d’épargne”), managed by the Caisse des Dépôts, available to large infrastructure PPP projects. The facility offers loans for up to 25% of the senior debt raised on advantageous terms; however, a public guarantee of some sort to support the loan is required.
Spain	Subordinated Debt	The Spanish Government has made use of a subordinated financial instrument called subordinated public participation loan (SPPL) either as an <i>ex ante</i> support mechanism or as an <i>ex post</i> means to rebalance the economics of concession and PPP contracts. SPPLs are a subordinated financial instrument whose main characteristic is that the lender would receive a variable interest based on the evolution of the outcomes of the borrowing company’s activity.
Belgium	Equity	In 2006, the public limited company Via-Invest was set up with the aim of promoting the use of PPPs to address the missing links and capacity bottlenecks of the Flemish road network. Via-Invest is a structural partnership between the Flemish Region (represented by the Agency for Roads and Traffic, and the Department of Transport and Public Works) and the investment company PMV. Via-Invest operates as a holding company for several SPVs and provides them with venture capital.

Source: Schur (2016); Caselli et al. (2015); EPEC (2011a) and OECD (2014a)

Finally, public **guarantees** and back-up liquidity facilities are agreements under which the government assumes some or all of the downside risks of a PPP project with the aim of improving its creditworthiness. The main risks that these guarantees seek to address are (EPEC, 2011a): (i) PPP contractor default risk, through termination guarantees or debt assumption undertakings; (ii) demand risk, through revenue guarantees; (iii) construction risk, through cost overrun guarantees; (iv)

technology risk; (v) sub-sovereign risk; (vi) political and regulatory risks; (vii) macroeconomic risks, through (foreign) exchange-rate insurances, loan or refinancing guarantees; and (viii) residual value risk. These risks may be either manageable (i.e. political-and-regulatory risks, exchange-rate risk in some cases, etc.) or not (demand risk, force majeure, etc.) by the government (Irwin, 2003). Some examples are provided in Table 2.2 below:

Table 2.3 Examples of public support mechanisms in the form of guarantees available to PPP projects worldwide

Type of Guarantee	Countries	Description and examples
Guarantee for refinancing risk	Korea Belgium	The Government commits itself to repay the lenders if the PPP company is unable to refinance its debt when it is close to maturity. In Korea, the Infrastructure Credit Guarantee Fund (ICGF) provides guarantees on the commitments of PPP companies, including the repayment of bridge loans. In Belgium, to lessen the impact of the financial crisis, the Flemish government implemented in 2009 a refinancing guarantee available for projects that had already been tendered or were ready for tender by April 2011.
Guarantee in case of default	Spain Turkey France UK	The government guarantees either the PPP company to be economically compensated or the lenders to be paid the outstanding debt in case the PPP contract is prematurely terminated following the bankruptcy of the PPP company. In Spain, there is a legal provision called " <i>Responsabilidad Patrimonial de la Administración</i> " (State's Financial Liability) included in the public contracts law that, before it was amended in 2015, committed the government to compensate the PPP company for the works that had been built and not yet depreciated in case of early termination of the contract due to bankruptcy. In Turkey, the PPP legislation contains a "debt assumption clause" whereby the Treasury assumes the outstanding amount of the loan still owed to creditors in the event the project is terminated for PPP company default. Most PPP contracts in France foresee the minimum and maximum levels of the outstanding debt to be covered by the sums due by the contracting authority following the termination of a PPP contract in case of default.
Loan Guarantee	US UK Italy Singapore Spain Portugal Mexico India	The government guarantees the lenders to service, partially or fully, their debt if the PPP company fails to do so. The TIFIA (Transportation Infrastructure Finance and Innovation Act) program provides loan guarantees to private creditors and standby letter of credit in the first ten years of the operational life of the project. The UK Guarantees Scheme (UKGS) offers government-backed guarantees to help infrastructure projects access debt finance where they have been unable to raise finance in the financial markets. The Italian export credit agency SACE SpA, owned by the Italian Ministry of the Economy and Finance, provides loan guarantees for strategic infrastructure projects in Italy, including PPPs. The Singapore government also provides guarantees on debt through the Infrastructure Guarantee Fund (IGF). In the late 1960s, the Spanish government also provided state-backed loan guarantees for up to 75% of the PPP companies' foreign loans to attract financing at a time when the country's PPP market had not yet taken off.

Type of Guarantee	Countries	Description and examples
Exchange rate guarantee	Spain	The Spanish government provided an exchange rate insurance against any increase in the cost of finance raised in the international market to road PPP companies in the period from 1967 to 1975, thus reducing their exchange rate risk. This measure, together with the loan guarantees for foreign loans provided, turned out to be a great financial burden for the government.
Revenue or usage guarantees	Turkey Italy Chile Brazil France Germany Korea	The Government guarantees the PPP company a certain level of usage (e.g. a minimum level of traffic on a toll motorway project) or revenue (e.g. if traffic revenue falls below a certain level, the Government covers the deficit). In Turkey, minimum revenue and traffic guarantees have been often used in PPP projects, especially for toll motorways and airports. In Italy, revenue support from the public sector has been used in some transport projects where the private sector assumed demand risk. The Chilean government has also made extensive use of minimum income guarantees in toll road and airport PPP contracts. This guarantee considers both minimum and maximum thresholds so that both losses and gains are shared between the parties. A similar demand risk mitigation mechanism has been also used in the PPP contract of the Fourth Line of the São Paulo Metro. BANOBRAS also offers guarantees that secure the availability payments committed to the PPP company during the operational phase. The “Cession de Créances” and the “Forfaitierungmodell” in France and Germany respectively pursue a similar objective. In these schemes, the State guarantees that the service charge it has committed to pay to the PPP company during the operational phase will not fall below the level that allows it to service the debt, regardless of the performance of the project.

Source: Schur (2016); Caselli et al. (2015); EPEC (2011a); OECD (2014a); Vassallo and Sánchez-Solís (2007, 2006).

In addition to the mechanisms implemented by governments, supra-governmental organizations such as multilateral institutions or development banks also offer different types of support to PPP projects. At the EU level, the most important supra-governmental support available is that provided by the European Commission (EC) and the European Investment Bank (EIB) (see Table 2.4 below). These institutions have also jointly implemented different mechanisms aimed at leveraging private finance so as to make PPP projects financially bankable (Garrido et al., 2017).

Table 2.4 Examples of public support mechanisms available to PPP projects at EU level

Support Mechanism	Type of Support	Description
The Cohesion Fund (CF) The European Regional Development Fund (ERDF)	Grants	The CF and the ERDF are grants that support the cohesion policy of the Union and individual EU Member States. They comprise the largest funding source potentially available for PPPs, both as a whole and at project level. Nevertheless, these grants are only available for those Member States less developed of the EU.

Support Mechanism	Type of Support	Description
The TEN-T program The Connecting Europe Facility (CEF)	Grants	The TEN-T program and its successor, the CEF, are sectoral-focused grants that promote investments in projects of pan-European interest. They are explicitly open to PPP projects that implement TEN-T schemes. Unlike the ERDF and the CF, every Member State, regardless of its level of development, is eligible to receiving financing from these programmes.
The Project Bond Initiative (PBI)	Subordinated debt	The PBI is a liquidity back-up facility launched in 2012 by the EC and the EIB that uses 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 interest in Europe. It has been applied to projects in the sectors of transport, energy, and ICT.
The Marguerite Fund	Equity	The Marguerite Fund is a pan-European infrastructure equity fund established to act as a catalyst in the development of infrastructure in the transport and energy sectors.
The EIB co-financing	Debt	The EIB is a EU's long term lending, not-for-profit institution owned by the Member States that supports projects of European interest. The Bank is one of the largest EU sources to promote PPP projects for transport infrastructure throughout Europe, particularly the TEN-T networks. It offers loans to PPP projects of EU interest for up to 50% of the total cost of the project. They are characterized by long amortizing maturities, capital grace periods and flexible financing structures that are adapted to the needs of the projects.
The EIB Loan Guarantee for TEN-T projects in the EU (LGT)	Loan guarantee	The LGTT provides guarantees to the private sector aimed at improving the ability of the borrower to service senior debt during the initial operating period (ramp-up) by covering the traffic risk that is inherent to PPPs. If the guarantee is called on, the EIB funds are subordinated to senior lenders and act as a typical credit enhancement mechanism.
The European Fund for Strategic Investments (EFSI)	Debt and Equity-type operations	EFSI is an initiative jointly implemented by the EIB Group and the EC in 2015 aimed at leveraging up to EUR 500 bn in investments in a wide range of EU policy areas, including transport. This is to be achieved by using EUR 33.5 bn of risk-bearing capacity, consisting of a EUR 26 bn guarantee from the EU budget complemented by a EUR 7.5 bn capital contribution from the EIB, that is expected to enable the EIB Group to provide over EUR 100 bn of additional financing to projects with a higher risk profile than that usually supported by the Bank.

Source: Garrido et al. (2016); European Court of Auditors (2019)

2.2.2 Benefits and drawbacks of public support

Public support has proven to be crucial in facilitating the feasibility of PPP projects. In this respect, Dias and Ioannou (1995) studied the financial effect of certain guarantees on the debt capacity of projects, and how they affect the optimal capital structure. They found that the presence of guarantees increases the debt capacity of the owning company as the project becomes less risky, as well as both the projects' net present value (NPV) and the investors' return on investment. On its part, Wibowo (2006) valuated the financial impact of different types of public support mechanisms —minimum income guarantees, subsidized subordinated loans, and cash subsidies— on the expected rates of return obtained by debt and private equity investors. He concluded that they all improve the NPV of the projects by increasing

the expected return on equity (ROE) of the companies. Furthermore, several authors have explored the potential of public support in attracting investors to finance infrastructure PPP projects (Hellowell, 2013; Jacobsson and Jacobsson, 2012; Scannella, 2012; Zaharioaie, 2012).

Public support also reduces the risks borne by the private investor at the expense of increasing the risk for the government. This may affect the value for money of the PPP solution which, in some cases, may end up being worse off compared to the conventional method of infrastructure provision, where most of the risks are assumed by the public sector (Turley and Semple, 2013). Public support may also have a significant impact on the fiscal sustainability of the countries. The financial sustainability of the public sector has been compromised during the last decades by large increases in primary deficits and public debt, a trend that has been accentuated by the financial crisis and the following economic recession and that, in some cases, has led to sovereign debt defaults. Increasing debt and slow economic growth has also increased the cost of financing for many weak economies such as Spain, which has seen the national debt to GDP ratio rising from 35.6% in 2007 to 98.3% in 2017. In this context, the importance of assessing fiscal vulnerabilities and risks, as well as the implementation of sound fiscal policies, has been stressed (Stoian et al., 2018; Tu and Padovani, 2018; Yemelyanov et al., 2018).

It should be noted that some of the instruments mentioned earlier have a direct impact on public resources. Subsidies are financed by taxation and do not usually require any form of compensation or it is below market standards, in-kind grants entail a reduction in the stock of public capital, and tax privileges imply a lower tax revenue collection by governments. The exact impact can however only be measured in the case of up-front subsidies since their cost is clear and accounted within the public deficit. The cost of both in-kind grants and tax breaks is their opportunity cost, which might be quite difficult to estimate depending on the case (Irwin, 2003), and operational subsidies entail certain government exposure throughout the operational period of the PPP contract that may vary depending on whether it is fixed or traffic-linked. The impact of co-investments and guarantees on public resources are rather indirect and its magnitude will depend on the future performance of the project. Guarantees are contingent liabilities so, unlike capital contributions, do not imply an initial disbursement of resources. However, if enforced, they bind the government to take on the obligations undertaken. Thus, with the sole exemption of cash subsidies, it is very difficult to estimate the true cost of the public support to be provided, which may lead to misuse of public resources. Moreover, this fact may create perverse incentives at the time of selecting the type of support to be granted, since greater value can be provided to the lower

—or inexistent— short-term costs for the government of a certain measure than to the appropriateness and effectiveness of the measure itself.

Irwin (2003) also states the importance of the rationale behind the decision to provide support for private infrastructure services, given the opportunity cost associated to the measure and, in the case of guarantees, the contingent liabilities they create, which may have significant future budgetary impacts. Thus, he determines five different governments' objectives that justify the implementation of fiscal support measures in infrastructure PPPs: (i) internalizing externalities in infrastructure markets; (ii) overcoming failures in markets for financing infrastructure; (iii) mitigating political and regulatory risks; (iv) circumventing political constraints on prices of profits; and (v) redistributing resources to the poor via infrastructure. However, their use is usually prompted by financial-related considerations such as getting the asset built while circumventing public spending, leveraging additional sources of finance from the private sector and the capital markets, reducing the cost of capital and improving value for money (EPEC, 2011a). In any case, public support should only be provided when the economic and social benefits arising from the project surpass the public cost of the measure adopted.

Public sector intervention is also common due to the incomplete nature of PPP contracts. Governments may introduce contractual changes for reason of public interest thereby requiring to rebalance the economics of the contract to compensate the private sponsor for requirements different to the ones originally set up in the contract. Depending on the legislation, the rebalance can be conducted automatically, according to the terms set up in the contract, or through a renegotiation between the government and the private sponsors. Renegotiations have the risk of being used opportunistically or strategically by the sponsors to make a profit rather than address the incompleteness of the contract, thereby reducing the overall welfare of the project (Guasch, 2004). In some cases, well-founded renegotiations may end up being inefficient due to political pressure to accelerate the process or to adopt more politically convenient solutions in the short-term that bring about greater costs in the long-term (Sarmiento and Renneboog, 2017).

Thus, as a form of government intervention that involves a cost (either in the short or the long-term), any kind of public support should demonstrate that it is in the public interest and subject to the principle of financial sustainability³. The

³ Financial sustainability shall be understood as the capacity to finance current and future expenditure commitments within the limits of deficit, public debt and delinquency of commercial debt in accordance with the Law.

government exposure to risk and the cost-benefit analysis of the measure during its whole life cycle should be, but rarely is, carefully assessed to guarantee the long-term sustainability of the public finances. This issue has motivated much of the research work carried out regarding public support so far, either through theoretical analyses or through case studies. In this respect, Irwin (2007) conducted a thorough compilation of government guarantees and provided techniques for measuring and valuing the government's exposure to the risk that some of them may entail. On its part, Wibowo (2012) studied the fiscal risk assumed by the Government of Indonesia as a result of the contingent liabilities undertaken when providing guarantees to PPP projects. Other researchers have focused on the quantification of the real value provided by governments to PPP projects through guarantees by using real option models (Ashuri et al., 2012; Brandao and Saraiva, 2008; Lara-Galera et al., 2016).

Equally important is to carry out *ex post* evaluations of the public support provided. This way, the effectiveness of the support mechanisms can be checked in order to get lessons for future similar experiences. *Ex post* evaluation analysis is in fact an approach often used by the European Union, the European Investment Bank or the World Bank to evaluate the impact of the support they provide (see e.g. European Court of Auditors, 2014; Pfeffer et al., 2014; Thomson et al., 2005a; World Bank, 2012) to PPP projects. However, these evaluations usually focus on very specific impacts of interest for the institution providing the support, and the role played by that institution during the implementation of the project. Thus, for example, the evaluations carried out at EU level mainly focuses on the financial value added to the projects, (European Investment Bank, 2005) and/or whether the projects receiving support actually moves forward and are delivered on time and budget (European Court of Auditors, 2014; European Investment Bank, 2004).

In summary, most of the research undertaken so far regarding public support to PPP projects has focused on developing or applying methodologies to quantify their value and analyse their effect on either the public or the private partner. Furthermore, to a lesser extent, some *ex post* evaluations of projects receiving support from different organizations have been carried out. However, these studies have barely examined to what extent the support provided actually influenced the ultimate outcome of PPP projects. Moreover, little attention has been paid to evaluating the global impact that this support may have taking into account different perspectives.

2.3 Measuring PPPs' performance: criteria and success factors

This section briefly summarizes the main criteria used in evaluating the success or performance of projects, the perceived factors that influence their successful performance, and the methodologies used to establish the relationship between them.

The first problem we find in the literature is that the concept of “proper performance” or “success” has not yet been clearly defined. Its definition varies according to the type of industry, the project team or the point of view of each individual. In addition, it varies from project to project depending on its size, uniqueness, technological level or scope of its services (Parfitt and Sanvido, 1993; Shenhar, 2001; Shenhar et al., 2001). Consequently, objectively determining whether a project has been successful or failed is extremely complex (Lam et al., 2008) to the point of being considered completely illusory (de Wit, 1988).

Despite the great divergence of opinions regarding its definition (Prabhakar, 2008), the literature agrees that the success of a project has two distinct components: the Success Factors and the Success or Performance Criteria. *Project Success Factors* are the set of circumstances, facts or influences that contribute, directly or indirectly, to the project's outcomes and therefore increase or decrease its likelihood of success. They are therefore the independent variables that influence the success of a project. On their part, *Project Success or Performance Criteria* are the set of measures, principles or standards established to judge the results of a project and, therefore, its success or failure. These are the dependent variables that measure the success of the project.

2.3.1 Success factors for PPP projects

The success or failure of a project will be directly affected by a set of circumstances or facts that are beyond its direct control and contribute to its performance but do not serve as a basis for judgement (Lim and Mohamed, 1999). Since the early 1990s and in tune with the progressive development of PPPs, several researchers have resorted to the study of success factors in order to improve the understanding and implementation of PPP policies to foster infrastructure development (Liu et al., 2014).

Since the number of success factors that have been identified to date is very large, several authors have applied factor analyses in order to reduce and regroup the overflowing list of initial factors into a relatively smaller and more critical one (hence these factors are referred to as critical success factors or CSF), based on responses from expert group surveys (Chan et al., 2010; Hardcastle et al., 2005; Zhang, 2005).

Hardcastle et al. (2005) analysed the relative importance of 18 success factors for PPP/PFI projects in the UK construction industry through a questionnaire survey that was distributed to UK organisations, both from the public and private sector, involved in PPP projects. Based on the factor analysis applied to the survey responses, the results revealed five critical success factors: 1) effective procurement, 2) project implementability, 3) government guarantee, 4) favourable economic conditions, and 5) available financial market.

Zhang (2005) also evaluated the relative influence of 47 success factors for PPP projects based on a questionnaire survey distributed among a panel of 46 experts, practitioners (29) and academics (17), from different organizations around the world. Statistical mean analyses revealed five CSF, which in order of importance were: 1) economic viability, 2) appropriate allocation of risks through reliable contractual arrangements, 3) sound financial package; 4) reliable concessionaire with strong technical strength, and 5) favourable investment environment. However, none of the researches addressed to what extent the critical factors identified contribute to the overall outcomes of PPP projects.

Adopting the list of 18 success factors previously developed by Hardcastle et al. (2005), Chan et al. (2010) also analysed the relative importance of these factors based on the survey responses by 87 PPP experts from China and Hong Kong. The factor analysis conducted identified five CSFs: 1) stable macroeconomic environment, 2) shared responsibility between public and private sectors, 3) transparent and efficient procurement process, 4) stable political and social environment, and 5) judicial government control. Despite sharing some points, the differences in both the significance and the ranking of the same success factors by these authors highlight the lack of consensus on what the success factors of PPPs are and to what extent they are perceived to influence the performance of PPPs.

On their part, Ozdoganm and Birgonul (2000), built a decision support framework in the form of a checklist of success factors intended to test the viability of PPP projects. The factors were divided into four main groups referring to 1) Financial and commercial factors, such as the existence of service need, government guarantee, strong consortium, or stability of economic environment in the country; 2) Political and legal factors, including stability of the country's political environment, government's experience in PPP schemes, transparency of the procurement system, and existence of a mature and adequate legal and regulatory frameworks; 3) Technical factors, such as technical manageability of project size, reliability and experience of private consortium, and possible innovative solutions; and 4) Social factors, such as public acceptance of the project, project's sustainability, and price of service. However, given the subjectivity of this approach,

it was unable to determine the precise influence of the success factors selected on the feasibility of projects, and has been considered too restrictive to be used as a decision making tool at the project level (Salman et al., 2007).

More recently, Osei-Kyei and Chan (2015) carried out a comprehensive review of critical success factors for PPP projects in order to identify and rank them according to their relative importance to the success of the projects. The results were based on the relevance they had been given in the research studies conducted from 1990 to 2013. Finally, they found that the critical success factors most considered in the literature were: 1) Appropriate risk allocation and sharing, 2) Strong private consortium, 3) Political support, 4) Public/community support, and 5) Transparent procurement.

2.3.2 Success or performance criteria of PPP projects

Since the 1970s, much research has been done on the criteria by which project success should be judged (Pinto and Slevin, 1988; Sanvido et al., 1992). Traditionally, the success of a project has been linked to the measurement of its performance or effectiveness in terms of a series of objectives. Several authors appeal to the objectives of a given project as a criterion of its success or failure. De Wit (1988) and Belout (1998) consider that the degree to which these objectives have been achieved determines their success or failure. According to Parfit and Sanvido (1993), the success of a project is defined as the overall achievement of the project's objectives and expectations. These goals and expectations include technical, financial, educational, social, and professional aspects. The problem arises in defining these objectives and expectations, since they vary according to the perspective of each project stakeholder. Other authors such as Pinto and Slevin (1988) refer precisely to this problem, the fact that the success or failure of a given project depends on the eyes of the beholder. Freeman and Beale (1992) provide an example that clearly shows the dilemma of different points of view: *«An architect can consider success in terms of aesthetic appearance, an engineer in terms of technical competence, an accountant in terms of dollars spent below budget, a human resources manager in terms of employee satisfaction, and a general manager evaluates his success in the stock market.»*.

Difficulties in assessing the success of a project from various points of view have resulted in project managers traditionally relying on very simplistic formulas to determine their success. The criterion most commonly used to evaluate the behaviour and therefore the success of the projects was the so-called "Iron Triangle" or "Golden Triangle", and was based on the analysis of cost, time and quality

(Ratnasabapathy and Rameezdeen, 2006). A project was considered successful if it was completed within the established budget, on schedule and was carried out according to the quality standards and technical specifications. These features were used mainly because they were easy to measure, objective and kept within the scope of the project organisation (Pinto and Slevin, 1988).

In the literature, despite the many authors who have defended this triple standard, many others have criticized it for being either too complex or too simplistic (Atkinson, 1999). Some researchers such as Dvir et al. (1998) argue that a project can be considered successful when it meets budget and time objectives even if it does not meet user needs or final product quality criteria. Other researchers consider these criteria excessive because time is only a variable in the cost function of the project. That is, for a given project and level of quality, there is a relationship between the duration of the project and the cost of the project (Khosrowshahi, 2003). Therefore, time is not an independent variable and should not be considered as a measure of the success of a project (Yu et al., 2005). Many others such as Atkinson (1999), de Wit (1988), Pinto and Slevin (1988) or Wateridge (1998) agree that cost, time and quality should be used as criteria for success, but not exclusively.

As already mentioned, the evaluation of the success of a project varies according to the point of view of the judge: stakeholders, project managers, end users, employees, etc. Some projects are conceived as successful from the point of view of the agents involved in their implementation but do not have a good reception by users and become real failures. By contrast, other projects that are considered internal failures because they have consumed too many resources during their construction later become very profitable successful projects. This is why several researchers introduce user satisfaction as an additional success criterion to those traditionally considered time, cost and quality (Baker et al., 1988; DeCotiis and Dyer, 1979; Pinto and Slevin, 1988).

Pinto and Slevin (1988) suggest that the relative importance of the different dimensions of a project's success changes over time. The important factors in the early stages of a project are internal: meeting budget, time and performance targets. However, at more advanced stages of the project, external factors such as needs and user satisfaction become more important. Baker et al (1988) agree with the previous ones that exceeding deadlines and budget ceases to be important once the project has been built. However, user satisfaction and their relationship to the project organization continues to be important even beyond the project boundaries.

Another problem with the traditional approach was its limitation in analysing long-term objectives, as they were only used at the time of project completion. In this

respect, Alarcon et al. (1996) argue that traditional performance parameters, time and cost, are not appropriate to support the progressive improvement of projects over time as they do not identify the possible causes of loss of productivity and quality. These parameters do not provide an adequate view of the potential for improvement, and the information they provide often arrives too late to be able to take corrective actions. In addition, most value-added activities go unnoticed, as do flow activities. For these reasons, new criteria such as the satisfaction of the agents involved, the strategic objectives of the organisation that initiated the project or the profitability of the project are now being considered.

Chan et al. (2002), Chan and Chan (2004) and Crawford and Pollack (2004) have proposed two sets of key performance indicators as measures to assess the success of construction projects. They have differentiated between *Objective Measures*, such as time, cost, safety, and environment; and *Subjective Measures*, which include quality, functionality, and satisfaction of the different participants in the project.

Collins and Baccarini (2004) published a survey to analyse the success criteria used in different industries and found little difference between them. Time, cost, and compliance with specifications were the most commonly used and most important success criteria. However, other criteria were also considered important, such as project efficiency, stakeholder and user satisfaction, or project profitability (Shenhar et al., 2001).

However, this assumption cannot be made with respect to different types of projects, as success criteria vary from project to project (Müller and Turner, 2007; Shenhar and Wideman, 1996) depending on their size, uniqueness, the technology required, complexity, risk, participants, scope of services, sophistication and experience of the owners (Parfitt and Sanvido, 1993; Shenhar, 2001; Shenhar et al., 2001; Wateridge, 1998). Consequently, creating universal success criteria that are suitable for all projects is impossible, since a measure of success for one project may be perceived as an absolute failure for another.

2.3.3 Relationship between project success factors and project performance

Gunathilaka et al. (2013) highlighted the great deficiency of studies focused on the development of methodologies that determine the relationship between the factors that influence projects success and the actual performance of the project. As it has been observed, most of the research work has focused on either identifying project success factors or determining the proper criteria to measure project performance,

but little work has been done in studying the relative importance of each of the factors or the influence that they have on the successful performance of projects.

Some researchers have attempted to fill this gap through the development of conceptual tools intended to relate critical success factors to project performance. In this sense, Westerveld (2002) developed the “Project Excellence Model”, based on the European Foundation for Quality Management (EFQM) model, with the aim to incorporate project objectives and external factors into project management decisions. Williams (2016) on his part used the “causal maps” technique to plot out the causal chains and combination of factors that led to project success.

However, most of the scarce studies carried out up to date used some type of multivariate analysis technique based on the information obtained through interviews, surveys or questionnaires. The success factors evaluated and the criteria used to measure projects performance greatly vary among the cases analysed (see Table 2.5).

For instance, Jha and Iyer (2006) used a multinomial logistic regression model to evaluate the contribution of 11 success factors and 9 failure factors to the quality performance of PPP projects. The analysis was based on the responses to questionnaires provided by Indian professionals in the construction industry, which were rated on different ordinal scales. In a similar way, Alzahrani and Emsley (2013) analysed the impact of contractors’ attributes on the success of projects on the post construction phase by developing ordinal logistic regression models that predicted the probability of project success. In this case, four regressions were developed to model the relationship between contractors’ attributes and the four variables established as performance criteria. The data feeding the models were obtained from the rating of the impact of different contractor CSFs on the success of construction projects and the evaluation of completed projects provided by construction professionals through a survey.

Klijn and Koppenjan (2016) analysed the impact that contract characteristics have on PPPs performance and innovativeness by using a multilevel regression analysis. The characteristics analysed included whether the contract allows sanctions to be impose, contract’s length, contract’s complexity, contract’s flexibility, and whether it is susceptible to being renegotiated. The data included in the models were obtained through a survey questionnaire of public sector officials and project managers, representatives of private consortia and consultancy firms involved in PPP projects in the Netherlands. Ng et al. (2010) on their part opted for using a structural equation modelling approach to explore the relationship between different evaluation factors related to the initial feasibility of PPP projects and the

success of PPP projects measured through the level of overall satisfaction of stakeholders. The authors based the analysis on data obtained from a survey conducted in Hong Kong and directed to individuals from the government, the private sector and community groups.

Lam et al (2008) used the multiple regression analysis to study the causal relationships between the critical success factors and the success criteria of *Design & Build* (D&B) projects. The model was based on the evaluation of the factors influencing project performance carried out by the main agents and stakeholders (clients, promoters and consultants) of Hong Kong D&B projects through a survey and a subsequent factor analysis that allowed the authors to identify the critical success factors to be tested. Regarding the dependent variable, a project success index for D&B projects was calculated according to the weights obtained for 4 different key project performance indicators through another survey questionnaire sent to project stakeholders. Kwofie et al. (2016) on their turn followed a similar approach to identify and analyse the critical success factors that influence the PPP outcome in the delivery of public housing projects in Ghana. In this case, a stepwise multiple regression was conducted on the main variables to be tested: 16 CSFs as independent variables and a success performance index including 4 different performance indicators as the dependent variable.

Andersen et al. (2006) analysed the relationship between project factors within the direct influence of project managers and project performance using a stepwise linear regression. To that end, they drew on the results of a survey of project stakeholders which served to reduce the initial 60 project success factors and project success criteria into 9 and 3 factors respectively. Then, a composite factor score was computed for each of the resulting categories of PSF and PSC before the regression analyses were performed. Almarri and Boussabaine (2017) also used the multiple regression analysis to evaluate the contribution of different critical success factors to the performance of PPP projects. To that end, the authors launched an online survey of PPP experts from the UK and the UAE where respondents had to rate PPP performance through different CSFs by using a five-point scale. Then, the influence of the CSFs on each of the six key project performance indicators considered was estimated by using stepwise regression models. Ika et al. (2012) performed a multiple regression analysis to measure the contribution of 5 CSF — monitoring, coordination, design, training and institutional environment— to project success, and a stepwise regression analysis to determine which of the CSF influenced the most to project success. All the projects included in the study were international development projects funded by the World Bank. The analysis was

based on the responses provided by project supervisors of the World Bank on CSFs and PSC through a questionnaire.

Finally, few studies have relied on real project data when modeling the relationship between CSFs and project performance. In this sense, Galilea and Medda (2010) evaluated whether the political and economic context, with a special focus on the perception of corruption and democratic accountability, of a certain country influence the success of a transport PPP project. To that end, they analysed a database with 86 transport PPP projects covering 72 countries by using a generalized linear model in the form of a logit model. In this case, the project was defined as successful if its current status was under construction, operational or concluded, and unsuccessful if it was cancelled or distressed.

On their part, Marcelo and House (2016) analysed the impact of multilateral support on the contract survival of infrastructure PPP projects. In this case, they hypothesized that if a contract is not cancelled is because all the parties involved are sufficiently satisfied with the outcomes of the PPP project. The evaluation is based on the identification of a counterfactual scenario for projects without support and the latter comparison of their cancellation rates with those of the projects that have been supported. Jandhyala (2016) also focused on the impact of multilateral support on PPP projects, but she evaluated the extent to which this support lowers the likelihood of projects becoming distressed. To that end, she applied a logit model to a sample of 2,117 infrastructure PPP projects developed in 45 countries from 1995 to 2009.

The analyses carried out to evaluate the impact of success factors on projects performance are mostly based on the subjective opinion of different stakeholders involved in PPP contracts or experts, which is obtained through questionnaires or surveys. In most cases, they are asked to rate both the relative impact of the different success factors considered by the researcher on project's performance and the performance of the project itself. Thus, the models developed are based on perceived impact of success factors and perceived project performance, with the consequent risk of common method bias the latter entails. Therefore, the actual impact of the aforementioned factors on the actual performance of PPP projects has not been addressed in the literature, since only very few studies have relied entirely on actual data.

Table 2.5 Summary of previous studies analysing the relationship between CSFs and project performance

Research	Potential and Critical Success Factors analysed*	Performance Criteria	Data collection	Methodology used
Jha and Iyer (2006)	Project Manager's Competence; Top Management Support; Monitoring and Feedback by Project Participants; Interaction among Project Participants; Owners' Competence; Conflict among project participants; Hostile socio-economic environment; Harsh climatic condition; PM's ignorance & lack of knowledge; Faulty project conceptualization; Aggressive competition during tendering; Project Specific Factors.	Schedule, Budget, Quality , No-dispute	Surveys**	Multinomial logistic regression
Andersen et al. (2006)	Rich project communications; Stakeholder endorsement of project plans; Well-structured and formal project approach; Strong project commitment; Early stakeholder influence; Well understood and accepted project purpose; Clear project constraints; Project execution flexibility; Influence over on-going project processes.	Project impact; Captured experience; Managerial ability to deliver on time and within budget	Surveys	Multiple Regression Analysis
Lam et al (2008)	Competency of client body; Competency of construction team leader; Effectiveness of project management action; Competency of contractor's design consultants; Working relationships among project team members; Client's input in the project; Project nature; Client's emphasis on time and cost; Application of innovative management approaches; Client's emphasis on risk transfer; Physical and social environments; Economic environment.	Project success index f(Time, Cost, Quality, Functionality)	Surveys	Multiple Regression Analysis
Ng et al. (2010)	Technical factors; Financial & Economic factors; Social factors; Political & Legal factors; Other Factors.	Overall Stakeholders' Satisfaction	Surveys	Structural Equation Modelling
Galilea and Medda (2010)	Past experience with PPPs; Project characteristics (Total investment (-); %private); Number of investors (-); Number of multilateral lenders; Country's corruption index (-); Country's democratic accountability; Country's region; Country's income; Country's macroeconomic performance.	Current status (successful: under construction, operational or concluded; unsuccessful: cancelled or distressed)	PPI Projects Database	Logit Model
Ika et al. (2012)	Monitoring; Coordination; Design; Training; Institutional Environment.	Project success factor f(Efficiency, Effectiveness, Relevance, Impact, Sustainability)	Surveys	Multiple Regression Analysis
Alzahrani and Emsley (2013)	Safety and quality; Past performance; Environment; Management and technical aspects; Resource; Organisation; Experience; Size/Type of previous projects; Finance.	Schedule, Budget, Quality, Contractor's impact	Surveys	Ordinal Logistic regression

Research	Potential and Critical Success Factors analysed*	Performance Criteria	Data collection	Methodology used
Klijn and Koppenjan (2016)	Contract length; Possibility of sanctions ; Contract's complexity, Contract's flexibility; Possibility of negotiation.	Project Performance (Integral nature of solution; Effectiveness of solution; Effectiveness in the future; Support for solution; Relationships costs and benefits); and Project innovativeness	Surveys	Multilevel regression analyses
Kwofie et al. (2016)	Commitment and responsibility of public and private sectors; Stable macro-economic condition and sound economic policy ; Competitive and transparent procurement process ; Multi-benefit objectives; Government involvement by providing guarantee ; Strong and good private consortium; Favourable and efficient legal framework ; Stable and effective social support; Involvement of well-organized and committed public agency; Thorough and realistic assessment of cost, projections and benefits; Available strong and resilient financial market ; Shared authority, trust and communication between public and private sectors; Appropriate risk allocation and risk sharing; Good and favourable governance and strong political support; Right project identification and project technical feasibility ; Expected debt paying ability of the project.	Index of perceived success performance outcome f(Satisfied parties; Affordability of the project outcome; Delivery on time and budget; Meeting project goals)	Surveys	Multiple Regression Analysis
Marcelo and House (2016)	Multilateral support.	Cancellation rate of PPP contracts	PPI Proj. Database	Counterfactual scenarios
Jandhyala (2016)	Multilateral support ; Country's institutional development ; Country's multilateral debt; Project characteristics (Size ; Type of sector ; Type of Private investment; Multiple sponsors; cross-border sponsors (-) ; Government support (-)); Country's macroeconomic performance.	Project distress	PPI Projects Database	Logit model
Almarri and Boussabaine (2017)	Appropriate risk allocation ; Commitment of public and private parties; Committed and competent public agency; Competitive procurement process; Detailed cost/benefits assessment ; Favourable legal framework; Good governance ; Government guarantees ; Local financial market ; Macro-economic conditions; Multi-benefit objectives of all stakeholders ; Political support; Project technical feasibility ; Shared authority public and private sector ; Social support ; Sound economic policy; Strong private consortium ; Transparent procurement process.	Time, Cost, Quality, Service, Profit, Variation Performance	Surveys	Multiple Regression Analysis

*The potential Critical Success Factors that resulted significant in the analyses undertaken are in bold.

**Both performance rating and CSF contribution to each criterion are based on surveys or questionnaires' responses

2.4 Measuring the impact of public support

The empirical literature has attempted to address whether public support has been effective in pursuing its expected objectives. In this respect, two main approaches can be observed: those aiming at analysing the impact of the support at the country level; and those focusing on evaluating the effectiveness of the support at the project level.

2.4.1 Analysis of the impact of public support at the country level

Most of the empirical research conducted to evaluate the impact of public support has focused on analysing its effects on the economic performance and development of the recipient countries. These studies can be divided into two main categories (Ederveen et al., 2003): (i) those attempting to directly measure to what extent economic growth is determined by the support provided, and (ii) those looking for indirect evidence regarding the impact of the support on growth.

The support that has received more attention in the literature includes that provided by the International Monetary Fund (IMF), the World Bank (WB) and the EU structural funds (SF). Most of the studies focused on analysing the impact of public support on economic growth, using as outcome or dependent variable the growth of economic variables such as (per capita) GDP, (un) employment rates or private investment during a certain period of time (see Becker et al., 2010; Garcia-Milà and McGuire, 2001). Other studies analysed its impact on different variables such as school enrolment (Vranken et al., 2011), industry location and agglomeration (Midelfart-Knarvik et al., 2002) or quality of the economic policy of the benefited countries (Smets and Knack, 2014). However, no consensus has been reached up to date given the great disparity in the results obtained. Whilst some authors found a positive impact of public support on economic growth, either to a lesser or greater extent, some others found non-significant or even negative growth effects.

The divergence of results may be due to multiple factors, being the most recalled in the literature poor data quality on both public support and regional economic variables, the use of different sources, the analysis of different periods and/or programs, differences in the groups of countries considered (e.g poor developing versus emerging or transition economies), fail in controlling for other determinants of economic growth and differences in the methodologies applied (Butkiewicz and Yanikkaya, 2005; Mohl and Hagen, 2010).

Mostly, three methodologies have been applied in order to analyse whether public support has influenced economic growth (Dreher, 2006): (i) before-after analysis, (ii) with-without approach and (iii) regression analysis. The first approach consists on comparing the recipient countries economic growth before and after the support has been provided. The main drawback of this methodology is that it attributes all changes in the countries growth to the support provided, so its effects may be judged too negatively depending on the context in which that support is granted. For instance, the EU SF are targeted at the least favoured regions and countries within the EU, and the IMF support is usually provided to countries in balance-of-payments difficulties (Barro and Lee, 2005). As a consequence, the results obtained tend to be too negatively biased. The second approach consists in comparing growth rates in benefiting countries with those in a control group of countries not being supported. This is an attempt to undertake a counterfactual analysis, that is to compare the outcome of a benefited country with the hypothetical outcome of that same country had it not been supported (Atoyan and Conway, 2006). Thus, for the methodology to be as effective as possible, it is crucial that the countries included in both groups have very similar characteristics. Finally, the third approach involves the use of regression techniques, which nowadays are the most widely used among researchers on this topic. As pointed by Dreher (2006), these techniques seem to be the most suitable for analysing the impact of financial support.

2.4.2 Analysis of the impact of public support at the project level

Although most of this type of public support is provided in the form of financing for individual projects, little research has been conducted on analysing its impact on the outcome of the supported projects. In this respect, two main approaches can be also identified: (i) those adopting macro approaches to analyse the extent to which public support has influenced projects performance; and (ii) those conducting micro analyses to evaluate how projects receiving support have performed with respect to their initial expectations.

The first approach has been adopted within the literature focused on determining the success factors for PPP projects. In this respect, public support has been appointed as a success factor for PPP projects by several researchers. Hardcastle et al. (2005) point out the importance of both guarantees and committed government policies to ensure investment protection when the private sector does not have much confidence in the PPP procurement. Kumaraswamy and Zhang (2001) also find government support through flexible and project-specific guarantees important to create favourable investment environments able to attract private sector involvement in BOT projects. They also suggest a wide set of guarantees, benefits

and co-investments that could be considered in order to diminish the economic risks of this type of projects.

The identification of public support as a success factor for PPP projects has also been supported by empirical research. The government involvement by providing guarantees was also found critical at the concession award phase of BOT projects in China (Qiao et al., 2001), and for the proper performance of PPP projects (Almarri and Boussabaine, 2017; Babatunde et al., 2012; Kwofie et al., 2016). Kanter (1999) considers investment by both parties (public and private) essential to ensure full commitment when analysing PPP projects in the social sector. Liu and Wilkinson (2013), based on the case study of the Beijing Metro, found that government involvement through revenue subsidies would be essential to implement urban rail PPP projects that are viable from the financial standpoint. Finally, multilateral support has proven to be effective in lowering both the cancellation rate and the likelihood of distress of PPP projects (Jandhyala, 2016; Marcelo and House, 2016).

However, most of the research carried out regarding the impact of public support on projects performance at the macro level has been based on questionnaires or surveys and, to a lesser extent, on individual case studies. Thus, greater empirical analysis based on actual data is needed in order to validate the results obtained.

Regarding the second approach, there are few research works, especially in the “grey literature”, analysing the extent to which supported projects have achieved the objectives set out once they have been implemented. Given the scarcity of studies found, the evaluations carried out for both PPP and non-PPP projects and the performance criteria adopted in each case are shown below.

The World Bank (2012) evaluated whether and to what extent 173 PPPs that benefited from its support during project preparation, structuring, and bidding, and that received financial support by means of equity, debt, or guarantees were successfully performing. Specifically, 99 projects of the sample benefited from IFC investments, 47 from MIGA guarantees and 27 from WB loans. First, projects success is evaluated according to their business performance, since it is assumed that a good business performance is required to obtain positive development outcomes. The evaluation is carried out at the time of operational maturity, project completion or project closure, depending on the mechanism analysed. Then, projects performance is evaluated by using a wider set of indicators: access, quality, efficiency, financial soundness, fiscal aspects, and access for the poor. In the particular case of toll road PPP projects, the performance criteria selected was evaluated through the following indicators:

Table 2. 1. Indicators related to the performance criteria selected for the toll road PPPs

Performance criteria	Indicators
Access	Increase in traffic
Quality	Performance Standards are met* (maintenance, road safety, signage)
Efficiency	Vehicle operating costs Reduction in travel time
Financial soundness	Revenue (target vs. actual) Long Term sustainability of fees is assured*
Fiscal aspects	Level of contingent undertakings, transfers subsidies
Poor	Bus share of traffic

* *Performance-Based Contracts only*

However, the scarcity of available data on most of the dimensions analysed — particularly lacking in pro-poor and fiscal effects, efficiency and quality— posed a major drawback to the evaluation. To overcome this issue, they managed to evaluate in depth 22 PPPs through a multiple country case study methodology. In this case, both the WB upstream and downstream work were evaluated. On the one hand, the extent to which WB support helped the recipient countries to execute the PPP transactions. On the other hand, what the effects of the WB direct support provided to PPPs were, that is, how effective the PPPs were according to the performance criteria previously mentioned. The projects analysed performed well along all dimensions, except for efficiency, where results were mixed.

Thomson et al. (2005a) evaluated in-depth 10 PPP projects that received EIB financing between 1990 and 2001, based on data and information available within the Bank and interviews held with projects' stakeholders. The projects were either in the operational phase or close to full completion and were selected to provide a representative sample of the Bank's PPP portfolio in terms of geographical and sectorial scope. The evaluation carried out followed the same criteria used by the EIB when deciding to provide financial support to this type of projects: 1) relevance/effectiveness, 2) efficiency and 3) sustainability. The relevance of the project is rated according to its objectives' contribution to EU and EIB policies, while effectiveness refers to the project's ability to comply with budget and schedule expectations. Efficiency takes into account whether actual traffic levels are accurate with respect to original forecasts. Finally, sustainability is measured in terms of project's financial and technical soundness. Projects performance was rated against each criterion as poor, unsatisfactory, satisfactory or good. The relevance and effectiveness of all projects was rated at least as satisfactory. Efficiency and sustainability aspects received weaker ratings, mainly due to traffic deviations from forecasts, being 3 projects rated as unsatisfactory.

Bain (2009b) analysed the performance of 66 PPP projects financed by the EIB based on project and credit monitoring documentation facilitated by the Bank. In this case, all projects evaluated had completed the construction phase and were in operation at the time. Projects performance was evaluated in terms of 1) delivery within (or under) budget, 2) delivery within schedule, 3) completion according to their original specifications, and 4) accuracy of traffic forecasts. Due to lack of data, not all the projects conforming the sample were evaluated against all the criteria. The results show that 85% of the projects analysed (51) were delivered either under or within budget; 63% of the projects on the operational phase analysed (48) were delivered on schedule; 10 projects were not delivered according to specification, although in all cases it was due to changes required by the procuring agency; and finally, almost half of the toll motorways analysed (27) under-performed their forecasts.

The European Court of Auditors (ECA) has carried out different reports intended to analyse the performance of both PPP and non-PPP projects benefiting from EU financial support. In 2013, the ECA examined 24 road projects developed in Germany, Spain, Greece and Poland subsidised by either the ERDF or the CF to evaluate whether they had achieved their objectives at a reasonable cost (European Court of Auditors, 2013). The sample included 10 motorways, 10 express roads and 4 two-lane national roads. The performance criteria used to analyse the projects included: 1) Impact on economic development; 2) Economic feasibility of the investments made; 3) Achievement of results translated into qualitative or quantitative improvements. The first criterion could not be evaluated due to lack of data and indicators measuring the economic impact of the projects on neither the local economy nor the users. The second criterion analysed whether the projects were still feasible taken into account the final usage of the infrastructure and the final cost of the projects compared with those initially estimated. The last criterion evaluated whether the projects fulfilled the objectives set out in the grant applications, which for most of the projects included road safety improvements and travel time reductions. They found that, whilst all projects made it possible to reduce travel times and improve road safety, several projects did not achieve the return on investment foreseen in the cost-benefit analysis. Also, they concluded that insufficient attention was paid to the profitability of the projects, since most projects had inaccurate traffic forecasts.

The ECA (2014) also analysed the effectiveness of 26 non-PPP urban public transport projects that have been supported by EU structural funds (ERDF and CF). The chosen criteria of success were: 1) whether the projects were implemented as planned in the grant applications; 2) whether the services they offer covered the

needs of the users; and 3) whether the projects reached their objectives in terms of utilization. The first criterion comprised analysing whether the projects were implemented according to the project specifications, meeting their deadlines and within their initial budget. The second criterion involved measuring users' satisfaction with the quality of the service provided through surveys, interviews with projects' promoters and operators, and the analysis of indicators such as punctuality, cleanliness, information for travellers, etc. Finally, the third criterion was evaluated by calculating the level of usage of the projects and comparing the estimated and actual demand. The evaluation concluded that most projects were implemented according to specifications (14) and successfully covered users' needs, few had significant implementation delays (4) and substantial cost overruns (3), and very few reached the expected utilization levels (2).

The ECA also evaluated the extent to which 12 PPP projects —6 transport projects and 6 ICT projects— developed in France, Ireland, Greece and Spain, which were financed by either the Structural and Cohesion Funds or by financial instruments, managed to achieve the benefits inherent to this type of infrastructure financing and delivered adequate value for money (European Court of Auditors, 2018). Likewise, the potential risks arising in these projects were also analysed. They also evaluated whether the projects were based on sound analyses and suitable approaches and whether the overall institutional and legal frameworks within the Member States were adequate for the successful implementation of PPPs.

The results obtained show that, in general terms, the projects analysed have not managed to achieve most of the benefits associated with the PPP model. The evaluation stresses as shortcomings the existence of long delays, cost overruns, poorly prepared projects by the public partner, over-optimistic demand forecasts, inappropriate and ineffective risk allocation, and the lack of justification for choosing the PPP model as opposed to traditional procurement. On a positive note, they highlight that 9 of the projects have shown good levels of service and maintenance. While it is true that most of the projects have not performed as well as expected, it should also be noted that three of the four countries analysed — Ireland, Spain and Greece— were among the countries most affected by the economic crisis, which might have biased the results.

The literature review shows that very few *ex post* evaluations have been carried out to analyse the performance of PPP projects receiving public support. In addition, the evaluations mainly focused on analysing the extent to which these projects have performed against their initial expectations —usually according to the time, cost, quality and/or expected demand criteria— and, to a lesser extent, whether they have proven to deliver some of the benefits they were supposed to. However, most

of the criteria used focus on evaluating the results of the construction phase, which is only one stage within a PPP project. Also, few studies incorporate sufficient perspectives in the analysis to evaluate the overall sustainability of PPP projects, in some cases due to lack of data, or the appropriateness of the support provided. Finally, little attention has been paid to analysing the effects of the governmental support provided to PPP projects.

3 RESEARCH OBJECTIVES, HYPOTHESES AND OVERALL APPROACH

This chapter details the approach developed to achieve the objectives of the Thesis and to provide answers to the research questions. Section 3.1 presents the main objective and research questions of the Thesis. Section 3.2 presents the hypothesis adopted by the author. Section 3.3 summarizes the proposed overall methodology of the research. Section 3.4 presents the selection of the case studies that will be analysed in the framework of this research Thesis.

3.1 Research objectives

According to the literature review, it is necessary to deepen the study and evaluation of the public support provided to PPP projects. In this sense, it is essential to investigate the overall impacts, both positive and negative, arising from this support. Based on the above considerations, the main objective of this Thesis is to provide empirical knowledge about the impacts that the public support granted to PPP projects may have on the projects, the contracting authority and the society. Specifically, this Thesis aims at:

- (i) Empirically analysing whether the public support granted to PPP projects has had a positive influence on their performance over time.
- (ii) Identifying further variables, both intrinsic and extrinsic to PPP projects, affecting the proper performance of this type of projects.
- (iii) Evaluating the social and financial impacts of the public support provided to PPP projects.
- (iv) Evaluating the extent to which the government providing support to PPP projects takes into account the overall impact it may have and the public interest when granting it.
- (v) Drawing policy lessons and recommendations based on the analysis and findings from (i) to (iv) above, in order to provide useful and practical suggestions for governments when providing public support to PPP projects.

To achieve these objectives, several questions arising from the research literature carried out in previous sections need to be answered. These are developed throughout the present Thesis, which focuses on analysing the case of road PPPs in Spain.

1- *Is public support improving the performance of PPP projects? Is there empirical evidence of public support being a success factor of PPP projects?*

The reason for this research question is that the existing literature on success factor for PPP projects have left some issues to be investigated. Most of the research carried out on success factors identification is based on questionnaires or surveys and, to a lesser extent, on empirical data and individual case studies. Thus, greater empirical analysis based on actual data is needed in order to validate the results obtained.

Ensuring adequate performance of PPP projects is an important public policy goal for any government, given the potential costs for society that the opposite may entail. At the same time, it is equally important to guarantee that public funds are efficiently and effectively used in pursuing their purposes. In that sense, there is a growing interest in analysing whether public support is being used wisely. Public support has been appointed as a success factor of PPP projects by several researchers. However, as far as the author is concerned, there are no studies empirically analysing whether this support has actually influenced the ultimate outcome of PPP projects. To solve this problem, the thesis will develop a methodology to assess to what extent public support improves the performance of PPP projects. The result can be considered of great interest for both governments and supra-governmental institutions that provide support to PPP projects.

2- *Are there further variables influencing PPP's performance?*

The reasoning used in the previous research question applies in the present case. A large number of success factors, besides public support, have been determined in the literature based on the perception of experts or stakeholders of PPP projects, but in very few cases have they been evaluated empirically beyond the study of specific case studies. In addition, several researchers have pointed out that different contextual factors related to the project may influence its performance, such as the type of project, the type of contract or the characteristics of the project itself. However, little research has been conducted to empirically analyse the potential correlation between these factors and the performance of PPP projects.

Therefore, it is unclear which project characteristics or contextual factors may contribute to improving projects performance over time. The methodology to be developed in the context of this Thesis is also intended to clarify potential differences in performance between PPP projects depending on their intrinsic and extrinsic characteristics. Addressing this question may be of great interest for

decision-makers since it would provide them with guidance regarding the most suitable design and delivery of PPP projects in the future.

3- Is the public support allocated to PPP projects aligned with the growing policy of support of this type of projects? Is it worthwhile supporting PPP projects?

As presented in the literature review, different countries and supranational institutions promote the use and development of PPP projects by facilitating their access to various types of public support. Some institutions, such as the European Commission, have been encouraging the use of PPP as an effective alternative to traditional procurement of infrastructure since the 1990s. This fact worth evaluating whether the public support allocated to PPP projects is in line with the growing policy of support that this type of mechanism has enjoyed. Then, once it has been determined whether the public support received has positively influenced the final outcomes of these projects, it will be possible to analyse to what extent it is worthwhile to continue investing public funds in PPP projects.

4- What are the main social benefits and drawbacks of the public support provided to PPP projects? Is this type of support justified from a sustainability standpoint?

Most of the research undertaken so far regarding public support to PPP projects has focused on either exploring their potential in attracting investors to finance infrastructure projects or developing or applying methodologies to quantify their value and analyse their effect on either the public or the private partner. Furthermore, to a lesser extent, some *ex post* evaluations of projects receiving support from different organizations have been carried out. Nevertheless, little attention has been paid to evaluating the global impact that this support may have taking into account different perspectives.

Carrying out *ex post* evaluations of the public support provided is very important to assess the effectiveness of the support mechanisms and get lessons for future similar experiences. This Thesis intends to evaluate the sustainability of the decision to support PPP projects taking into account the financial feasibility of the support provided, its impact on the public budget and the social benefits stemming from its application. This analysis will identify relevant policy implications arising from the use of public support to help PPP projects and provide guidelines to governments that may implement these mechanisms in the future.

5- Do governments take into account the financial sustainability of the support mechanism before it is provided?

As a general rule, public intervention should be subject to a careful assessment of the benefits and costs, including those related to the risks assumed, arising from the intervention itself. Ideally, public support should only be provided when the economic and social benefits arising from the project surpass the public cost of the measure adopted. However, as seen in the literature review, even well-founded renegotiations may end up being inefficient due to political pressure to accelerate the process or to adopt more politically convenient solutions in the short-term that bring about greater costs in the long-term (Sarmiento and Renneboog, 2017). In this sense, an interesting question arises as to what extent governments take the feasibility of the support mechanisms into account when backing PPP projects with public resources or whether political expediency has a greater weight in the decision-making.

3.2 Research hypotheses

Related to the aforementioned research objectives, the author adopts two main hypotheses that are to be tested through the different methodologies set out in the Thesis.

I. Those projects benefiting from financial backing will have a higher performance than those that did not receive economic support.

The hypothesis is based on the literature review, where public support has been appointed as a success factor of PPP projects by several researchers. Public support has been found very important to diminish the economic risks arising from this type of projects, providing a more favourable investment environment that may positively influence the bankability and feasibility of the projects (Kumaraswamy and Zhang, 2001). Also, public support has a positive influence on the debt capacity of projects, improving their economic stability over time (Dias and Ioannou, 1995). This fact may guarantee a better performance, at least from the economic perspective, of projects receiving public support.

II. The government developing the PPP project has little incentive to set out the terms of public support efficiently, especially when it comes to ex post support.

Although this hypothesis may apply to every type of public support since they all have an impact on public resources that should be carefully assessed, it gains greater importance in the case of guarantees and co-investments. As it was already mentioned, these two mechanisms may impose greater costs than expected on governments, since they depend on the recipient project's performance. This fact makes it crucial to cautiously set the conditions under which these instruments are

provided so as to guarantee the public interest against that of the private sector, especially if they are not provided in the context of competition. In that latter case, where either the amount or the conditions are determined at the bidding stage, competition may lead to more optimal values for these mechanisms (Barbosa et al., 2016). However, when public support is granted *ex post* it is usually because projects are experiencing financial problems and aid is indispensable for them to move forward. In this context, the political rush to prevent projects failure and the consequent political costs that this would entail may lead to poor decisions when selecting and determining the support to be provided.

3.3 Research approach

The research developed to achieve the objectives set out in a previous section has been structured into different stages, as can be seen in Figure 3.1. This Figure shows the overall methodology followed in the investigation and the interaction among the stages of the research.

First, a thorough review of the literature has been carried out regarding four main topics: (i) the public support provided by either governments or supra-governmental institutions to PPP projects; (ii) the success factors influencing the performance of PPP projects previously identified; (iii) the methodologies most commonly applied to explain PPP projects performance; and (iv) data availability to develop the analyses at both the macro and the micro level proposed in the current Thesis. The literature review allowed the author to identify the existing research gaps that will be addressed throughout the Thesis.

In order to address the specific objectives set out in the Thesis, the case studies to be analysed are then selected. The aforementioned selection comprises the determination of both the public support provided and the sample of PPP projects to be analysed. The availability of sufficient public support information and data at project level to carry out the analyses proposed in the present Thesis has been an essential condition for the selection of the case studies. Then, the available raw data is analysed in order to build up a data set containing the variables that will be needed to develop the methodological approaches adopted in this Thesis.

The research framework considers analyses at both the macro and the micro level to provide insight regarding the positive and negative impacts of the public support provided to PPP projects, particularly road PPP projects. These approaches complement each other, allowing the object of study to be analysed from a broader perspective. The statistical analyses within the macro approach provide representative results of the sample analysed. However, their scope may be

restricted by the quality and quantity of the data available for this purpose—in this case, the number of PPP projects receiving the type of support to be analysed—. The micro approach, on its part, allows conducting a much in depth analysis of a certain case, no matter how small the sample might be.

Thus, the macro approach intended to analyse the extent to which public support has influenced the performance of PPP projects is defined. The selection of the econometric specifications developed to carry out the aforementioned analysis is based on the suitability of data and the case study selected. Additionally, the econometric approach allows the author to identify other variables affecting the proper performance of this type of projects.

Then, the micro approach intended to analyse the positive and negative impacts of the public support provided to PPP projects from a global perspective is determined. This is carried out following a case study methodology. The methodology comprises a thorough *ex post* evaluation of a case study that takes into account the performance of the PPP projects, the financial feasibility of the support provided, the social benefits stemming from its use and the public interest. According to the criteria selected, the government's decision to support the projects is analysed from the standpoint of sustainability.

Finally, a set of conclusions and policy lessons and recommendations arising from the case studies analysed are drawn and areas for future research are identified.

Figure 3.1 Methodological scheme of the research

3.4 Selection of the Case Studies

As stated in the previous section, the selection of case studies is irremediably subject to the availability of sufficient data to carry out the analysis proposed in this Thesis. In this sense, the case studies must meet a series of requirements.

In the first place, as obvious as it may seem, the existence of PPP projects that have received public support and that this fact is verifiable. In this sense, it is important to be able to certify which project received support, which type of support it was and when it was provided.

Secondly, the possibility of creating a sufficiently large and comparable database of PPP projects. To that end, it is necessary to have access to project-level information on the entire sample to be analysed and that the historic data set is long enough for the analysis to be carried out.

Thirdly, that the PPP projects to be analysed are sufficiently mature, since PPPs performance can only be reasonably measured once they have been in operation for long enough to allow their outcomes to be observed (Marcelo and House, 2016). This is much more important when real toll projects are involved because of the greater demand uncertainty they have during the first years of operation.

Fourthly, it is considered interesting to analyse the impact of the public support granted by different institutions, with different objectives and frameworks for the evaluation and definition of the public support to be provided.

Finally, the timing of public support will also be taken into consideration, in order to evaluate both the public support granted *ex ante* —before PPP projects reach financial close— and *ex post* —once PPP projects are in operational phase—. The former is usually intended to strengthen the economic feasibility of the project and, consequently, encourage private participation in the tender. They are therefore subject to careful scrutiny and are tailored to the specific needs of the project. Moreover, if they are offered at the bidding stage, its determination is subject to competition. The latter, on the other hand, is often provided to projects already in operation facing viability problems or even on the verge of bankruptcy, so their definition and awarding may be subject to political haste and expediency. As a result, this support may result less efficient in its purpose and led to greater risks for the authority providing it.

3.4.1 Case study for the macro approach

The first part of the research is aimed at analysing to what extent public support has a positive influence on the performance of PPP projects through a macro approach.

This approach entails the development of statistical models, so it requires a relatively large sample of PPP projects, a significant part of which must have received public support for the sample to be balanced and the results to be robust. Based on the aforementioned selection criteria, it was decided to analyse the financial support provided by the European Union and the European Investment Bank to road PPP projects in Spain.

On the one hand, Spain has a large number of road PPP projects with different degrees of maturity, most of which have been operating for a period of time sufficient to evaluate their performance. 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 road transport. At the time of the writing of this Thesis, road PPP projects represented more than 33% of the high capacity network currently in operation, 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 road PPP 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 (Liyanage and Villalba-Romero, 2015; Müller and Turner, 2007). All this provides the author with a sufficiently large database of road PPP projects to carry out the macro approach analysis proposed in the Thesis. In this regard, the data needed are available at the project level for the entire sample and are homogeneous enough to be comparable across projects.

On the other hand, Spain has been one of the biggest beneficiaries of EU support ever since its accession to the EU and a large share of Spanish road PPP projects have benefited from this support. Moreover, these projects have received financial aid from almost every European source available to PPPs, including ERDF, CF and TEN-T grants, EIB loans, and financial engineering instruments such as the LGTT or the Marguerite Fund. EU support is granted before projects reach financial close (*ex ante* support) and under a set of requirements intended to guarantee the feasibility of the projects. Moreover, this supra-governmental support is not only financial, but also entails assistance and supervision during all stages of the project cycle, from design to operation, which may enhance the quality and resilience of the projects over time.

At the time of the writing of this Thesis, 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 (Hellowell, 2013; Jacobsson and Jacobsson, 2012; Scannella, 2012; Zaharioaie, 2012) or analysing their impact on the recipient countries' economic performance and development (Becker et al., 2010; Ederveen et al., 2003; Mohl and Hagen, 2010). However, these studies have

barely examined to what extent the EU aid actually influenced the ultimate outcome of PPP projects.

The analysis conducted is relevant for a number of reasons. Firstly, it allows the author to empirically contrast previous literature on PPP success factors where public support has been found an enabler of the proper performance of PPP projects. By contrast, most of the studies on success factors identification are based on questionnaires or surveys. Secondly, besides analysing the potential influence of public support on PPPs performance, the analysis enables identifying, at the macro level, other variables, either inherent or extrinsic to PPP projects, that may influence projects performance. Thirdly, this analysis also seeks to evaluate whether EU funds are being properly allocated, that is, whether it is worth to keep supporting PPP projects with community funds, a subject of growing interest within the EU (European Court of Auditors, 2018). Fourthly, the review conducted regarding the main funding programs implemented at EU level allows evaluating the extent to which EU support has been actually channelled to PPP projects for the case of road infrastructure in Spain. Finally, the analysis conducted also identifies relevant policy implications that arise from the case study.

3.4.2 Case for the micro approach

The second part of the research is aimed at analysing the positive and negative impacts of the public support provided to PPP projects through a micro approach. Unlike the previous case, this approach does not require a broad sample of projects; however, it requires more detailed information about the projects to be analysed in order to incorporate all possible perspectives in the case study evaluation. Following the selection criteria previously established, it was decided to analyse the financial support provided by the Spanish government through the awarding of subordinated public participation loans (SPPLs) to a set of brownfield shadow toll road PPPs, known as the First Generation Motorways.

First, all the information necessary to analyse both the process of granting SPPLs and its outcomes was made available. Second, the First Generation Motorway PPPs were awarded in 2007, and then they are sufficiently mature for the analysis to be carried out. Third, these government loans are presently the most important public instrument for supporting PPP contracts in Spain. Fourth, this type of support has been previously used by the Spanish government, with diverse results. Fifth, in the case study, this support mechanism is granted once the projects are in operation, which allows evaluating the effectiveness of the public support granted *ex post*.

SPPLs are government loans, subordinated to the senior debt, intended to both increase the financial feasibility of projects and establish a fairer means of sharing profits between the private sector and the government (Vassallo and Sánchez-Soliño, 2007). This instrument is very appealing for governments since it does not account for public deficit, however, it transfers quite risk to the government since its impact on public resources is unsure and will depend on the performance of the project. These subordinated loans have been implemented by the Spanish government either as an *ex ante* support mechanism or as an *ex post* means to rebalance the economics of concession and PPP contracts. In both cases, there are supported projects that managed to turn around their financial position and are performing well and projects that ended up going bankrupt and were not able to comply with the loan commitments.

In the case study selected, the use of SPPLs as a means to rebalance the economics of the First Generation Motorway PPPs after the government imposed additional works not included in the original contracts is evaluated. On the one hand, the upgrading of these motorways, built back in the 1980s, was deemed necessary by the government given the large increase in traffic volumes and accident rates they experienced. On the other hand, the conditions of these loans were very advantageous for the PPP contractors, to the point that could be considered insufficient to guarantee the interest of the State against that of the shareholders.

SPPLs have been found interesting by previous researchers. Vassallo and Sanchez-Soliño (2007) studied the SPPLs offered to a set of toll motorway concessions in the procurement process. These authors analysed from a theoretical point of view how SPPLs work, and the strategic incentives they produce among bidders. However, they did not study the performance of the loans once awarded. On their part, Lara et al. (2016) focused on quantifying the real value provided to the PPP contractors of the first generation motorways through the SPPLs by employing a real options model that is later applied to one of the sections. To that end, they calculate de NPV of the loan for different scenarios of traffic growth. However, these authors do not conduct any analysis intended to analyse the sustainability of the public loan from a global perspective. Neither do they study the impact that the payback of the loan may have on the future budget. The research conducted intends to fill the gap left by the aforementioned research works by conducting an *ex post* sustainability analysis of SPPLs on the basis of the real information collected ten years after the PPPs were awarded.

The analysis conducted is relevant for a number of reasons. Firstly, evaluating the *ex post* sustainability performance of the public support provided to PPP projects is very important to analyse the effectiveness of the mechanism itself, in order to

provide guidelines to governments that may implement this mechanism in the future. Secondly, to the knowledge of the author, most of the previous research works study the existing support mechanisms in different countries (Dailami and Leipziger, 1998; OECD, 2014b) by focusing on methodologies to quantify the value of different support mechanisms in order to analyse how they impact different stakeholders such as PPP contractors (Dias and Ioannou, 1995; Wibowo, 2006) or the government (Wibowo et al., 2012). However, those studies do not pay much attention to the global impact on sustainability. Finally, the *ex post* evaluation conducted identifies relevant policy implications that arise from the case study.

***PART II* METHODOLOGICAL
DEVELOPMENT OF THE CASE STUDIES:
ANALYSIS, RESULTS AND DISCUSSION**

4 PUBLIC SUPPORT TO PPP PROJECTS IN SPAIN

This chapter presents the Spanish context in which the case studies selected in this Thesis are framed. Section 4.1 provides a brief background of the Spanish experience with PPP projects over time. Section 4.2 analyses the Spanish public support to this type of projects, with a special focus on the evolution of the regulatory framework in the country. Section 4.3 focuses on the public support mechanism that will be analysed in the micro case study (see chapter 6). Section 4.4 analyses the support that Spanish PPP projects have received from the EU and the EIB, the effects of which will be further examined in the macro case study (see chapter 5).

4.1 Spanish experience with PPPs: brief background

Spain has an extensive experience in promoting infrastructure through concession and PPP contracts (Vassallo and Izquierdo, 2010). The first concessions awarded to build, finance and operate railway lines date back to the first half of the 19th century (Ortega et al., 2016a). Although there were previous attempts, the Spanish PPP model did not really start to develop in the road sector until the 1960s, and its legal framework was not regulated until the Toll Road Concession Law was passed in 1972 (Villalba-Romero, 2014). Since then until the new PPP Law was approved in 2003 —Law 13/2003—, almost every PPP project granted in Spain was in the transport sector, with a clear predominance of motorways. Since then, a diversification of these schemes towards other sectors and activities such as public buildings —especially healthcare—, urban mobility infrastructure, hydraulic infrastructure, and water and waste treatment can be observed (Allard and Trabant, 2007). In terms of volume of projects, from 1990 to 2017, 162 PPP projects worth more than EUR 35 billion were developed in Spain (EPEC, 2018), only surpassed by the UK and France at the European level.

With a total of 17,157 km (Ministerio de Fomento, 2018a), Spain has currently the longest high capacity road network within Europe (EUROSTAT, 2018). 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 Cohesion Funds —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 Marguerite Fund. 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 Cohesion Fund and ERDF). Structural funds are redistributive funds so 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 financing in the form of loans.

In addition, the country has relied on the PPP model to carry out a significant part of such a wide network. Since the late 1960s, 54 concessions totalling 3,307 km have been awarded, 2,759 km of which are state motorways (Ministerio de Fomento, 2018b). Since the late 1990s, the country has also got quite a long experience in shadow-toll road projects. At the regional level, 26 shadow toll projects totalling around 1,200 km (Acerete et al., 2018) have been awarded so far. On its part, the Central government has made use of this mechanism for the first time in 2007 when implementing the First Generation Motorway Plan, comprising 10 projects based on a combination of shadow toll and availability payment approaches; and five years later with one project that relies entirely on availability payments, totalling 1,042 km altogether. The latter implies that toll and shadow toll road PPPs represent, respectively, 19.27% and 13.07% of the high capacity network currently in operation, what also makes Spain one of the countries that has resorted the most to the use of PPPs in the world.

Government's recourse to PPP schemes over time has been mainly motivated by budget constraints, and different approaches according to the ruling political party's ideology can also be observed throughout three differentiated periods. Between 1967 and 1975, the scarcity of quality roads in the country, the increase in road traffic levels and the lack of sufficient budgetary resources forced the government to start a new toll motorway program to expand and improve the motorway network. During this period, almost 2,000 km of toll motorways were awarded greatly due to the fiscal advantages and financial guarantees provided by the government.

From 1975 to 1996, there was a period of stagnation in the toll road sector mainly motivated by the political instability in the country and the destabilizing effect of the petroleum crisis on the Spanish economy. The socialist party elected in 1982, which was politically opposed to road charging, decided to build free access motorways fully financed through the public budget by widening and upgrading the most important Spanish roads. During this period, only 112.3 km of toll motorways were awarded by the government, who had to create a state-owned company (ENA) to take over three road PPP projects in financial distress. On their part, regional governments started an active policy on toll motorways after new competences were assigned by the Spanish Constitution, and previously state-owned concessions were transferred accordingly.

The new conservative government that took office in 1996 relied once again on the PPP approach to develop new motorways so as to meet the requirements of the Stability and Growth Pact in terms of public deficit and debt. The new PPP Law 13/2003 extended the scope of the PPP model to any kind of infrastructure, boosting

the use of these schemes by central, regional and local governments not only to build, but also to rehabilitate and operate different types of public facilities. From then on, financial restrictions in public budgets have moved even progressive parties towards adopting PPP models, although a swift may be observed from toll schemes to shadow toll and availability payment mechanisms, more socially acceptable. The last PPP program implemented by the government is the First Generation Motorway Plan, intended to rehabilitate and operate different stretches of the free motorways upgraded back in the 1980s. With the exception of the aforementioned motorway based on availability payments that was awarded in 2012, the PPP model has not been used in the road sector since the crisis started.

4.2 Spanish support to PPPs

4.2.1 Evolution of the Regulatory framework in Spain

As seen in the previous section, Spain has an extensive experience in financing motorways through concession and PPP contracts that dates back to the 1960s. The public support and the economic-financial advantages from which these motorways have benefited have undergone several changes over time according to the evolution of the regulatory framework on PPPs (Albalade et al., 2015; Baeza, 2008; Vassallo and Sánchez-Soliño, 2007). This regulatory framework can be divided into three clearly differentiated periods.

First Phase (1953-1972)

The first law attempting to regulate toll roads in the country dates back to 1953 (Law of 26 February 1953 on toll roads' construction). This law had several drawbacks, basically the lack of regulation of the fiscal, financial and economic framework of the concession contracts, and did not provide for the possibility of granting any subsidy by the State. This Law was quickly repealed and replaced by Law 55/1960, which did foresee the possibility that either works or operation were subsidized by the State. The Law also allowed the concessionaires to benefit from tax exemptions and bonuses, and State guarantees for the loans raised on the foreign capital markets

From 1966 until 1972, toll motorways were awarded by specific decree-laws, with the consequent dispersion and casuistry of the rules on concession of toll motorways (Blasco, 2008). The Decree-Laws also maintained a favorable legal framework for toll road concessions through the awarding of foreign exchange insurances guaranteeing up to 75% of the financing in foreign currencies (generally located around 40-45%), providing non-refundable state subsidies, refundable

advances during the first years, tax rebates and exemptions, or allowing flexibility in the depreciation of assets. Also, projects were allowed to extend the concession term if the delay in the construction was due to force majeure, and toll revision was based on the increase in construction and operation costs.

Second phase (1972-2003)

Toll motorways awarded from 1972 were regulated by Law 8/1972 and the successive Decree 215/1973. This Law consolidated the benefits and exemptions conferred to this mechanism by previous Decrees-Laws. The establishment of a stable and clear legal framework and the contractual formalization of the guarantees, rights and duties of the public and private sectors in the PPP formulas led to an increase in business confidence and allowed the development of a great number of motorways under these schemes (Blasco, 2008). However, the main driver of the aforementioned motorway PPPs development during this period was the wide range of tax and financial benefits available, which in practice covered most of the financial risk arising from the projects.

Among the tax benefits, concessionaires would benefit from reductions in the taxable base of the property tax, capital transfers and documented legal acts, tariff duties, internal taxes and sales taxes of up to 95%, and bonus of up to 95% of the tax on Capital Income. Regarding the economic-financial benefits, the following can be pointed out: (i) concessionaires were allowed to depreciate the asset during the entire concession term; (ii) both the State guarantee and the foreign exchange insurance were maintained; (iii) exceptionally, non-refundable subsidies —both cash subsidies or in kind-grants— were available when, for reasons of urgent national interest, it was advisable to promote a motorway before it reaches the minimum profitability threshold; and (iv) exceptionally, refundable advances were allowed during the first years of operation of the toll road when collection was insufficient to meet the financial commitments acquired.

In most cases, the government opted for granting the aforementioned benefits to their maximum amount, except for the subsidies and refundable advances (Baeza, 2008). However, given the costly consequences for the government of the State guarantees and exchange insurances awarded during the period of 1967 to 1975 (Vassallo and Sánchez-Soliño, 2007), they were suppressed in 1988 (Law 25/1988). Law 8/1972 also introduced the extension of the contract term as a means to compensate the concessionaire for any delay not attributable to the concessionaire itself. Also, toll revision was related to the increase in the costs of services.

Several amendments were introduced to modify the Law during the 1990s and early 2000s. First, the possibility of awarding subordinated loans and refundable advances,

besides contract term extensions, from the beginning of the concession period to maintain the economic-financial viability of the concession was included (Law 13/1996). Also, the extension of the concession term was established as the main mechanism to restore the economic-financial balance of the concessionaire on a subsequent amendment (Law 66/117). Finally, a new mechanism for toll revision based on the CPI's evolution was established, although it was latter modified to take into account both the evolution of the CPI and the difference between the actual and the expected traffic volumes (Law 14/2000).

Third phase (2003-2015)

This phase was noted for the approval of the public works concession law in 2003 (Law 13/2003), which repealed and amended part of the Articles comprising the previous legislative regulation on toll motorways (Law 8/1972 and Decree 215/1973). This Law introduced new mechanisms to restore the economic-financial balance of the concessionaire, a fairer traffic-risk sharing approach, a wider set of financing sources and new guarantees.

In this phase, the economic-financial balance of the concessionaire could be restored by modificating either the fares, the concession term, or any specific clause of economic content of the contract. Regarding the traffic risk, the elimination of non-repayable subsidies (Law 38/2003), the introduction of the commitment to limit the maximum and minimum total yields of the concessionaire, and the introduction of a mechanism for measuring the quality of service sought to achive a fairer risk-sharing approach. The new legal regime of the concession contract is characterized by its wide flexibility regarding the diversity of sources and forms of financing made available to the concessionaires. It seeks to facilitate their access to the capital market either through conventional means —that is, the financing by credit institutions or the issuance of bonds or similar securities—, with the possibility of public guarantees, or through the securitization of the credit rights linked to the explotation of the project. Also, it incorporated several mechanisms whereby the public sector could eventually contribute to the financial feasibility of these contracts either during construction or the operational phase such as in-kind grants⁴, refundable advances, price-linked subsidies, repayable subsidies or loans —with or without interest— and subordinated or participation loans. Also, tax credits and exemptions to concessionaries were maintained.

⁴ The assets delivered to the concessionaire would be integrated in the concessionaire's patrimony and destined to the use foreseen in the project during the contract term and then would revert to the government.

Finally, in all phases, concessionaires have benefit from the State's Financial Liability⁵. This clause acts as a termination guarantee since it commits the government to compensate the concessionaire in case of early termination of the contract, being bankruptcy one of the causes of termination of the contract contemplated by law. This guarantee is pledged in the financial contracts of the concessionaries, thus acting as a safeguard of the financial risks incurred by the companies.

Thus, a gradual decrease of the public support provided to PPPs intended to cover risks that are more manageable by the private sector such as financial risks (through State guarantees and the foreign exchange insurances) or construction and maintenance risks (by linking toll revision to either construction or maintenance costs) can be observed. In contrast, there is a gradual increase of public support intended to cover risks derived from traffic through price-linked subsidies, subordinated or participation loans, toll revision linked to traffic deviations or the introduction of availability payment schemes related to the quality of service provided by the concessionaire. Overall, public support to PPPs has been a constant in the Spanish government policy over time and PPPs have benefited from a somewhat favourable framework that has boosted the development of road infrastructure in times of budgetary constraints.

4.2.2 Economics of PPP contracts in Spain

Even though PPPs have allowed the construction and update of an extensive network of high-quality motorways with private financing, they have not prevented neither excess capacity nor frequent recourse to the renegotiation of contracts, with consequent changes in initial terms, prices, and recourse to public aid (Engel et al., 2015). Even though the risk-sharing model under which these motorways were awarded has been improved over time (Albalade et al., 2015; Vassallo and Sánchez-Soliño, 2007), there are still certain issues to be improved (Baeza and Vassallo, 2011).

According to the Spanish law, the government is obliged to restore the economic balance of the contract, to the benefit of the relevant party as it corresponds, in the following cases: (i) when the government modifies, for reasons of public interest, the contractual terms originally agreed—for example by requesting additional

⁵ Law 40/2015 on the legal arrangements for the public sector introduced a set of changes to the public procurement law 3/2011 regarding the early termination of the concession contracts. Since then, the RPA is only applicable in the cases of contract resolution for reasons attributable to the government.

works to be carried out; (ii) when circumstances of force majeure or actions undertaken by the government lead directly to the substantial disruption of the economics of the contract; and (iii) when the contract terms establishes thresholds (both upside and downside) to share the return obtained or the losses incurred by the PPP contractor.

Although the causes for rebalancing the economics of the contract are clearly defined in the Law, the Government of Spain has gone beyond these causes when it comes to avoid the bankruptcy of road concessions. This way of acting has been highly motivated by the effects of the aforementioned legal provision known as the State's Financial Liability included in the public contracts law that regulates the compensation to the PPP contractor in case of early termination of the contract. This clause commits the government to compensate the private sponsors for the works that have been built and not yet depreciated in case that the early termination of the contract has not been caused by their negligence. It is worth noting that bankruptcy caused by low traffic levels is not considered negligence by the private sector since traffic risk is mostly allocated to the private sponsors. This guarantee may have serious negative consequences for the government since the committed payments, once they are effective, will immediately increase the size of the Spanish public deficit. This is particularly undesirable for the Spanish government given that since the country entered the EU it has had to undergo a process of fiscal consolidation and reduction of the public debt that has become even tougher after the financial crisis. This situation encourages the government not to let the PPP go bankrupt and, consequently, to provide aid to the contracts when they experience financial difficulties (Baeza and Vassallo, 2011).

As a consequence of that, a great number of concessions have had their economic balance restored so far (Acerete et al., 2018; Baeza and Vassallo, 2011) at the expense of the user, the taxpayer or both. Mechanisms often used to adjust the economic balance of the contracts include the extension of the contract term⁶, the increase of fares, the *ex post* introduction of revenue mitigation mechanisms, the modification of the fare review system, the awarding of economic-financial benefits, the granting of new road sections, the awarding of cash subsidies⁷, and the provision

⁶ Although the extension of the concession term as a mechanism to restore the economic-financial balance has been a common practice in Spain, its use is currently restricted by law to a certain type of PPPs and to a maximum percentage of the initial concession term (Ridao Martín, 2012).

⁷ The granting of direct cash subsidies by Spanish public administrations was limited by Law 38/2003 to competitive concurrency procedures. However, the interpretation of the exceptions contained in the aforementioned law and the subsequent laws passed at the regional level have allowed governments to circumvent this restriction, resulting in subsidies being used to compensate PPP contractors (Acerete et al., 2018; Bueno Armijo, 2017).

of SPPLs. These government loans are presently the most important public instrument for supporting PPP contracts in Spain since they allow to increase the financial feasibility of the projects without increasing the national public deficit.

4.3 Subordinated Public Participation Loans (SPPLs) in Spain

4.3.1 Regulation

Participation loans are currently regulated by Royal Decree-Law 7/1996, which defines them as a subordinated financial instrument whose main characteristic is that the lender would receive a variable interest based on the evolution of the outcomes of the borrowing company's activity. The criteria to determine such evolution may be either profits, revenues, sales or any other variable demanded by the government or freely agreed by the contracting parties. Law 13/2003 on PPP contracts strengthens the role of this instrument as a source of financing PPP infrastructure projects. It also states that the government may award a SPPL to a PPP contractor either before or after the contract has been awarded. SPPLs are sometimes awarded *ex post* to help the economic viability of the contract.

When the government decides to offer SPPLs, it can freely design their characteristics as long as they comply with three rules (Vassallo and Sánchez-Soliño, 2007):

- SPPLs must always be subordinated to other senior debt. Therefore, participation loan holders (the government in this case), will be paid back only after the PPP contractor has met its obligations to the senior lenders.
- The expected return of SPPLs must be related to the economic performance of the PPP contract. That is, the better the results —either in terms of traffic, sales, profits, or any other variable specified in the contract— the greater the rate of return of the loan. The idea behind this approach is that the government partially shares the profits and losses of the project with the private sponsors.
- The expected yield of SPPLs should be market based since otherwise the government could make use of SPPLs to provide hidden subsidies that should be accounted within the public deficit.

Likewise, and unless expressly stipulated otherwise, the PPP contractor may not amortize the borrowed capital in advance, unless the early amortization implies the payment of the net present value of the expected future benefits according to the

economic-financial plan revised and approved by the competent body of the government at the time of the return of the capital.

SPPLs have important advantages compared to other means of fiscal support (Vassallo and Sánchez-Soliño, 2007). They not only increase the financial feasibility of PPP contracts, but also establishes a fairer risk-sharing approach between the private sponsors and the government since unforeseen additional profits will be shared between them. Therefore, this mechanism aligns the interests of both parties since, as the interest rate to be paid by the sponsors to the government is related to the project performance, the better it performs, the larger the return of the SPPL will be. Also, unlike subsidies, this mechanism allows the PPP to receive aid from public resources without increasing the national public deficit. This is due to the fact that SPPLs are treated for accounting purposes as financial transactions according to the European National Accounting Standards defined by EUROSTAT (2016) as long as those financial investments are made under market conditions.

However, this mechanism has also some issues (Vassallo and Sánchez-Soliño, 2007). One of the problems is that the requirement established by EUROSTAT is difficult to prove wrong. As there is no competition, it is difficult to know if the loan is provided under market-based conditions. Governments actually prove this requirement by using future revenue forecasts that are hard to refute. As a consequence, the government could misuse this mechanism as an implicit subsidy by providing loans that the PPP contractor in the end will not be able to pay back. Also, this type of guarantee turns the government into a borrower of the project. Therefore, if the project does not perform as expected, the annual interests incurred will significantly decrease while the risk that the loan is not repaid will increase. Finally, if the supported project is unable to turn its financial position around and goes bankrupt, the contract must be liquidated with the consequent activation of the State's Financial Liability. Therefore, the government —and ultimately the taxpayer— will bear both the costs associated to assuming responsibility for the infrastructure and the non-repayment of the participation loan and its interests until the end of the contract term.

4.3.2 Practical implementation of SPPLs in motorway concessions and PPPs in Spain

SPPLs have been implemented by the Spanish government either as an *ex ante* support mechanism or as an *ex post* means to rebalance the economics of concession and PPP contracts. Regarding the first case, the possibility of requesting SPPLs has been offered to the bidders at an early stage of the procurement process to strengthen the economic feasibility of the project and, consequently, encourage

private participation in the tender. This approach was used, for example, in 2004 in the procurement of the *Cartagena-Vera*, the *Madrid-Toledo*, and the *Ocaña-La Roda* motorways and the Alicante's ring road; and, two years later, in the procurement of the *Málaga-Alto de las Pedrizas* motorway (Vassallo and Sánchez-Soliño, 2007).

However, SPPLs have also been granted to already awarded PPPs to compensate the contractor for amendments in the contracts or changes made by the government on the grounds of promoting the public interest; or even, in an attempt to save a project from bankruptcy. This is mainly due to the fact that, as already commented, the Spanish contract law obliges the government to take over the concession and compensate the private sponsors for those works already built and not yet amortized in case of bankruptcy, resulting in a high cost for the government and the taxpayers.

The suburban toll motorway concessions around Madrid (R-2, R-3, R-4 and R-5) represent a good example of the use of this instrument by the government in a failed attempt to avoid those concessions to go bankrupt. The economic performance of these concessions was pretty damaged by the traffic shortfalls caused by the economic recession (and an overly optimistic estimate of the traffic demand), and large cost overruns in the expropriation process. In this context, the government granted SPPLs to help them pay the cost overruns incurred when acquiring the right of way, and to provide liquidity because of the revenue shortfall (Baeza and Vassallo, 2011; Vassallo et al., 2012c). However, despite the regulatory and financial aid, estimated at around EUR 600 million, all concessionaires went bankrupted in the end (Bel et al., 2017).

Another example of the use of SPPLs to rebalance the economics of the contract to compensate PPP contracts for a discretionary change in the initial contractual conditions by the government is the case study selected for the micro-analysis conducted in this Thesis (see Chapter 6). As it will be later explained, the private companies in charge of the first generation motorways were granted SPPLs as a compensation for the government's imposition of carrying out additional works not foreseen in the original projects.

4.4 EU financial support to Spanish PPP projects

Ever since the Trans-European networks (TEN) policy was founded in the 1990's 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 or the European Regional Development Fund (ERDF); and loans provided by the European Investment Bank (EIB). However, it soon became evident that the Community funds were not sufficient to push ahead with the projects needed at EU level. The budgetary constraints to which Member States were subject in the context of the Stability and Growth Pact, made it practically impossible for them to raise the necessary funding to carry them out, even with EU support. This situation was delaying the completion of the trans-European transport network, as well as that of the Member States' own networks.

PPPs began to be regarded by the European Commission (EC) as a key instrument to boost the completion of the infrastructure projects of interest of both the EU and the Member States. Since the 1990s, there has been a clear policy from the EC to support PPPs as a means to promote infrastructure projects within the TEN-T network (European Commission, 2008) and increase the level of private financing in public infrastructure projects, especially in the transport sector. This position has been reflected through a variety of actions, such as the reform of the procurement rules; the progressive removal of technical (European Commission, 2003), legal (Commission of the European Communities, 2004), administrative and accounting barriers (EUROSTAT, 2004); and the evolution of EU financial resources available for the development of PPP projects, including a series of innovative financial instruments (Zaharioaie, 2012).

The EIB, on its part, has been very active in supporting effective PPPs across Europe, especially in transport infrastructure (Thomson et al., 2005b). The Bank has also worked together with the Commission to create an adequate regulatory, financial and administrative framework to promote private sector investments and the mobilization of community financial resources in order to contribute to the development of PPPs (European Economic and Social Committee, 2005). Currently, the EIB carries out the promotion of PPPs not only through the usual lending activities, but also by making available to the interested parties their technical knowledge and experience; providing technical support in the realization of the projects; acting as an intermediary between the interests of the public and private sectors; increasing the scope and affordability of PPP projects by reducing their financing costs; and introducing a wide range of new financial products and securitization to facilitate the participation of private lenders. In addition, the EIB continues to work closely with the Commission and the private sector to increase the multiplier effect of the Bank's financing by encouraging the combined use of its loans with subsidies from the EU budget and different innovative financial instruments.

The recent economic and financial crises posed a number of constraints limiting long-term financing for large-scale infrastructure in Europe (Christophersen et al., 2014; Medda et al., 2013). Banks became both more risk averse and less willing to provide long-term financing due 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 European sovereign debt crisis led to a drastic reduction in public sector investments in infrastructure, aggravating the already existing investment gap in transport infrastructure across Europe.

As a consequence, the EU renewed its interest in PPPs as one of the vehicles to increase investments in infrastructure (Dhéret et al., 2012), considering crucial providing support for promoting PPP projects to deliver infrastructure. Therefore, the EC jointly with the EIB created a set of innovative financial instruments to facilitate long-term financing for developing European infrastructure through PPP projects.

Below, a brief revision of the main EU financial instruments currently available for PPP projects to get funding is presented. Also, the extent to which projects under that scheme have benefited from these instruments is undertaken in order to analyse whether all the measures adopted by both the EC and the EIB to promote the use of PPP projects in combination with EU funds have been successful for the case of Spain.

4.4.1 EU grants: Structural Funds and TEN-T budget line

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 co-funding 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 GDP/GNI. They account for the largest amount of funding potentially available to PPPs, and 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 which 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 (EPEC, 2011b).

Spain has been the largest beneficiary of both Structural and Cohesion Funds until the enlargement of the EU in 2004. More than 60% of these resources were allocated to transport infrastructure projects (Dall'Erba, 2003). However, only two of the major projects supported up to date by the ERDF and the CF, were PPPs: the AP-53 (Santiago-Alto de Santo Domingo) toll road in Galicia and the *Almanzora* (Purchena-AP-7) shadow toll motorway in the region of Andalusia. These projects represent only 1.6% of the ERDF budget allocated to Spain from 2000 to 2013.

Regarding the TEN-T line and its successor the Connecting Europe Facility, the majority of grants are offered to support studies or works that contribute to the TEN-T programme priorities. Unlike the ERDF and the CF, every Member State, regardless of their level of development, is eligible to receiving financing from the TEN-T programme. TEN-T funding opportunities are also explicitly open to public private partnerships (PPPs). However, both its co-funding rates and budget allocation are much more constrained than the ERDF or the CF ones.

Despite the fact that TEN-T funding allows for grant disbursement to private partners and both its rules and application process are favourable for PPPs (EPEC, 2011b), only two PPP projects have benefited from this grant in Spain, both in the 2007-2014 period: the high speed rail line Perpignan-Figueras, connecting France and Spain; and the new motorway A-66 from Benavente to Zamora, accounting for just 9.8% of the whole budget in this period.

4.4.2 EU loans: EIB co-financing

One of the largest EU sources to promote PPP projects for transport infrastructure throughout Europe, particularly the TEN-T networks, is the European Investment Bank (EIB). The EIB is a EU's long-term lending, not-for-profit institution owned by the Member States that supports projects of European interest (European Investment Bank, 2015a). All projects financed by the EIB must be in line with the objectives of the European policy and be viable from an economic, financial and technical point of view, meet strict environmental and social standards and be tendered according to the EU procurement rules (European Investment Bank, 2004).

The EIB has a positive influence on the stability and added value of the PPP projects it co-finances (European Investment Bank, 2004). It has developed flexible financing structures for PPPs and adapts the financial system to the needs of each project. This fact, in combination with the lower cost of EIB funds, strengthens the economics of

the projects and improves the affordability of the investment for both the public sector and the potential private lenders. Moreover, economic quality is ensured by the EIB's high standard of due diligence, which comprises the project appraisal and selection, as well as its close cooperation with the promoters in the whole life cycle of the project.

Figure 4.1 shows the volume of loans granted by the EIB to both conventional procurement and PPP projects in Spain. Although a greater amount of loans allocated to PPP projects can be noted ever since 2000, this amount has never surpassed the amount allocated to conventional projects. Moreover, in the last few years, with the sole exception of 2010, the loans to PPPs have been dwindling. This has been caused by the huge decline in the PPP market since the beginning of the financial crisis.

Figure 4.1 Comparison of the volume of loans granted by the EIB to PPP projects and non PPP projects in Spain in the period 1990-2014. Source: EIB (2015b)

Figure 4.2 displays the relative involvement of the EIB in the Spanish PPP market, showing the share of financing of the total volume of PPP projects that has been covered by loans from the Bank. This figure gives an idea of the overall implication of the EIB in the financing of this type of projects, which can be considered quite relevant. However, it is important to clarify certain issues related with the nature of the data compared in the figure. On the one hand, SEOPAN provides the volume of PPP projects tendered each year. On the other hand, EIB loans are often granted the year after the project in question has been tendered. There is therefore a slight distortion in those years in which this happens, with 2013 being a clear example of this. This year also coincides with the fact that very few projects were tendered and for a total volume much lower than that of previous years.

Figure 4.2 Share of the volume of transport infrastructure PPP projects financed through EIB loans in Spain in the period 2003-2014. Source: EIB (2015b) and SEOPAN (2015)

Finally, it can be concluded that although EIB financing has evolved slightly in line with CPP project activity in Spain, the total amount of loans earmarked for this type of mechanism has been relatively small compared to both the Bank's total volume of loans for infrastructure projects and the volume of CPP projects carried out in Spain.

4.4.3 EU Innovative Instruments

More recently, the Commission has set up a number of instruments aiming at supporting the provision of important transport infrastructure and addressing the financing gap that most PPP projects have to meet. The beneficiaries of these instruments are PPP projects facing difficulties in becoming bankable for several reasons. In the last few years, the EU has promoted innovative instruments aimed at covering some of the project risks associated to PPP projects, whilst others try to supply the lack of sufficient financing for large infrastructure projects under PPP schemes.

The most important ones are the Loan Guarantee Instrument for Trans-European Transport Network Projects (LGTT), designed to encourage and promote private-sector involvement in the financing of the TENT projects by covering traffic revenue shortfalls during the initial operating period (ramp-up); the EU Project Bonds Initiative, aimed at enhancing the credit quality of project bonds issued by private companies in order to make them more attractive to investors; and the Marguerite Fund (MF), a pan-European infrastructure equity fund established to act as a catalyst in the development of infrastructure in the transport and energy sectors.

Their scope has been quite modest in Europe in general and particularly in Spain. Only the LGTT and the Marguerite Fund have contributed to finance transport PPP

projects in Spain. One of the seven projects signed by the LGTT is the C25-Eix Transversal, located in the region of Catalonia, in Spain. On the other hand, in 2012 the Marguerite Fund made its first investment in the transport sector by acquiring a 45% stake in *Autovía del Arlanzón*, a brownfield TEN-T project in Spain.

5 MACRO-ANALYSIS OF EU SUPPORT TO PPPs

This chapter presents the evaluation carried out to empirically analyse whether the EU financial support provided by either the European Union or the European Investment Bank has positively influenced the proper evolution and sustainability of the economic performance of PPP projects over time. The analysis was applied to the case study of road PPPs in Spain.

The research conducted in this regard led to the publication of two scientific articles:

- (i) *Garrido, L., Gomez, J., Baeza, M.A., Vassallo, J.M., 2017. Is EU financial support enhancing the economic performance of PPP projects? An empirical analysis on the case of Spanish road infrastructure. Transport Policy, 56, 19-28.*
- (ii) *Garrido, L., Rangel, T., Baeza, M.A., Vassallo, J.M., 2019. Does EU support contribute to economically successful Public-Private Partnerships (PPPs?) A panel data analysis of road PPP projects in Spain. Journal of Public Policy, 39(1), 65-87*

5.1 Analysing the relationship between EU support and PPPs performance

As seen in the previous chapter, both the EC and the EIB have been actively promoting the use of the PPP model to develop large infrastructure projects at the EU level through a variety of measures, including making available financial resources and technical support for this type of projects. These measures are expected to have influenced not only the number of PPPs developed in recent years across Europe (Verhoest et al., 2015), but also their quality, soundness and performance over time. This makes EU support a very interesting case of supra-governmental support available to PPPs to be analysed in the framework of the research objectives of the present Thesis.

There is also growing interest in the extent to which Community assistance is effective in achieving its objectives. In this context, the results of the support have been analysed both at the project level, albeit to a very limited extent, and the country level, to a much greater extent. In the first case, a few micro studies have been carried out to assess the performance of relatively small samples of projects benefiting from EU support (Bain, 2009b; European Court of Auditors, 2018, 2014). In the second case, most of the studies have focused on analysing, at a macro level, the impact that the support has had on the economic development of the beneficiary country (Becker et al., 2010; Mohl and Hagen, 2010). The present research aims to carry out a macro analysis in Spain at the national level, but analysing the impact of EU support at the project level.

Specifically, this part of the research is aimed at analysing, at the macro level, to what extent EU financial backing had a positive influence on the economic performance of PPPs applied to the case study of road projects in Spain. A relatively high number of Spanish road PPP projects have benefited from EU support. This allows analysing the relationship between receiving EU support and the performance of PPP projects through the application of econometric methodologies and statistical techniques, thus broadening the scope of previous studies. In this respect, two analyses are carried out by using two different econometric specifications: (i) a multiple regression analysis, and (ii) a panel data analysis. They both are intended to evaluate, empirically, whether EU support is a success factor of PPP projects, and also to identify further variables affecting the proper performance of this type of projects. The methodology used to that end is summarized in Figure 5.1.

Figure 5.1 Steps conforming the methodology followed in the macro approach

5.1.1 Data collection and treatment

In order to accomplish the objectives of the research, an intensive data collection from multiple sources was carried out.

Regarding the compilation of data concerning tolled motorways, the Spanish Ministry of Transport (Ministerio de Fomento, 2013) publishes annual reports providing data related to the motorways under the competence of both the central and regional governments. With regard to shadow toll motorways, Vassallo and Pérez de Villar (2010) already conducted a detailed compilation of the projects awarded in Spain at the time, which served as a starting point. The resulting PPP projects included in our database are illustrated in Figure 5.2.

Figure 5.2 Current situation of PPP road infrastructure in Spain

Source: Author's elaboration

From the database comprising all Spanish PPP projects, two different samples have been selected to be used in the different statistical analyses carried out, according to the requirements imposed by the specifications. The sample used in the multiple regression analysis includes all the Spanish PPP projects whose contracts were awarded between 1995 and 2009. The sample used in the panel data analysis initially included all PPP projects awarded before 2008, although some of them had to be excluded in order to obtain a sufficiently balanced dataset. This sample includes motorways with different degrees of maturity, all of them having an historic data set long enough for the statistical approach adopted. The projects conforming the aforementioned samples are illustrated in Figure 5.3.

Sample 1

Sample 2

Figure 5.3 Projects included in the samples analysed

Source: Author's elaboration

The second phase of the data collection involved an in-depth analysis of the European and Spanish working papers to know which projects received EU support (Directorate General for EU Funds, 2014). This information allowed completing the PPP project database with the European financial support that each project had received, as well as the form under which this aid was channelled: grant, debt, guarantee or through innovative financial instruments, as can be observed in Table 5.1.

Table 5.1 Share of financed PPP projects in the samples analysed

	Financed Projects				Non Financed Projects	Total
	EIB	EIB + MF	EIB + LGTT	ERDF		
Sample 1	27	1	1	1	27	57
Sample 2	21	-	1	1	31	54

For collecting economic and financial indicators of the PPP projects performance, the unconsolidated annual accounts of every concessionaire were obtained from the SABI database. Regarding the variables included to control for the evolution of the economy, traffic data (AADT data) were collected from the statistics of both the Spanish Ministry of Transportation (Ministerio de Fomento, 2013) and of regional governments whilst GDP data were collected at both national and provincial level from the National Statistics Office (Instituto Nacional de Estadística, 2014). The GDP deflator was used to convert the currency values to constant euros. This information was obtained from the Bank of Spain (2015).

5.1.2 Definition of the variables included in the models

Identifying the indicator for measuring performance (IMP)

Establishing a proper indicator for measuring economic performance of PPPs revealed to be one of the most important decisions in the methodological approach. Although there are many IMPs in the literature to take into consideration, the primary screening was considering the necessity for the criteria to be objective, measurable and available in a database for as many projects as possible.

Particularly, it was selected the economic profitability (EP) measured as the ratio between the gross annual profit and the assets included in the balance sheet of each PPP company. Profitability is a proper measure of the economic performance of the project and, in a context of increasing competition, concessionaires are aware that the project must be properly managed to be profitable (Parfitt and Sanvido, 1993). Burja and Burja (2009) indicate that EP is an important indicator for financial analysis since it reflects the level of economic viability of the firm necessary for

highlighting, planning, and controlling its performance and competitiveness. Furthermore, profitability is considered a critical criterion for a project to be successful by Project Managers (Menches and Hanna, 2006) and the most important one for public sector clients (Kušljic and Marenjak, 2013).

Additionally, this variable was widely used before for the same purpose in the literature, such as in Horta et al. (2012) or Kangari et al. (1992). Profitability is measured in the post-construction phase, when the final account is settled and the financial result can be assured (Chan et al., 2002). Particularly in PPP projects, it constitutes a relevant criterion given the clear incentive to hasten the construction phase so as to accelerate the rate of return. Moreover, as a performance measurement, profitability can be taken as a key indicator of the evolution of the project over time, acting as a tool for continuous improvements (Takim and Akintoye, 2002).

There is an 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 economic profitability. Feenstra and Wang (2000) and Fisher and McGowan (1983) in their turn criticize the fact that EP is based on published economic statements that may hide the real economic performance of a certain company. Holian and Rez (2011) suggest using other metrics, such as Economic Value Added (EVA) as an alternative measure.

Another performance indicator available in many databases is the financial profitability, which measures the net profit (NP) of the concessionaire divided by the equity of the firm at a specific time. However, this performance indicator is not considered suitable for the analysis, since it is highly influenced by strategic decisions of the firm, such as dividend distribution, capital increases, accumulated losses, etc.

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

The economic profitability (EP) that is used as the dependent variable in the models measures the gross profit of the concessionaire before taxes and interests (Horta et al., 2012). It was calculated for every project using the gross profit ($GP = \text{concessionaire revenue} - \text{non financial costs}$) and the total assets ($TA = \text{all financial resources}$). This indicator is not affected by the different financial structure (equity vs. debt) of the project database.

Definition of the explanatory variables

An exhaustive review of the current literature in order to identify the most appropriate success factors for PPP projects was conducted in order to define the explanatory variables to be included in the models. Although a higher number of success factors was considered in a first round, the difficulties encountered in terms of collecting data made it impossible to include some of them in the present research. Also, the final selection of explanatory variables was based on the specific characteristics of the selected cases and the econometric specifications used for each case. The main factors affecting the performance of PPP projects that have been considered in the models developed in the following sections are explained below. The specific variables controlling for these effects will be explained later for each of the models in Subsection 5.3.

Favourable investment environment factors, such as stability of the economic environment in the country, stable macroeconomic conditions, sound economic policies or the existence of sufficient demand of services have been found relevant for PPP projects in both developed and developing countries (Chan et al., 2010; Hardcastle et al., 2005; Zhang, 2005). These factors are inherent to the state of the economy, which makes it necessary to include a control variable capturing the evolution of the economy in the models. Economic performance may be measured through variables such as GDP or employment, either at the national or regional level. However, when PPPs are demand-based, traffic is likely the most accurate factor for controlling economic performance (Liyanage and Villalba-Romero, 2015). These variables are expected to be correlated to each other so they will be tested in the analyses and the most appropriate will be included in the final models.

In addition to this, it makes sense to add some explanatory variables referring to the institutional environment. The government expertise and experience in delivering PPP schemes has been proved as an important driver of the success of PPPs (Ng et al., 2012). In the case of Spain, the central Government has extensive experience in arranging this type of contracts, dating back to the 1960s. However, since the PPP Law 13/2003 was passed, many regional governments have launched quite a large amount of PPPs.

Project performance may also vary depending on the type of project, the type of contract and the characteristics of the projects (Liyanage and Villalba-Romero, 2015; Müller and Turner, 2007). Thus, it is important to include explanatory variables to capture additional effects regarding the inherent nature of the projects under analysis, such as their size, the type of PPP or the type of project.

Other variables that might explain the evolution over time of the economic profitability are supply-side factors, such as: (i) the average toll per km, as higher tolls tend to deter road users but increase projects profitability; (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 tourism 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 order to analyse the potential impact of the EU support on PPPs performance, a categorical variable indicating whether the project has been supported by the EU or not will be included in both analyses, being the variable of greater interest for this research. Another variable in this regard that may be worth studying is the type of EU support provided to each project so as to analyse the different effect that the support measures may have on projects performance. Unfortunately, this distinction could not be made in the selected case since the samples are not balanced enough to provide conclusive results about the different financial instruments (see Table 5.1).

Finally, political and legal factors and the degree of reliability and technical strength of the PPP consortiums were not explicitly included in the analyses conducted. The literature (see for example Abdel Aziz 2007; Hardcastle et al. 2005; Ng, Wong, and Wong 2012; Zhang 2005) points out political and legal 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) as important success factors of PPPs. However, these factors are not considered in the research as all projects are located in Spain and are subjected to the same regulatory context. Similar considerations were applied to the reliability and technical strength of the PPP consortiums, which is also considered significant for the proper performance of the PPP projects (Zhang, 2005). This factor was not explicitly included in the analyses since all the PPPs were awarded to Spanish infrastructure operators with a large experience in PPPs and a technical strength endorsed worldwide (Chislett, 2014).

5.1.3 Research Hypothesis

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 (EPEC, 2011b; European Investment Bank, 2004). 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., 2005b). Because of this fact, those 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 benefits 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.

In this research, it is assumed that there is no treatment selection biased, that is, that the PPP projects analysed had the same probability of receiving EU support or, in other words, that projects with EU support are not systematically different from those not being supported. This assumption makes sense when analysing projects within the same country. As observed by Marcelo and House (2016), projects tend to be correlated or clustered at the national level since they are subject to the same macroeconomic and legal environments and often to a common national infrastructure and investment policy.

In this respect, several facts should be considered regarding the projects not supported by the EU: (i) projects awarded before Spain entered the EU, in 1986, were not able to apply for EU financing; (ii) projects were not generally in need of financial support: Spain experienced a period of economic prosperity during the 1990-2007 cycle that boosted the development of the financial markets; the low interest rates and the high liquidity available at that time helped banks to get more debt out of the market, being relatively easy for the projects to reach financial close; (iii) it is very complex to blend PPP projects and EU funds, especially when it comes to Structural Funds (ERDF or CF): the inflexibility of the grant application, the funding gap analysis, the difficulty in timing the grant application and the PPP procurement, etc., tend to discourage PPP projects from applying for this funds not

only in Spain, but in the EU in general; (iv) every project to be financed must contribute to meeting one or more of the EU policy objectives: unless a project comply with this requirement it will not be eligible for funding regardless of its soundness and high quality; and (v) the EU has a limited budget and, consequently, all projects cannot be funded even though the EU requirements are met. Therefore, a project not receiving EU funding does not necessarily mean that the project has not enough global quality.

This case study thus allows the author to test the hypothesis adopted in this research, which 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 the EU requirements provide a clear added value to the project, both enhancing and assuring its economic feasibility and resiliency.

5.1.4 Modelling approaches

In order to analyse the supra-governmental support provided by the EU and the EIB to PPP projects at the macro level, two different analyses have been developed through different econometric specifications: a multiple regression analysis and a panel data analysis.

5.1.5 First analysis: Multiple Regression Analysis Model

The first analysis carried out in order to analyse whether EU financial backing has a positive influence on the economic performance of PPP projects involves the development of a multiple regression model. This model has been applied to the sample 1 defined in a previous section, which comprises all road PPP projects awarded from 1995 to 2009 in Spain.

Selection of the variables included in the model

As stated in a previous section, the economic profitability (EP) was adopted as the dependent variable in the model. To account for the EP in the modelling approach, the fifth year of operation for each project was considered in order to avoid the ramp-up period, when traffic demand is not consolidated yet. This period is characterized by greater inter-annual instability of road demand levels and consequently of its economic profitability, potentially showing a non-representative picture of the project performance in the medium- and long-term. Although the ramp-up period may vary from immediate to beyond five years (Bain and Wilkins,

2002), the most considered ramp-up duration among the researchers ranges from three to five years (Baeza and Vassallo, 2008b; Pašić et al., 2014).

A later date was also initially considered to evaluate the economic profitability of the projects, particularly the seventh year of operation. However, the sample was substantially reduced in this case, as at the time of the analysis⁸ several projects had been in operation for less than seven years and had to be discarded. Thus, the fifth year was finally regarded as a trade-off between allowing the ramp-up period to be avoided and preserving as many projects in the sample as possible.

Within the sample, both cases of economic success and failure can be found regarding EU supported and non-EU supported projects. The mean of the economic profitability variable for the EU supported projects is 0.019, compared to a 0.012 for non-EU supported ones. The model will explore whether there is a statistically significant difference between both groups of projects.

Regarding the explanatory variables, all variables included in the previous and final models are described and explained:

- (1) In order to account for the favourable investment environment factors, that is, to control for the evolution of the economy, two potential explanatory variables were tested: (i) provincial GDP, and (ii) provincial GDP per capita. The level of traffic was discarded as explanatory variable because there are availability-based projects in the sample, whose income does not depend on demand levels. As the model tries to explain the EP of the PPP projects in their fifth year of operation, the 5-year GDP variation for each project is calculated. GDP data was collected at the provincial level with the aim of better understanding the influence of local socioeconomic characteristics on projects economic performance. In this respect, each road was assigned the total GDP of the provinces it crosses, in contrast to adopting an average national GDP evolution for the whole road network analysed.

In the end, the potential effects of the macro-economic situation were introduced through the evolution of the provincial GDP, since the provincial GDP per capita did not seem to explain the EP. Particularly, it was considered its variation in the first 5-year period since the project was awarded. As traffic demand is elastic with respect to the level of economic activity (Gomez et al., 2015; Matas et al., 2012), the GDP variable will also capture the effect of the evolution of traffic in those projects that are demand-based.

⁸ The analysis was carried out during 2015, by which time the latest available data for the projects analysed were from 2013.

- (2) The construction cost of the project was also included in the model as a control variable for the size of the project. Table 5.2 shows a descriptive analysis of the continuous variables of the model.

Table 5.2 Descriptive analysis of continuous variables

	5 th year Project's EP	5-year GDP variation	Total construction investment
Mean	1.59	6.21	261.82
Median	1.29	6.80	153.55
Range	9.09	35	1248.07
SD	2.05	9.26	266.58
CV	1.29	1.49	1.02
IQR	3.29	16.88	280.10

SD: Standard Deviation; CV: Coefficient of variation; IQR: Interquartile Range

- (3) Four dummy variables were considered in order to capture additional effects regarding the type of PPP and the type of project (see Table 5.3 below). Firstly, the type of PPP variable distinguished between explicit toll, shadow toll and availability payment, taking into account the different payment mechanisms established in the PPP contracts. Secondly, the type of project distinguished between greenfield, brownfield or widening of a conventional existing road, thus considering the nature of the construction works carried out by the concessionaires to deliver the projects.
- (4) A categorical variable differentiating urban and interurban road PPPs has been introduced in the model. Demand elasticities in short-distance trips, more attuned to urban motorways, significantly differ from long-distance movements, typical of interurban mobility. It seems that changes in generalized transport costs —toll, fuel, etc.— tend to discourage long-distance trips to a greater extent than the shorter ones (Gomez et al., 2015). This may lead to a difference in terms of traffic demand evolution between urban and interurban motorways that might have an impact on the EP of the projects. In addition, a categorical variable distinguishing between road PPPs located in coastal or inland regions was also considered. In this respect, demand levels on coastal motorways may be strongly influenced by the high levels of tourism characteristic of these areas, especially in holiday seasons. This may have a positive and significant impact on the EP of these projects compared to those located in the interior of the country, where there is much less tourist flow.
- (5) Regarding the government experience in developing PPP schemes, most of the PPP projects of the sample were promoted by the Spanish national government, which has an extensive experience in arranging this type of contract. Unfortunately, it was not possible to differentiate in the analysis the

national government from the regional governments because, as most of the regional governments have developed shadow-toll PPPs, there are multicollinearity problems between the type of PPP and the governmental level managing the contract.

- (6) Finally, the variable of greater interest for this research was included: a categorical variable indicating whether the project has been supported by the EU or not. Table 5.3 presents the descriptive analysis of the categorical variables of the model, showing the share of PPP projects supported by the EU according to their characteristics.

Table 5.3 Descriptive analysis of categorical variables

		Type of project	EU financed		Total
			Yes	No	
Type of PPP	Explicit toll	Greenfield	9	5	14
		Brownfield	0	0	0
		Road Widening	0	0	0
		Total	9	5	14
	Shadow toll	Greenfield	7	7	14
		Brownfield	10	0	10
		Road Widening	4	11	15
		Total	21	18	39
	Availability Payment	Greenfield	0	0	0
		Brownfield	0	4	4
		Road Widening	0	0	0
		Total	0	4	4
Total	Greenfield	16	12	28	
	Brownfield	10	4	14	
	Road Widening	4	11	15	
	Total	30	27	57	

Table 5.4 Definition of the variables included in the analysis

Indicators	Variables		Type
Economic performance	PPP's economic profitability in the 5 th year of operation	$EP = \frac{Gross\ Profit}{Total\ Assets}$	Continuous
Favourable investment environment factors	Provincial GDP	5-year variation from PPP award	Continuous
	Provincial GDP per capita		Continuous
Economic factors	Construction cost of the project		Continuous
	EU support		Categorical
Factors inherent in the PPP	Type of PPP		Categorical
	Type of project		Categorical
Location	Urban / Interurban		Categorical
Situation in the country	Coast / Interior		Categorical

Econometric model employed

Several econometric models were initially considered in order to analyse the influence that EU support has on PPP project performance. Some were discarded due to the specific nature of the variables involved in the analysis. For example, logistic regression analysis was not suitable since the dependent variable selected, EP, is not categorical. Other specifications were rejected because of the characteristics of the PPP sample. For instance, panel data techniques and time series analysis were initially discarded because of the great disparity between PPP concessions with regard to the year they were awarded, which resulted in highly unbalanced data samples. Cross-sectional analysis was discarded as well for a similar reason. This specification only provides information at a very specific period of time (e.g. in 2013). However, the maturity of the projects at that time, and consequently their profitability, may substantially differ among the concessionaires conforming the sample, thus providing biased results.

The technique finally adopted was the standard Multiple Regression Analysis, which allowed avoiding the inconvenient already mentioned and has been already used by previous research analyses with a similar purpose (Andersen et al., 2006; Lam et al., 2008). This technique has also proven to be useful in identifying the explanatory factors that are considered critical to the successful outcome of PPP projects (Kwofie et al., 2016).

The multiple regression technique is a statistical specification widely used to analyse the functional relationship between several independent variables and a single dependent or criterion variable, in order to explain the variation in the dependent variable as a result of changes in the explanatory or independent factors. This analysis thus allows establishing the nature and magnitude of the impact of different explanatory variables on the dependent variable (Andersen et al., 2006).

Hence, multiple linear regression analysis was employed to model the relationships between the economic profitability (dependent variable) and a set of success factors (independent variables) for road PPP projects in Spain (see Table 5.4). The regression equation can be expressed as follows:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} + \varepsilon_i; \quad i = 1, \dots, N \quad (1)$$

where β_0 represents the intercept while $\beta_1, \beta_2, \dots, \beta_k$ are regression coefficients which denote the estimated change in the dependent variable Y for a unit change of the independent variables $X_1, X_2, \dots, X_k$. The prediction error (ε_i) or the residual, is the difference between the actual and predicted values of the dependent variable.

The adjusted coefficient of determination (adjusted R^2) reflects the goodness of fit of the regression model.

Several models with different combinations of the explanatory variables previously described were tested before selecting the final one. The adjusted coefficient of determination was used to determine the model that best explains the variance of the economic profitability of road PPP projects.

Final model

The final model includes six explanatory variables: (i) provincial GDP variation in the first 5-year period since the project was awarded; (ii) construction cost of the project; (iii) type of PPP; (iv) type of project; (v) a categorical variable differentiating between urban and interurban PPP projects; and (iv) the parameter of greatest interest for the study, a dichotomous variable indicating whether the project has received support by the EU or not.

$$EP = f(\Delta GDP, \text{project size}, \text{type of PPP}, \text{type of project}, \text{location}, \text{EU support}) \quad (2)$$

In terms of econometric method, the multiple regression model can be estimated by the ordinary least squares procedure (OLS) and in our study it is written as:

$$Y_i = \beta_0 + \beta_1 \Delta GDP_i + \beta_2 PS_i + \beta_3 TPPP_i + \beta_4 TP_i + \beta_5 Loc_i + \beta_6 EUF_i + \varepsilon_i \quad (3)$$

Where:

Y_i is the economic profitability of concessionaire i in the fifth year of operation;

β_0 is the intercept term;

ΔGDP_i represents the GDP variation in the first 5-year period since the project was awarded to concessionaire i ;

PS_i is the total construction cost of the project awarded to concessionaire i ;

$TPPP_i$ is the type of PPP according to the payment mechanism established in the contract of the concessionaire i . This is a categorical variable that distinguishes between explicit toll, shadow toll and availability payment, taking the first one as the reference case in the model.

TP_i is the type of project regarding the nature of the construction works carried out by the concessionaire i to deliver the project. This is a categorical variable that distinguishes between greenfield, brownfield or widening of a conventional existing road, being the first category the reference case used in the model;

Loc_i represents the location of the PPP project awarded to concessionaire i with respect to its urban or interurban context. This is a dummy variable, which takes

1 when the project is an interurban road connecting different cities and it takes 0 when it serves or is located in urban areas;

$EU F_i$ indicates whether the road PPP project awarded to concessionaire i has received EU financial support. This is a dummy variable, which takes 1 when the concessionaire of the specific project received support, and takes 0 otherwise;

ε_i is the prediction error or the residual.

The model evaluates the economic performance of each project in the fifth year of operation. Therefore, there is one observation per project, in contrast to one observation per year, as in time series analyses. As a consequence, the sample is relatively limited from a statistical point of view regarding some aspects.

First, local fixed effects are only considered to a certain extent: the scarcity of sample makes it necessary to consider a trade-off between the number of variables and the degrees of freedom. The GDP variable is evaluated at the provincial level, capturing the local socioeconomic characteristics of the different areas where the projects are located. Moreover, a differentiation has been made regarding the location of the projects with respect to their urban/interurban context to take into account their influence on the projects performance. Other potential variables related to local effects were initially considered, such as the location of road sections in coastal or interior roads. However, they were not finally included in the model as resulted to be non-statistically significant.

Likewise, there are not enough projects to make an analysis disaggregated by region. Therefore, it is not possible to evaluate the regional governments' experience either in comparison with the Spanish national government —given the strong collinearity of this variable with the type of PPP variable— or among the different regions.

Modelling results

In order to analyse the relationship between the economic profitability of PPP projects and certain success factors such as the EU financial support for PPP projects in Spain, a multiple linear regression model has been calibrated. The model explores (see Table 5.5) the influence of the different explanatory variables (success factors) considered. Particularly, it estimates whether having EU financial backing has, from a statistical point of view, a significant influence on the profitability of the projects; that is, whether the projects beneficiaries of EU financial aid are more likely to be profitable. Before setting up the regression model, some tests for checking multicollinearity between the explanatory variables modelled were applied, showing no significant interactions.

Most of the explanatory variables in the model were categorical, so a base case needed to be chosen as a reference to establish comparative analysis among the different categories (see Table 5.5). For instance, with respect to the type of PPP, explicit toll concession was selected as the base case, so it allows us to approach whether shadow toll or availability payment concessions have a statistically significant different performance for project profitability.

Table 5.5 includes the modelling results from the multiple regression analysis. Given the significance level of every independent variable, we can observe that the type of PPP and the economic environment are critical success factors for the financial performance of PPP projects. Furthermore, the financial support provided by the EU seems to positively influence the economic performance of PPPs. By contrast, the type of project and its location did not evidence to be an explanatory factor significantly affecting the economic profitability. Further comments about the importance of these explanatory factors are provided in Subsection 5.2. Regarding the goodness-of fit of the model, the 37.9% of variance of the economic profitability can be explained by three success factors. In addition, the signs of the regression coefficients and their statistical significance are consistent with the expected results, as it will be later discussed.

Table 5.5 Multiple Regression Analysis for Economic Profitability

Explanatory variables	Multiple Regression Model		
	Unstandardized beta coefficients	Unstandardized typ. error coefficients	Significance level
(Constant)	-2.148	1.044	0.045
<i>Type of PPP</i>			
Explicit toll (base case)			
Shadow toll	2.932	0.780	0.000
Availability payment	5.096	1.476	0.001
<i>5-year GDP variation</i>	0.070	0.032	0.035
<i>EU financial support</i>	0.979	0.539	0.076
<i>Type of project</i>			
Greenfield (base case)			
Brownfield road	0.797	0.913	0.387
Road Widening	-0.488	0.705	0.492
<i>Total construction investment</i>	0.000	0.001	0.746
<i>Location</i>			
Urban road (base case)			
Interurban road	0.303	0.681	0.659
Adjusted R^2	0.379		
No. of observations	57		

5.1.6 Second analysis: Panel Data Analysis

A second analysis was carried out in order to circumvent some of the drawbacks of the previous analysis undertaken, but also to test whether the results previously obtained were consistent. In this case, a panel data corresponding to 54 Spanish road PPP projects observed between 2009 and 2013 was built so as to analyse the influence that EU financial support has had on the economic performance of road PPP projects. This econometric specification was initially discarded due to the impossibility of creating a sufficiently balanced data sample. In order to provide for sufficient observations, the sample was extended to include road PPP projects awarded before 1995 (Sample 2).

Selection of the variables included in the model

As in the first analysis carried out, the dependent variable representing the project's economic performance is the economic profitability (EP) of each concessionaire, but on an annual basis. The main advantage with respect to the previous analysis is that this model evaluates the annual EP of each project over the period of time considered (2009-2013), not only in the 5th year of operation. Thus, there is one observation per project and per year analysed, improving the statistical significance of the sample.

Regarding the explanatory variables, several models with different variables were tested before selecting the final one. In this section, all variables included in the previous and final models are described and explained.

- (1) In order to account for the favourable investment environment factors, four potential explanatory variables were finally tested: (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).
- (2) Time may have also a clear impact on economic performance since, regardless of the evolution of the economy, EP tends to increase over time. This is due to 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. Furthermore, 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 non-existent. Firstly, the road is being built and cannot hold any traffic, or is

being upgraded and the traffic might be restricted. Secondly, 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 familiarized with the new toll road, change their travel patterns, and recognize the potential time-savings of using the new infrastructure (Kriger et al., 2006). This period is therefore characterized by great instability of road demand levels and, consequently, of the project's economic profitability.

These issues have been considered in the model by: (i) introducing the year of operation as a variable accounting for the maturity of the projects, and (ii) not including in the sample any greenfield project based on toll rates with less than 6 years of maturity. Table 5.6 shows a descriptive analysis of the continuous variables of the model.

Table 5.6 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
S.D.	0.065	19,523	12.433
Min	-0.423	2,737	1
Max	0.248	90,566	47

- (3) In order to consider the experience of the contracting authority in delivering PPP schemes in the analysis, a categorical variable distinguishing between projects awarded by the Spanish Government and the regional governments was considered. The proportion of PPP projects awarded by each authority in the sample selected can be observed in Table 5.7.

Table 5.7 Share of financed road PPPs in the sample according to the contracting authority

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

- (4) Three dummy variables were initially considered in order to capture additional effects regarding the type of PPP and the type of project. Firstly, the type of PPP variable distinguished between explicit toll and shadow toll PPPs, since there were no availability-based projects in the sample. Secondly, the type of project distinguished between greenfield, brownfield and widening of a conventional

existing road. However, the type of PPP variable was finally discarded because it was correlated with the contracting authority variable.

- (5) The cumulative investment of the project was also tested in the model as a control variable for the size of the project.
- (6) The three supply-side variables mentioned in the previous section (the average toll per km of the concession, the location of the road —interior or coastal— in the country, and the urban or interurban nature of the road) were also tested.
- (7) Finally, the most important explanatory variable of the model is a categorical parameter showing whether the PPP projects have received financial support or not.

Table 5.8 summarizes 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.

Table 5.8 Average values for Spanish PPP projects (2009-2013).

Concessionaires	Economic Profitability		AADT		Years of operation	
	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

Concessionaires	Economic Profitability		AADT		Years of operation	
	2009	2013	2009	2013	2009	2013
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
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	21,827	20,354	11	15

Source: SABI database, Spanish Ministry of Transportation and regional governments' statistics

Table 5.9 Definition of the variables included in the analysis

Indicators	Variables	Type
Economic performance	Annual PPP's economic profitability $EP = \frac{Gross\ Profit}{Total\ Assets}$	Continuous
	Provincial employment	Continuous
Favourable investment environment factors	Provincial GDP	Continuous
	Provincial GDP per capita	Continuous
	AADT	Continuous
Economic factors	Cumulative investment of the project	Continuous
	EU support	Categorical
Government experience	Contracting authority	Categorical
Factors inherent in the PPP	Type of project	Categorical
	Years of operation	Continuous
Location	Urban / Interurban	Categorical
Situation in the country	Coast / Interior	Categorical
Toll	Average toll per km	Continuous

Econometric model employed

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 involves 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 likely introduce at least some bias in those estimates due to omitted variables (Clark and Linzer, 2015).

The fixed effects model does not seem suitable for our analysis, since there are five variables that are constant within a group (time invariant variables): *Contracting authority, EU support, type of project, location and situation in the country*. This perception is corroborated by the results provided by the Hausman test, which is used to select between the fixed and the random effects model (Hausman, 1978)⁹. Therefore, a random effects model is applied to explore the relationships between the economic profitability of road PPP projects in Spain and the explanatory variables previously described (see Table 5.9).

Final model

Previous calibrations demonstrated that the type of project, the cumulative investment of the project and the three supply-side variables tested were not statistically significant, so neither of them were ultimately considered in the final model.

Thus, the final model includes four explanatory variables: (i) the annual average daily traffic volume (AADT) 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.

$$EP = f(AADT, maturity, contracting authority, EU support) \quad (4)$$

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

⁹ 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 fixed effect model. However, if a significant p-value is found, the fixed effect models should be considered.

$$Y_{it} = \alpha + \beta_1 \ln AADT_{it} + \beta_2 NY_{it} + \beta_3 CA_{it} + \beta_4 EUF_{it} + v_i + \varepsilon_{it} \quad (5)$$

Where:

Y_{it} is the economic profitability of concessionaire i at year t ;

α is the single constant term;

$AADT_{it}$ is the average annual daily traffic in the road section awarded to concessionaire i at year t ;

NY_{it} is the number of years that concessionaire i has been in operation at year t ;

CA_{it} is 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 0 when the concessionaire of the specific project did not receive European financial support, and it takes 1 when the concessionaire received any European support;

v_i is the unobservable random component that varies among the concessionaires;

ε_{it} is the error term that varies across each concessionaire i and year t .

Modelling Results

In this section we summarize the results of the random effects model applied to capture the differences across the 54 road PPP projects over time. The influence of the explanatory variables on the economic profitability of the concessionaires is analysed and discussed in Subsection 5.2 together with the results obtained in the first analysis carried out.

We have analysed the Wooldridge test for autocorrelation in panel data and the results indicate that the data do not present serial correlation. We 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 to 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 5.10. 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 economic profitability. Furthermore, the financial support provided by the EU seems to positively influence the economic performance of PPPs. Against our expectations, the results also indicate that PPP projects awarded by the central Government are associated with lower economic profitability.

Table 5.10 Estimation results and goodness of fit of the model.

Model's variables	Random effects model		
	Coefficient	Robust Standard Error	P-value
Constant	-0.178	0.043	0.000
ln(AADT)	0.019	0.004	0.000
Years of operation	0.003	0.001	0.000
Contracting authority (central Government)	-0.038	0.009	0.000
EU support	0.020	0.009	0.025
R-squared	0.7		
No. of observations	263		
Hausman test*	2.61		
	p-value > 0.05		

*The fixed effect model is rejected by the random effect model.

5.2 Contrast and discussion of the modelling results obtained in the analyses conducted

This section reports the main findings from the econometric analyses undertaken to explain the economic performance of road PPP projects for the case study of Spain. In this respect, the models allowed analysing the relative importance of different explanatory variables referred to (i) socioeconomic context, (ii) institutional environment, (iii) PPP-related attributes, (iv) supply-side factors; and (iv) EU support.

The results confirm that, as could be initially expected, the macroeconomic situation is positively correlated with the economic performance of road PPP projects. That is, greater levels of economic activity may enhance the profitability of PPP projects, whilst poor macroeconomic conditions may adversely affect it. This result confirms that favourable economic conditions promote better PPPs performance, as has been suggested in previous research on success factors of PPP projects (Hardcastle et al., 2005; Zhang, 2005).

The second analysis conducted also finds that traffic demand, in the form of AADT, is an enabler of the proper economic performance of demand-based PPP projects, since the remuneration of all projects included in sample 2 depend on traffic. Thus, the greater the traffic levels on the motorways, the higher the economic performance of the projects. This result also confirms previous research that has identified the existence of service need and traffic as key factors leading to project success (Liyanage and Villalba-Romero, 2015; Ozdoganm and Birgonul, 2000). This proves that both GDP and AATD variables are relevant for predicting the outcome of PPP projects.

Regarding the institutional environment, and against all expectations, the results of the second model indicate that the PPP projects implemented by regional governments showed better performance levels than those developed by the central Government, which has greater experience in arranging this type of contracts. This result seems to contradict, a priori, previous research that points to the government's expertise and experience in arranging PPP projects as a success factor of PPP projects. However, 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 to the regional ones. While most of the projects delivered by the Spanish Government were financed through explicit tolls, almost every project developed by 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. This result is consistent with the previous result discussed, which states the better economic performance of shadow toll PPPs compared to real toll ones.

Regarding the intrinsic characteristics of road PPP projects, it was found a significant difference in terms of economic performance among the sample according to the type of remuneration mechanism used. Particularly, the first model points out that both shadow toll PPPs and, to a greater extent, availability payment schemes tend to be more profitable when compared to explicit toll PPPs. At this point, it seems that those projects not directly financed through users' contributions (explicit tolls) or not assuming the demand risk show a better economic performance, and thus have a higher probability of being successful from the economic standpoint. This seems reasonable given that both shadow toll and availability payment mechanisms are less sensitive to economic fluctuations. This provides further support for the global trend towards preferably bidding new PPPs under availability payment approaches.

Unlike expected, the project's total construction investment and the type of project—that is, greenfield, brownfield or road widening approaches—were not found to

be significant in either of the two models developed. Regarding the total construction cost of the project, it was expected that the greater the investment needs of a project, the more difficult it would be to achieve positive outcomes. Regarding the type of project, it might seem reasonable for this variable to be significant given the substantial difference in terms of complexity of works, investment needs and level of risk assumed by the private sector between the different approaches, variables that have been identified as factors that may influence projects outcome (Alias et al., 2014; Chua et al., 1999; Sanvido et al., 1992). However, the results obtained for these variables are consistent with each other and show that, for the case study analysed, these variables seem not to be determinant for the proper economic performance of PPP projects.

On its part, the years of operation have a positive influence on economic profitability as expected, suggesting that more mature PPP projects are associated with a higher economic profitability of the concessionaire. This result is consistent with the usual evolution of PPP's cash flows, since they tend to increase over time. However, it could also point to the fact that the older projects may have been better planned and designed than more recently awarded ones. In this sense, the rationale and design of part of the PPP projects tendered during the late 1990s and early 2000s have been criticized in previous studies (Vassallo et al., 2012a).

Regarding the supply-side factors analysed, neither the average toll per km of the PPP project, project's location —interior or coastal— in the country, nor project's urban or interurban nature appeared to significantly influence the profitability of PPP projects. That is, differences in economic performance between urban and interurban roads, coastal and interior roads and in terms of the toll charged are not statistically significant. With respect to the urban or interurban nature of the PPP projects, this might be due to the fact that although a higher traffic can be observed in urban roads, interurban ones are subjected to a greater traffic of heavy vehicles. Trucks tariffs are commonly 2 to 10 times higher than the car ones, so they make a significant contribution to total revenues of the PPP compared with light vehicles. As for the location of PPP projects within the country, coastal roads were expected to be greatly influenced by tourism demand and thus generate higher revenues than those located in the interior. However, most coastal road PPPs in the country are toll roads, which may have biased the results. Although traffic on coastal toll roads shows greater elasticity with respect to the country's macroeconomic situation and lower toll elasticities than toll roads located in the interior (Gomez et al., 2015), their economic performance is still lower compared to shadow toll and availability schemes, mostly located in the interior of the country. Regarding the differences in the toll charged to users, the greater profits generated by higher tariffs may have

been offset by the greater sensitivity to tolls they generate, which may result in lower traffic.

Finally, we made the hypothesis that EU support contributes to a better quality and soundness of the projects, thereby improving *ceteris paribus* the economic performance of these projects in the operational phase. The results support this hypothesis, since having EU support seems to be positively correlated with the economic performance of PPP projects, and the variable is significant at 90% and 95% level of confidence in the first and second analyses conducted respectively. This is likely related to the quality and suitability of the PPP project, the correct contract design and the transparency and fairness of the procurement process. All these facts together are ensured by the EU, giving rise to projects with a better economic performance over time.

6 MICRO-ANALYSIS OF SPANISH SUPPORT TO PPPs

This chapter presents the *ex post* evaluation of the awarding of subordinated public participation loans (SPPLs) to ten brownfield motorway PPPs in Spain, the so-called First Generation Motorways. The social and financial impacts of the government support provided to these projects and their performance are analysed in order to evaluate whether the government's decision to support these projects was justified from a sustainability standpoint, taking into account the social benefits of the PPP projects, the financial feasibility of the loan and the public interest.

Part of the research conducted in this regard was presented at an academic conference:

Pérez de Villar-Cruz, P.; Garrido, L.; Barnés, B.; Vassallo, J. M., 2018. Mid-Term assessment of the shadow toll PPP Program to upgrade highways in Spain. XIII Congreso de Ingeniería del Transporte, 6-8 de junio, Gijón, España.

6.1 The First Generation Motorway PPPs

6.1.1 Main characteristics

In 2006, the Ministry of Transportation (MT) of Spain launched the First Generation Motorways Plan. The purpose of this Plan was to improve the alignment standards, quality and safety levels of a set of important motorways in Spain that were built at the beginning of the 1980s with quality standards far below those of the motorways designed and built years later, which made these roads much less safe than the rest of the network.

Given the budgetary constraints of the government and the need to improve the roads as soon as possible, the government decided to procure them using a shadow-toll PPP approach. Thus, the MT tendered the upgrading, maintenance and operation of eleven brownfield stretches, totalling 993 kilometres, which were finally awarded during 2007 for a period of 19 years (see Figure 6.1).

Figure 6.1 Motorway stretches included in the First Generation Motorway Plan

Source: author's elaboration

The contracts included three types of works: (i) initial works to adjust the design of the motorway to the current technical and functional standards required; (ii) major repairs to guarantee the proper level of service; and (iii) routine maintenance activities throughout the life of the contract. The private sector was entrusted the

design, financing, construction and operation of the infrastructure for a period of 19 years. The motorways were tendered on the basis of preliminary designs conducted by the government. However, the final PPP contractor was in charge of conducting the definitive designs that have to be approved by the government.

As the original motorways stretches were free of charge for the users, instead of charging real tolls, the government decided to keep the motorways free of charge by using a combination of shadow-toll and availability payment approaches. As a consequence of that, the government commits itself to pay a fee to the private PPP contractor on the basis of both traffic demand and a set of performance indicators during the life of the contract. The “demand fee” is monthly calculated according to: (i) the type of vehicle (light or heavy); (ii) the number of vehicles-kilometres of each type that run on the motorway; (iii) the fare applicable to each type of vehicle per kilometre travelled; (iv) until the full completion of the initial works, the percentage of the motorway stretches in service at the end of the previous year; and (v) the correction factor, upwards or downwards, depending on a set of performance indicators stated in the contract that measure the condition of the road and the quality of service provided.

6.1.2 Amendments to the contracts

All the contracts were awarded in 2007, before the economic crisis started, so traffic estimates were conducted on the basis of high future economic growths that in the end did not happen. The crisis, which started soon afterwards in 2008, had a great impact on the actual traffic volumes on the motorways. This situation was exacerbated by the high competition in the tender that incentivized bidders to make aggressive offers. The offers of the winning bidders were in some cases around 58% below the estimates originally conducted by the government.

Once the contracts were awarded, the government was reluctant to approve the definitive designs provided by the PPP contractors on the ground that they did not have enough quality. The PPP contractors in their turn complained that their designs rightly fulfilled the regulations and standards established by the government. This dispute caused important delays in the beginning of the works. In the middle of this dispute the economic crisis burst with force, causing a deterioration of the financial conditions originally foreseen by all PPP contractors. As the works had not started, PPP contractors had not reached a financial close at the time.

In this circumstances, the feasibility of the contracts was at risk, and with it the possibility of upgrading the motorways and henceforth improving their safety rates. Despite the delays and the financial problems, the government still wanted to have

the works made since they were very important to reduce the high rates of fatalities and injuries in the network. For this reason, in 2010 the government prompted an overall change in the contract terms aimed at both including additional works and imposing stricter requirements considered indispensable to provide the right service, and also helping the PPP contractors find the financing that, by that time, was extremely difficult to obtain in the financial markets.

According to Spanish law, the government has the right to change the terms of the contract to bring it closely into line with the public interest. If this change affects the economic balance of the contract, the initial conditions can be modified in favour of either the private contractor or the government in order to compensate for this change (Vassallo et al., 2012c).

The measures established in the 42nd Additional Provision of Law 26/2009, of the General State Budgets for the year 2010, for restoring the economic-financial balance of the PPP contracts of the First Generation Motorway Plan included two main aspects: (i) the increase in the fares originally approved to compensate for additional works; and (ii) the possibility of granting participation loans to the PPP contractors to finance these additional works. Finally, Additional Provision 8 of Law 43/2010 established the procedure for the approval of the restoration of the economic-financial balance and for the granting of public participation loans.

Once the contractors' obligation to build additional works was admitted, the economic-financial balances of all the contracts were re-established based on the original Economic-Financial Plans (hereinafter EFPs) according to the criteria selected by the MT. The criteria established to calculate the new fare was to preserve the Internal Rate of Return (IRR) before taxes of each project in case that the additional changes (mostly new works) had not been required. The PPP contractors delivered a new EFP, based on the original one, which included the additional investment amounts and the new fares necessary to keep the IRR according to the rules previously mentioned. These new EFPs, once approved by the government, became part of the contract documents.

Table 6.1 presents a summary of the main characteristics of the projects of the First Generation Motorways Plan awarded before and after the modifications introduced to adjust their economic-financial balances.

Table 6.1 Summary of the main characteristics of the PPP contracts of the First Generation Motorways before (BR) and after (AR) the restoration of the economic-financial balance.

Stretch	AADT 2010 (veh/day)	Motorway length (km)	Estimated payment** BR (M€)	Estimated payment** AR (M€)	Total investment BR (M€)	Additional works (M€)	Total investment AR (M€)
A1 - T2	23,446*	146.0	475.24	632.75	292.73	48.67	341.40
A2 - T1	97,555	56.1	409.19	523.71	219.82	39.97	259.79
A2 - T2	21,884	77.5	263.58	406.66	188.99	65.62	254.61
A2 - T3	15,263	93.3	350.03	502.84	216.29	57.83	274.12
A2 - T4	31,619	107.2	402.85	539.49	260.31	62.87	323.18
A3 - T2	23,097	136.6	277.89	389.92	192.97	45.53	238.50
A31 - T1	24,959	94.2	254.67	320.18	171.81	21.98	193.79
A31 - T2	30,617	111.4	241.90	339.68	157.6	34.85	192.45
A4 - T1	80,575	63.7	249.17	344.98	150.19	17.42	167.61
A4 - T3	23,149	107.0	319.07	445.75	199.22	59.68	258.90
Total		993.02	3,243.58	4,445.97	2,049.93	454.42	2,504.35

*2011 AADT

** This figure represents the estimated payment to be made by the government according to the EFP
M€ actualized to 2010 prices

This rebalancing, which was approved on June 2011, meant an increase in the fares that ranged between 21% and 67% with respect to the ones initially approved and an average increase in the price of the contracts for the government of around 37%. In addition, the granting of participation loans to the PPP contractors almost reached EUR 400 million.

6.1.3 Granting of SPPLs

The private companies managing the contracts of the First Generation Motorways Plan were also granted SPPLs as a compensation for the government's requirement of additional works not foreseen in the original contracts. The selection of this mechanism was motivated by different reasons. The first one was to facilitate the PPP contractors the financing of additional works not originally included in their financial plans at a time when the country was in the midst of a deep financial crisis. These loans were considered therefore the best way to provide liquidity to the private sponsors rapidly and at a reasonably low cost. The second reason was that this mechanism allowed the government to provide financial support to the PPP contractors without incurring in a higher public deficit. It is important to note that the Euro Pact required Spain to adopt strict control over national public accounts.

The conditions of the participation loans specified in the Additional Provision 42 of Law 26/2009, were very advantageous for the PPP contractors. First, the debt to the State was classified as subordinate debt, which allowed the contractors to reduce

pressure on equity, improve the risk profile of the senior debt and mitigate the liquidity risks of the project. Second, the repayment of the principal was set to take place six months before the end of the contract through a single payment. This repayment conditions allowed them to benefit from the entire loan during the whole contract period. Third, a three-year grace period was established for the payment of the loan interests. The interest accrued in this period are to be capitalized together with the principal of the loan. This allowed the private sponsors not to pay interests during the most sensitive stage of the project, the construction phase. Finally, the interest rates were, at least initially, below those of the market since the government would receive as remuneration from the loan, the greater of the following amounts:

- The resulting amount of applying a fixed interest rate of 175 basis points on the outstanding participation loan.
- The resulting amount of applying the following formula:

$$R = 0.5 \times I \times \frac{RaDf}{MaDf} \times PL \quad (6)$$

where R is the annual remuneration; I, the IRR of the project before taxes; RaDf, the real annual demand fee; MaDf, the maximum annual demand fee; and PL, the outstanding amount of the participation loan granted.

6.2 Methodology used in the case study

This section undertakes an *ex post* evaluation on the impacts of the SPPLs awarded by the government to the PPP contractors of the first generation motorways. These projects have exceeded half their contract period, which is a reasonable time to conduct the analysis proposed. The evaluation is aimed at assessing the positive and negative impacts of the government's decision to support these projects from the financial and social perspective. On the one hand, the risk borne by the government that the PPP contractor ultimately does not pay back the SPPL principal is analysed. This risk is stressed by the fact that, according to the SPPL payback rules, the loan will be fully amortized the last year of the PPP contract. On the other hand, the social benefits in terms of decreasing accident rates are estimated in economic terms. The methodology used is summarized in Figure 6.2.

Figure 6.2 Steps conforming the methodology followed in the micro approach

6.2.1 Selection of the motorways

The first step of the methodology is the selection of the motorways. The First Generation Motorway Plan comprises ten PPPs distributed among four of the six Spanish radial corridors from Madrid to the coast: A-1 (Madrid-Burgos), A-2 (Madrid-Zaragoza), A-3 and A-31 (Madrid-Alicante), and A-4 (Madrid-Sevilla) (see Figure 6.1). We decided to choose three PPPs with different characteristics. The stretches selected are operated by different firms, are located in different regions of the country, have different physical characteristics, and are representative of the different economic performance levels shown within the sample. This ensures a reasonable variety in the characteristics of the different roads.

The PPP projects chosen were: (i) the *Autovía del Arlanzón* (A1-T2), the longest section awarded with the larger contract's budget and the one with the best economic performance among the first generation PPPs so far; (ii) the *Autovía Medinaceli-Calatayud* (Aumeinsa) (A2-T3), with almost half of the length of the previous section and a relative high up-front investment required. This section has been facing financial problems, being the worst economic-performing project within the sample; and (iii) the *Autovía de los Llanos* (Aullasa) (A31-T1), with average

traffic, length and upfront investment. This section has also shown a medium economic performance when compared with the rest of the first generation motorways. The stretches selected are represented in the figure below.

Figure 6.3 First generation motorway stretches selected for the case study

Source: Author's elaboration

6.2.2 Selection of the set of performance indicators

The second step consists of the selection of a set of indicators for assessing the actual performance of the three PPP projects chosen from 2010 to 2015. Two different types of indicators are selected: financial and social ones. On the one hand, the evolution of the financial indicators will be later compared with that foreseen for them in the EFPs approved after the rebalancing of the economics of the contracts. This comparison will allow us to evaluate whether the projects are or are not performing as expected from the financial standpoint and, consequently, will be able or not to face the payback of the principal of the participation loans. On the other hand, the social indicators are intended to evaluate the benefits arising from the projects themselves so as to evaluate their social feasibility. Based on the results obtained, we will be able to assess whether the government's decision to support these projects was justified from a sustainability perspective.

The financial indicators selected are those which may have a major impact on the economics of the projects: investment (both capital and O&M costs), income, and

dividends. The major costs associated to this type of contracts are those required to improve the infrastructure and maintain it in proper conditions during its lifecycle. The investment made for these purposes is to be recovered over the life of the contract through the payment by the government of a demand fee that depends on the volume of traffic and the contractor's compliance with a set of availability and service quality indicators. The annual revenue from traffic is contractually limited by the maximum traffic threshold offered by the PPP contractor in the respective EFP. The income received from availability and quality of service was not originally included by the bidders in their EFPs since, as they comprised both bonuses and penalties, the government considered that on average its impact would be neutral. Both cost overruns and shortfalls in revenue may have a large impact on the economics of the projects and affect the repayment capacity of the PPP contractors.

On the other hand, the distribution of dividends is of great importance for the analysis carried out in this paper due to the conditions under which the participation loans were granted to the PPP contractors. It is worth noting that the provisions regulating these loans neither requested the contractors to establish a reserve to guarantee the repayment of the loan, nor did they establish minimum financial ratios to restrict the distribution of dividends in order to safeguard the repayment of the SPPLs. This fact, along with the subordinated nature of the loan, and the fact that the repayment of the principal must be undertaken the last year of the contract term, could hinder the loans' chances to be repaid. As the PPPs are structured under the project finance approach, the sponsors will have to face the repayment of the participation loan with the free cash flow of the last year of the contract period, as will be analysed later.

Regarding socio economic indicators, the increase in road safety derived from the works carried out in the motorways and the benefit related to the anticipation in time of the infrastructure delivery were selected. In order to measure the road safety improvement in the motorways, the evolution of the hazard (HI) and the mortality (MI) indexes are analysed. They are measured in accidents with victims, regardless of their seriousness, for every one hundred million vehicles and fatalities per hundred million vehicles, respectively. Thus, these indicators provide a good proxy of the risk of the motorways. Finally, the anticipation in time for the works to be carried is taken into consideration since it allowed users to take full advantage of the social benefits derived from the works in advance. As already commented, providing these loans to the PPP contractors was critical for boosting construction works since the financial crisis would have made it almost impossible for the contractors to obtain the necessary financing to carry out the works required in a relatively short period of time.

6.2.3 Analysis of the financial sustainability for the government

The third step of the methodology consists on analysing the financial impact of the SPPLs awarded for the government. To that end, the capacity of the PPP contractors to repay the principal of the loan together with the capitalization of the interests accrued during the three-year grace period is assessed. Given that the reimbursement of the SPPL will take place six months before the end of the PPP contract, the last year's cash flow¹⁰ (2026) for each of the three PPP stretches selected is estimated. This is a crucial variable to evaluate the capacity that the PPP sponsors have to pay back the SPPL loans, given that other senior loans should have been previously repaid as is usual in project finance.

For its calculation, the evolution of the main variables affecting the PPP cash flow in the period 2017-2026 is estimated by assuming the elasticities to socioeconomic variables calculated by previous research studies for the case of Spain (Gomez et al., 2015; Gomez and Vassallo, 2016). According to the aforementioned authors, there is a marked and stable correlation between the variation in GDP per capita and the evolution of light vehicle traffic; and also between the variation of industrial GDP and the evolution of heavy vehicle traffic.

In order to allow for uncertainty in the evolution of the economy, three potential scenarios of GDP evolution have been defined:

- **Base scenario**, in which the average of the estimates coming from the sources described in Table 6.2 is adopted. For the period 2022-2026, for which data were not available, a 1.6% growth rate, consistent with the estimates for 2022, has been considered. This scenario assumes that industrial GDP remains at 16% of total GDP over time, which is the approximate value that it has represented in recent years.

Table 6.2 Forecasts of GDP growth in Spain according to different agencies

Source	2017	2018	2019	2020	2021	2022
IMF	2.59%	2.07%	2.05%	1.91%	1.73%	1.60%
Bank of Spain	3.10%	2.50%	2.20%	-	-	-
OECD	2.80%	2.40%	-	-	-	-
World Bank	2.70%	1.90%	1.90%	-	-	-
European Commission	2.80%	2.40%	-	-	-	-
Consensus	2.50%	2.20%	-	-	-	-
Average	2.75%	2.25%	2.05%	1.91%	1.73%	1.60%

¹⁰ It is considered that, since there is no mandatory imposition of creating a reserve account, the payment of the principal will be born with the last year cash flow.

- **Optimistic scenario**, which assumes that in the period 2017-2019 the evolution of GDP coincides with that of the base scenario because of the great certainty of these estimates. However, from year 2019 to 2026 we estimate a steady increase of the yearly growth rates up to 3.1% in the last period (2025-2026), i.e. 1.5% higher than the assumption in the base scenario. For its part, the *total GDP/industrial GDP* ratio has also been taken constant in this scenario and equal to 16%, considering that in the most optimistic scenario of economic growth industrial activity would not increase in relative terms.
- **Pessimistic scenario** where, like in the previous one, it is assumed that in the period 2017-2019 the evolution of real GDP coincides with that of the base scenario. However, from year 2019 to 2026 we estimate a steady decrease of the yearly growth rates down to 0.1% in the last period, i.e. 1.5% lower than the assumption in the base scenario. In terms of industrial GDP, we assume that industrial activity decreases linearly in relative terms from 16% in 2017 to 13.5% in 2026. This way, we take into account the potential impact on traffic flows of a potential reduction in the industrial activity of the country.

The evolution of GDP for the three scenarios considered is shown in Figure 6.4.

Figure 6.4 Evolution of total GDP in the three scenarios considered

Then, the simplified cash flow estimate is carried out for each of the three PPP projects and the three scenarios by calculating the difference between income and expenditure (both costs and investments). Finally, we estimate whether the government is running a risk of not being paid back by the contractors by comparing the expected free cash flow in 2026, the last year of the contract, with the SPPL commitments (principal plus interests) to be paid back by the contractors that year.

6.2.4 *Ex post* evaluation on the social impacts of the SPPLs

The last step of the methodology consists on assessing whether the government's decision to support these projects was justified from a social perspective. As already mentioned, these projects have brought numerous benefits to both users and the society as a whole, such as increased road safety, driving comfort improvement, lower travel times, fuel savings or decreased air pollution emissions. In this case, an estimate of the social gains of the projects in terms of road safety improvement is used as a proxy of the social impact derived from the awarding of the loans.

The estimation has been carried out following the methodology developed by Pérez de Villar (2015), whereby the annual social benefit derived from the improvement in road safety in a certain motorway is calculated according to equation (7):

$$SB_{annual} = PIA_{sv} \times V_{PIA} = (PIA_{ex} - PIA_r) \times V_{PIA} \quad (7)$$

Where: **PIA_{sv}**, Personal Injured Accidents saved, is the number of accidents with victims avoided as a result of the execution of a certain measure; and **V_{PIA}** is the average statistical value of avoiding a victim in a traffic accident in roads with characteristics similar to that analysed.

On its part, the number of victims avoided (**PIA_{sv}**) is calculated as the number of accidents expected on the motorway according to the general trend (**PIA_{ex}**) minus the actual number of accidents that occurred in the motorway (**PIA_r**). Since **PIA_{ex}** is a highly uncertain value, Pérez de Villar (2015) recommends using as an approximation the average value corresponding to roads with similar characteristics. Finally, the annual value of the accidents avoided (**V_{PIA}**) is calculated according to equation (8) (Pérez de Villar, 2015).

$$V_{PIA} = \frac{\sum_{sc} FAT \times V_{FAT} + \sum_{sc} SEI \times V_{SEI} + \sum_{sc} SLI \times V_{SLI}}{\sum_{sc} PIA} \quad (8)$$

Where: $\sum_{sc} FAT$, $\sum_{sc} SEI$, $\sum_{sc} SLI$ are the total number of fatalities, seriously and slightly injured in roads with similar characteristics. **V_{FAT}**, **V_{SEI}** and **V_{SLI}** are the value of avoiding a fatality, a seriously and a slightly injured. $\sum_{sc} PIA$ is the total number of victims in roads with similar characteristics.

Finally, we compare the estimated social benefit produced by road safety improvements until the end of the PPP contracts (2026) with (i) the additional investment carried out with respect to a scenario 0 in which the government has not supported the projects and, therefore, the existing roads have not been upgraded and (ii) the potential financial loss estimated for the government in the pessimistic

scenario. These comparisons allow evaluating the social feasibility of the projects and the extent to which the risk borne by the government in providing SPPLs to the projects was offset by the social benefits. It is worth noting that the evaluation of social benefits is very conservative for two reasons. On the one hand, the society will keep on benefiting from accident rates reduction beyond 2026. On the other hand, other social gains (such as travel time savings, fuel savings and comfort improvement) are not being taken into account in this estimate.

6.3 Results

This section refers to the last steps of the analysis carried out and summarizes the main findings of the three selected PPP projects of the First Generation Motorway Plan. First, it shows the actual performance of the projects compared to the EFPs approved. Then, the participation loan repayment capacity of the PPP contractors for different scenarios is calculated with the aim to estimate its potential impact on the public budget. Finally, the social gains derived from the improvement in road safety of the motorways is estimated in order to assess whether the government did it right when deciding to grant the participation loans to support the projects.

6.3.1 Financial performance and social benefits

In this subsection we evaluate the financial performance and the social benefits of the three PPP projects under study, based on the analysis of the indicators previously selected. First, we use the financial indicators to compare the actual performance of the projects with that foreseen in the EFPs in order to determine their economic evolution. Then, we analyse the most important social benefits arising from the implementation of the projects. We focus our analysis in five variables: costs, income, dividends, accident rates and anticipation in the commissioning of the works.

Capital and O&M costs

Regarding the capital cost of the initial works, the three selected PPPs seem to have adjusted very well to the estimates conducted in their EFPs. There were just slight variations in the work schedules and the costs originally foreseen. As can be seen in Table 6.3, two out of the three projects analysed incurred lower costs than expected in the initial works. In contrast, there has been a significant underinvestment in major repairs and rehabilitation actions compared with the original estimates. The accumulated investment until 2015 contemplated in the EFP delivered by the PPP contractors was 12.98, 7.73 and 17.09 EUR million (actualized to 2010 prices)

respectively for the A1-T2, the A2-T3 and the A31-T1. However, only the A2-T3 and the A31-T1 carried out rehabilitation works worth, in both cases, less than EUR 2 million. It is worth to note that PPP contractors were able to comply with the performance indicators related to the state of the pavement without the need of conducting these rehabilitation works. As we will see later on, this fact led them to incur larger O&M costs.

Table 6.3 Capital cost in initial works excluding VAT, in EUR million (2010 prices)

Stretch	Total foreseen in EFP	Actual total investment initial works	Deviation from EFP
A1-T2	186.10	181.10	-2.69%
A2-T3	158.32	145.74	-7.94%
A31-T1	90.55	91.62	1.18%

Finally, as can be seen in Table 6.4, the PPP contractors incurred larger O&M expenditures compared to what was originally planned. This was likely caused by the incentives provided by the contracts to the achievement of a better maintenance and operation performance. The contract defines a series of quality levels associated to service indicators and the thresholds that must be met throughout the contract period. The performance of the PPP contractor in terms of those indicators may contribute to either bonuses or penalties corrections of the revenue coming out from traffic. As it was early mentioned, this over expenditure in O&M might be also the cause for the underinvestment in major repairs and rehabilitation of the road.

Table 6.4 O&M costs excluding VAT, in EUR million (2010 prices), in the period 2009-2015

Stretch	Total foreseen in EFP	Actual total O&M costs	Deviation from EFP
A1-T2	27.53	32.31	17.36%
A2-T3	25.55	26.64	4.27%
A31-T1	17.26	26.67	54.52%

Income

Figure 6.5 shows, for the three PPPs analysed, the evolution of current revenues — both from traffic and availability payments— compared to those foreseen by the EFPs¹¹ represented by the grey line. The shaded areas show the yearly revenues actually received by the PPP contractors. The darkest area reflects the traffic income and the lightest one, the availability income. The summation of both areas —figures located over the total area— totals the yearly revenue received by the contractors.

¹¹ The expected income was only based on the traffic forecasted since the income derived from the application of indicators was considered equal to zero in the EFP.

The grey line represents the revenue expected from traffic by the contractors in their respective EFP.

Figure 6.5 Income from traffic and availability excluding VAT, in EUR million

This figure shows that all the PPPs, especially the A2-T3, obtained less income from traffic than originally expected, especially during the first few years of operation. However, it can also be observed how both the A1-T2 and the A31-T1 have largely

compensated for these losses through the availability payments. In the last few years analysed, due to the improvement of the economy of Spain and the bonuses from availability payments, the total revenue obtained almost coincides with the original estimates.

Dividends

As can be seen in Figure 6.6, the actual dividend distribution to the shareholders of the projects for two of the PPPs analysed has substantially differed from that envisaged in the EFPs.

In the case of the A1-T2, dividends began to be distributed in 2013, one year later than planned. However, the accumulated amount distributed till 2016 was much higher than initially envisaged¹². In the case of the A31-T1, dividends began to be paid in 2014, four years ahead of schedule¹³. It is important to note that the A1-T2 starts distributing dividends the first year in which actual income reaches the expected income, although it doubles the amount that was initially going to be distributed. However, the A31-T1 starts distributing dividends ahead of schedule even though the expected income has not been reached yet.

Finally, as of 2016, the A2-T3 had not distributed dividends yet, following the schedule established in the EFP, with dividends to be distributed from 2018 on. This PPP has obtained lower economic results than those expected so far and has been incurring losses despite the additional income from indicators, obtaining the worst economic performance of the projects under study.

¹² Up to and including 2016, EUR 11.12 million were distributed compared to the EUR 8.09 million expected at that time in the EFP (actualized to 2016 prices).

¹³ Up to and including 2016, EUR 4.24 million were distributed compared to the EUR 0 million expected at that time in the EFP (actualized to 2016 prices).

Figure 6.6 Dividends distributed to the shareholders, in current EUR millions

Accident rates

Table 6.5 shows the evolution of the hazard and mortality indexes in the PPP projects under study. An important decrease in their values comparing the situation before the projects were awarded (2006 and 2007) and after works were completed (2014 and 2015) can be observed. Quantitatively, the range of improvement of the HI in the motorways analysed with respect to the starting situation ranges between 78 and 90%, while the MI has fallen by 29% on average.

As can be observed in the same table, two out of the three motorways are significantly safer than the rest of the state-owned roads with similar characteristics in terms of traffic levels (AADT) and road type (urban or interurban nature). Therefore, the substantial reduction of the accident rates of the motorway sections awarded derived from the upgrading actions carried out, and the consequent improvement in road safety for the users, is one of the biggest social gains from the projects.

Table 6.5 Evolution of the hazard and mortality indexes

Stretch	Before works		Works in progress		After works		Equivalent roads	
	2006		2007		2008-2013*		2015	
	HI	MI	HI	MI	HI	MI	HI	MI
A1 - T2	18.64	0.46	15.48	0.17	3.63	0.27	3.37	0.27
A2 - T3	19.25	0.94	27.89	1.75	6.26	0.45	4.22	0.21
A31 - T1	14.7	0.22	17.82	0.84	2.07	0.13	1.86	0.37

*The years in which works were carried out were not considered representative and were excluded.

Anticipation in the commissioning of the works

One of the main reasons why these projects were undertaken under the PPP approach was the urgency of the Plan and the insufficient budgetary resources to carry out these actions through conventional budgetary approaches in a reasonable period of time. In that respect, the Strategic Plan of Infrastructure and Transport (PEIT) estimated that it would take about eight years to meet all of the investment needs if they had to be built with budgetary resources (Fomento, 2005). This estimation was, however, based on an economic growth scenario that did not take place given the economic downturn that soon after affected the country and resulted in continuous budgetary reductions for the road infrastructure program since 2009.

Table 6.6 shows the time it took to carry out the necessary works for the motorways under study. As can be seen, it was possible to anticipate the implementation of the actions (with their associated social benefits) in a range between 6.5 and 4.5 years with respect to the option of undertaking the actions through the conventional procedure estimated by the MT. As a result, the society has been reaping the benefits of the positive savings and externalities derived from the works ahead of time, especially in terms of road safety and reduction in the number of victims, but also in terms of improved comfort, reduced travel time, fuel savings, etc.

Table 6.6 Period of works

Stretches	Beginning of the works	Completion date	Period of works
A1 - T2	Dec 2010	May 2012	2.4 years
A2 - T3	Dec 2010	June 2013	3.5 years
A31 - T1	Dec 2010	June 2011	1.5 years

Summary of the analysis of indicators

From the analysis conducted, it can be disclosed that, after receiving the loans, the PPP projects were able to turn their financial position around and are currently performing almost as originally expected. Indeed, two out of the three projects are distributing higher dividends than originally expected. This fact demonstrates that the capacity of the PPPs to repay their loans will not be hindered by the actual economic performance of the projects.

Regarding the social benefits of the projects, they have proven to be successful in greatly decreasing the rate of accidents towards, in most cases, much lower levels than those of their equivalent roads within the Spanish high capacity network. Moreover, both users and society have been able to enjoy the gains in terms of road safety, but also from lower travel times, fuel savings, etc., well in advance thanks to the government's decision to support the projects.

6.3.2 Estimates of the debt repayment capacity of the PPP contracts

In order to estimate the debt repayment capacity of the SPPL principal, according to the methodology previously defined, we have estimated the cash flow in the last year of the contract (year 2026). To that end, we have proceeded to estimate: (i) traffic revenues; (ii) availability payments; (iii) O&M costs; (iv) capital costs in major repairs and rehabilitation projects¹⁴, and (v) corporate taxes. The hypotheses and the procedure that has been adopted for the calculation of each of the items are explained below.

Annual traffic revenues are calculated as the product of the volume of traffic using the road section (in vehicles x km) each year and the fare (without VAT) applied in the same period, differentiating between traffic and fares for light and heavy vehicles. The evolution of light and heavy traffic over the years has been obtained, for each scenario, by applying the elasticities estimated by Gomez et al. (2015) and Gomez and Vassallo (2016) to the socioeconomic variables of each scenario (GDP per capita and industrial GDP). The aforementioned authors concluded that in Spain: (i) the elasticity between the light vehicle demand and the evolution of GDP per capita is around 1; and (ii) the elasticity between heavy vehicle demand and the evolution of industrial GDP is approximately 0.65. Based on these premises, the future traffic of the three PPP projects under study for each of the three scenarios has been calculated. For its part, as indicated in the tendering specifications of the

¹⁴ Since the investment in initial works has been executed before 2017, it does not affect the cash flows from that year onwards.

contracts, the fare is updated yearly according to the variation of the national Consumer Price Index (CPI). Thus, the annual fares in nominal terms have been calculated by updating the fare applied in 2016 according to the Spanish CPI forecasts for the period 2017-2026 obtained from the International Monetary Fund (IMF).

Given that actual availability-based revenues have been higher than expected for all projects so far, and since it is considered that PPP contractors have already acquired certain expertise in the maintenance and rehabilitation of the road that will allow them to maintain their level of compliance in the future, it has been assumed that revenue from availability payments will keep a constant percentage of the total revenues in the period 2017-2026 (See Annex II).

The annual O&M costs to be incurred by the PPP contractors in the period 2017-2026 have been calculated based on those of the previous years, assuming that the only increase they will experience in the future will be caused by inflation. Given the difficulty of estimating future investments in road rehabilitation—including both replacement actions and major repairs—the values foreseen for this purpose in the EFPs delivered by the different PPP contractors have been adopted in the analysis. However, it should be noted that, so far, only five out of the ten projects have carried out rehabilitation works with a value much lower than originally forecasted. Therefore, this assumption implies that, unless the trend changes, the costs considered in the analysis under this item may be overestimated.

The corporate tax is calculated as the legal rate (25%) times the Profit Before Taxes (PBT) item of the Profit and Loss Account. The PBT has been annually calculated for each of the proposed scenarios as: annual revenues minus O&M costs, depreciation of the assets, and financial expenses.

After obtaining the expected free cash flows in 2026 (see Tables II.1–II.3 in Annex II), the last step of the analysis consisted of estimating whether they are enough to cover the repayment of the principal of the participation loans including the capitalization of the interests accrued during the three-year grace period.

Table 6.7 shows that the amount that PPP contractors have to pay back to the government the last year of the contract associated to the SPPL (both principal of the loan plus capitalized interests) is for all the scenarios higher than the expected Free Cash Flow generated. This implies that, according to the principles of project finance, whereby lenders should only rely on the cash flows of the project for the repayment of debt, the PPP contractors will not be able to pay back the full principal amount of the loan the last year.

Table 6.7 Free cash flow of the year 2026 and amount to be returned to the government

Stretch	SPPL principal + 3-year interests	Scenarios	Last year FCF (M€)	Difference with respect to the scenario (M€)
A1-T2	49.56	Optimistic scenario	43.37	-8.58
		<i>Base scenario</i>	40.98	-6.19
		Pessimistic scenario	38.33	-11.23
A2-T3	51.30	Optimistic scenario	28.16	-24.64
		<i>Base scenario</i>	26.66	-23.14
		Pessimistic scenario	26.15	-25.15
A31-T1	20.58	Optimistic scenario	18.77	-3.07
		<i>Base scenario</i>	17.51	-1.81
		Pessimistic scenario	16.24	-4.34

Thus, irrespective of the fact that, in the end, PPP contractors decide to comply with their obligations with the government or not, the analysis carried out shows that the government did not design the SPPLs in the right way. SPPLs were originally outlined as a means of helping PPP sponsors to raise the necessary resources to undertake the works in years where, because of the economic downturn, getting financing from the private sector was very complicated and costly. However, by awarding SPPLs, the government should never take a risk higher than the shareholders'. In the case we have shown in this paper, it is notable that the equity holders have been receiving dividends while the government is at risk of not being paid back the participation loans.

6.3.3 Estimate of the social benefits of the PPP projects

In order to obtain an approximation of the social gains derived from the projects, a conservative estimate of the social benefit derived from the improvement in road safety since the commissioning of the first section (A31-T1) until the end of the PPP contracts (2026) is carried out according to the methodology previously explained (Pérez de Villar, 2015). To that end, it has been assumed that if no actions had been taken to upgrade these motorways, the evolution of the accident rates of the first generation motorways under study would have followed the same trend of that of the rest of the Spanish roads with similar characteristics.

The annual social benefit (SB_{annual}) is calculated as the product of the number of victims avoided in the sections of the motorways analysed and the value of preventing a victim (Pérez de Villar, 2015). Thus, for the present case study, equation (7) can be rewritten as follows:

$$SB_{\text{annual}} = PIA_{sv} \times V_{PIA} = (PIA_{hyp} - PIA_{1G}) \times V_{PIA} \quad (9)$$

Where: $\mathbf{PIA}_{sv}$ is the number of accidents with victims avoided with respect to the hypothetical scenario where no upgrading actions are undertaken. $\mathbf{V}_{PIA}$ is the average statistical value of avoiding a victim in a traffic accident. $\mathbf{PIA}_{hyp}$ is the number of fatalities, serious and minor injuries expected if these motorways had not been upgraded, which has to be estimated. $\mathbf{PIA}_{1G}$ is the actual number of fatalities, serious and minor injuries in the three motorways analysed. Actual data up to 2015 were provided by the MT, thereafter they have to be estimated.

$\mathbf{PIA}$ has been calculated as the difference between the accidents with victims that would have occurred in the hypothetical scenario that no upgrading actions had been undertaken ($\mathbf{PIA}_{hyp}$) and the accidents with victims that have actually occurred ($\mathbf{PIA}_{1G}$). To that end, $\mathbf{PIA}_{hyp}$ has been estimated by assuming that, in this hypothetical scenario, the evolution of the hazard index ($\mathbf{HI}_{hyp}$) of the first generation motorways under study would have followed the same trend of that of the rest of the Spanish roads with similar characteristics ($\mathbf{HI}_{sc}$) (see Figure 6.7).

On its part, the annual $\mathbf{V}_{PIA}$ has been calculated according to equation (8) and taking as a reference the monetary values provided by the Handbook on External Costs of Transport (DG MOVE, 2014). In addition, it has been considered that the value of a human life has increased and will increase at a rate of 1% per year.

Figure 6.7 Temporal evolution of the HI of the first generation motorway stretches

A more detailed explanation of the hypotheses and the procedure adopted for the calculation of the main variables needed to estimate the social benefit is provided in Annex III.

From the analysis conducted, it was obtained that the social benefit derived from the reduction of accident and mortality rates in the three motorways since the upgrading works of the first section put into service were completed (2011) to the end of the concession period (2026) will reached the figure of **EUR 363.82 million** actualized to 2007 prices¹⁵ (See Table III.2 in Annex III). As we already mentioned, it is important to note that this value is conservative since other social benefits are not included in this calculation and future safety benefits beyond the contractual period are not incorporated. On the other hand, the total investment actualized to the year 2007 amounted to **EUR 360.91 million**. This amount takes into account those investments related to the establishment and upgrading of the motorways, including the additional works approved in 2010 (see Table 6.8), since their purpose is to correct the specific safety and functionality deficiencies of the motorway sections granted in concession. Works related to ordinary maintenance and rehabilitation actions are not included since, as a general rule, they are common to the rest of the Spanish roads.

Table 6.8 Total investment in initial works actualized to 2007 prices

Stretch	Investment initial works (current M€)								Total investment initial works (M€ 2007)
	2008	2009	2010	2011	2012	2013	2014	2015	
A1-T2	0.12	0.63	48.28	121.95	14.67	0.00	0.00	0.00	155.51
A2-T3	1.15	0.41	48.00	59.08	37.46	3.73	0.00	0.00	124.73
A31-T1	12.12	21.99	23.14	34.87	0.00	0.00	0.00	0.00	80.66
								Total	360.91

This estimate shows that the social benefit derived from the reduction of the accident rate in the 2011-2026 period exceeds the total investment made for the establishment and upgrading of the three stretches analysed. It should be noted that the calculation has been made on the basis of a series of hypotheses, though quite conservative, hence this value should be considered as an estimate that will be more precise the greater the historical series of data available for its calculation. However, it should also be pointed out that other benefits derived from the improvement of the roads —improved comfort, reduced travel time, fuel savings, etc.— were not taken into account when calculating the social benefit.

Finally, the potential financial loss estimated for the government in the pessimistic scenario, actualized to 2007 prices with the same discount rate used for the social

¹⁵ The value of 4.77% has been used as the discount rate, which is the yield on 30-year Treasury Bonds issued in the year in which the PPP projects were awarded (2007). Source: Public Treasury.

benefit, amounts to **EUR 16.8 million**, which is negligible compared to the social benefits that the motorways produced.

Summary of results

As a corollary of the analysis carried out, the main results obtained are summarized below. On the one hand, the government support provided allowed the projects to move forward, and they are now performing nearly as originally expected. These projects have proven to be very socially beneficial, especially in reducing accident and mortality rates, which has allowed users and society to benefit from it well in advance thanks to the support received. However, the design of the support mechanism does not guarantee that PPP contractors will meet their repayment obligations at the end of the contract, with the consequent financial risk that forces the government to assume. This result is more striking because the projects are performing well and, in two of the cases, distributing more dividends than expected. Finally, the social gains stemming from the projects, considering only those derived from the reduction in the accident rate, greatly outweigh the potential financial loss that the above may entail for the government, which endorses the government's decision to financially support projects from the sustainability perspective.

The case study analysed is a good example of the complexity of managing PPPs due to the incompleteness inherent to these contracts and how sometimes governments have to provide prompt response to unexpected circumstances —caused by either wrong ex-ante decisions or unpredictable events— that may affect the viability of PPP projects. It sheds some light about key aspects to respond to government decisions about providing support to PPPs in trouble with potential high benefits for the society. It also shows how taking drastic decisions in that respect, such as forcing the termination of contracts, may not be the best solution from the social point of view. This case study also demonstrates how governments often try to solve problems as quickly as possible without conducting the right analysis intended to measure the impact, both social and fiscal, in the medium and long term. Finally, it highlights the need for a more detailed assessment of both the support and the conditions under which it is granted in order to avoid opportunistic behaviour by the private sector.

PART III **CONCLUSIONS, POLICY LESSONS AND
RECOMMENDATIONS, AND FURTHER
RESEARCH**

7 CONCLUSIONS AND FUTURE RESEARCH

This chapter summarizes the compliance with the objectives, the main conclusions arising from this thesis and the further research that could follow up. Likewise, some policy recommendations are proposed.

7.1 Fulfilment of research objectives

As previously explained in Chapter 3, the main objective of this thesis was to provide empirical knowledge about the impacts that the public support granted to PPP projects may have on the projects, the contracting authority and the society. The research pursued four different specific objectives:

- (i) Empirically analysing whether the public support granted to PPP projects has had a positive influence on their performance over time.
- (ii) Identifying further variables, both intrinsic and extrinsic to PPP projects, affecting the proper performance of this type of projects.
- (iii) Evaluating the social and financial impacts of the public support provided to PPP projects.
- (iv) Evaluating the extent to which the government providing support to PPP projects takes into account the overall impact it may have and the public interest when granting it.
- (v) Drawing policy lessons and recommendations based on the analysis and findings from (i) to (iv) above, in order to provide useful and practical suggestions for governments when providing public support to PPP projects.

Regarding the first and second objectives, two different econometric specifications have been used in order to identify the variables that influence the economic performance of road PPP projects in Spain, with a special focus on the impact of the public support received from the EU and the EIB: a multiple regression model and a panel data model. The analyses carried out allowed evaluating, based on actual data, whether the financial support provided at EU level enhance the economic resiliency of PPP projects over time. The models also allowed analysing the relative importance of different explanatory variables referred to (i) socioeconomic context, (ii) institutional environment, (iii) PPP-related attributes, and (iv) supply-side factors. Thus, the research also enabled measuring, at a macro level, potential differences in economic performance between PPP projects depending on their intrinsic features.

Concerning the third and fourth objectives, a thorough evaluation of the financial support provided by the Spanish government through subordinated public participation loans (SPPLs) to the first generation motorway PPP projects is conducted. The research is based on a two-step methodology. First, the risk borne by the government that the PPP contractors cannot comply with the conditions

associated with the granting of the SPPLs and may not repay their principal at the end of the contract period was analysed. Second, a cost-benefit analysis was carried out to assess the social benefits derived from the improvement in road safety, and whether they offset the potential financial loss estimated for the government. Thus, the research enabled evaluating, at a micro level, whether the government's decision to support these projects was justified from a sustainability standpoint, taking into account the social benefits, the financial feasibility of the loan and the public interest. Finally, as a result of the final objective, and in the light of the research work developed in the current Thesis, some lessons and recommendations at the policy level are provided in this chapter —see Section 7.3 below. The policy lessons and practice-oriented recommendations discussed in this Thesis intend to shed some light on both the positive and negative impacts that can result from public support for PPPs and to propose measures that can help governments to prevent the latter.

7.2 Conclusions and research findings

The Thesis developed two main approaches (macro/micro) to analyse the positive and negative impacts of the public support provided to PPP projects applied to the case of road PPP projects in Spain. Particularly, two different types of public support were analysed: the supra-governmental financial support provided by the EU and the EIB, and the Spanish government support provided through SPPLs. The analysis yielded some interesting conclusions and contributions to the field of research concerning public support for PPPs. Even though the results are obtained on the basis of the information coming from the case of Spain, they provide lessons that are broadly generalizable to other governments.

1- *Is public support improving the performance of PPP projects? Is there empirical evidence of public support being a success factor of PPP projects?*

Based on the multiple regression and the panel data analyses carried out, the main conclusion of this research is that there seems to be a positive relationship between the EU financial support and the economic profitability of PPP projects. That is, the public support to PPPs coming from an independent supra-government authority, such as the EU, plays a positive role in promoting more economically resilient infrastructure PPPs. These results confirm the hypothesis I adopted in the Thesis, by which it was expected that those projects benefiting from financial backing would have a higher performance than those that did not receive economic support.

In the author's view, there are two related reasons explaining this positive influence. Firstly, 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. And second, the supra-government 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, etc.— that will likely 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 supra-government authority are reasonable from the economic, environmental, and social point of view. As a consequence of that, the larger the degree of politicization 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 etc. have been much more a consequence of discretionary decisions than of technical information (Benito et al., 2008; Ortega et al., 2016b). 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., 2012a). In the author's view, the interpretation of the main conclusion of the analyses carried out is not that projects supported by an independent supra-governmental 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 supra-governmental authority ensures an independent supervision and evaluation of the project that prevents wrong decisions.

2- Are there other variables influencing PPP's performance?

The literature review provided a general overview of which variables may influence the performance of PPP projects. However, the significance and impact of these variables may vary depending on the case study analysed and have barely been empirically tested.

The econometric models estimated in order to analyse whether public support is a success factor of PPP projects enabled identifying, at a macro level, other variables affecting the performance of this type of projects for the case of Spain, as well as measuring whether PPP projects show different levels of economic performance

depending on their intrinsic characteristics. The results are showed and discussed in greater detail in Chapter 5.

While both models acknowledged the importance of EU support, they also identified other variables positively correlated with the economic performance of road PPP projects in Spain. Specifically, the country's macroeconomic situation and traffic demand levels were found to be enablers of adequate economic performance for all road PPP projects and those demand-based, respectively. Therefore, EU support should be considered as a condition that helps but does not guarantee positive economic outcomes of road PPP projects.

Regarding the intrinsic characteristics of road PPP projects, it was found a significant difference in terms of economic performance among the sample according to the type of remuneration mechanism used, with PPPs based on user charges showing the worst results. These results suggest the selection of more socially acceptable approaches, such as shadow toll and availability-based schemes, when implementing PPP arrangements. On their part, the type of project and project's size were not found to be significant in either of the two models developed. These results suggest that differences in the investment needs, complexity and level of risk of PPP projects may not be determinant for the proper outcome of these projects in Spain.

Finally, more mature projects are associated with a higher economic profitability. This result is consistent with the usual evolution of PPP's cash flows, since they tend to increase over time. However, it could also point to the fact that older concessions were better planned than those most recently awarded.

3- Is the public support allocated to PPP projects aligned with the growing policy of support of this type of projects? Is it worthwhile supporting PPP projects?

The analysis of the case study of Spain shows that despite the EU's effort to encourage the use of EU funds to support PPP projects, the application of the ERDF, the Cohesion fund and the TEN-T budget line to promote PPP projects has been very limited. Regarding the innovative financial instruments, their implementation at the time of the writing of this Thesis has been quite modest in Europe in general, but particularly in Spain. However, this might be partially due to the decrease in PPP projects that have reached the market since their implementation, in the context of the economic and financial crisis that the country has undergone since then.

Finally, EIB co-financing has been the largest source of EU support from which Spanish PPP projects have benefited so far. EIB's lending activity has been in line with the EU policy of supporting PPP projects, evolving slightly in pace with PPP

project activity in Spain. However, if the impact of the Bank's promotion of the combined use of its loans with other sources of EU support is analysed, the results have not been as satisfactory as might have been expected. In this sense, only two projects managed to combine both mechanisms successfully and in both cases loans were combined with innovative financial instruments: the MF and the LGTT.

From the analysis carried out, it was found that the PPP projects that were financially backed by the EU seems to be more profitable. A proper economic performance over time is essential for a PPP project to be successful but also to protect the public interest. Persistent underperformance can lead to PPP projects going bankrupt, which in many cases poses great difficulties for the government and taxpayers. It is therefore necessary for the EU to continue promoting financial instruments available to the Member States to deliver transport infrastructure through successful public-private partnerships.

4- What are the main social benefits and drawbacks of the public support provided to PPP projects? Is this type of support justified from a sustainability standpoint?

The analysis carried out at micro level regarding the public support provided by the Spanish government through SPPLs to the first generation motorways as a means to rebalance their economics after the government imposed additional works not included in the original contracts enabled analysing the social impact of the measure.

On the one hand, the SPPLs together with the rest of measures agreed when re-establishing the economic balance of the contracts allowed the government to push ahead with the projects and carry out the works it deemed necessary to improve the road safety on the motorways. The *ex post* analysis shows that these projects have proven to be extremely successful in decreasing accidents rates thereby producing high social benefits that greatly exceed the potential financial loss estimated for the government in the pessimistic scenario analysed. Besides, these projects have also brought about other benefits such as driving comfort improvements, lower travel times, fuel savings and decreased air pollution emissions. Finally, both users and the society have been able to enjoy these benefits well in advance thanks to the government's decision to support the PPP contracts. On the other hand, the analysis undertaken also showed the potential social disadvantages, in financial terms, arising from the non-compliance with the conditions associated with the granting of the SPPLs by the PPP companies.

Thus, a key question arising after analysing the social impacts of the awarding of SPPLs to PPP projects is whether the government's decision to keep these projects alive by providing government loans was justified. Or, in other words, whether the

social benefits stemming from the projects are large enough to explain the risk assumed by the public sector in providing government support. Taken into account both social benefits and the financial feasibility of the SPPLs, the answer to the question previously formulated would be positive: it was a good decision to push ahead with these projects. If the government had chosen not to do it, the contracts would have likely been early terminated thereby entailing important costs for the society. The government would have incurred large transaction costs as a consequence of the early termination of the contracts (termination payments to the contractors, additional cost to retender the contracts, etc.). In addition, the benefits arising from the projects to the users (safety, etc.) would have been delayed. Thus, the government's decision to support the projects cannot be criticized from the social point of view since the alternative options would have meant imposing greater costs and benefit delays to the society. Moreover, the decision to provide SPPLs to finance the additional works requested by the government, allowed avoiding incurring additional public deficit.

5- Do governments take into account the financial sustainability of the support mechanism before it is provided?

Admitting that, given the circumstances, the government's decision to support the projects was reasonable, the way the SPPLs were provided is however more than arguable. These loans are undoubtedly a valuable mechanism for enhancing the financial feasibility of infrastructure projects and sharing risk between the government and the PPP contractor. However, the conditions under which the MT awarded them did not set sufficient measures to guarantee the public interest against that of the shareholders. The results show that, if no action is taken in this regard, there is a significant risk that the PPP contractors will not be able to pay back the principal of the loans even though the PPP projects are performing well. By awarding SPPLs, the government should never take a risk higher than the shareholders'.

Some of the issues identified might have been avoided if the government had set some provisions to safeguard the SPPL seniority to the shareholders. On the one hand, it did not make much sense to impose the amortization of the principal of the SPPL six months before the end of the contract. A more flexible amortization approach should have been permitted over the remaining contract period. On the other hand, the government should have never allowed equity holders to receive dividends before the principal of the SPPL was being repaid or provisioned. In this respect, the government should have required the PPP contractor to either account for a provision on the liabilities side of the balance sheet to safeguard the

amortization of the loan, or oblige him to set up a debt service reserve account¹⁶ at the end of the grace period.

Finally, no assessment of the level of risk that was being actually borne by the government when providing SPPLs to the PPP projects was carried out. As a form of government intervention that may involve contingent liabilities, which in turn may have a significant future impact on the public budget, the government exposure to risk and the cost-benefit analysis of the SPPL should be assessed, and if possible quantified, before deciding whether it should be provided.

These results confirm the hypothesis II adopted in the Thesis, whereby the government developing the PPP project was expected to have little incentive to set out the terms of public support efficiently, especially when it comes to *ex post* support. In this respect, it has been seen how by adjusting the conditions under which the SPPLs were granted, the risk assumed by the government would have decreased considerably. On the other hand, if the risk that the government was assuming when granting the loans had been assessed, it might have been considered to carry out such measures. However, none of this was done, which proves how, given the political significance of this type of projects, governments often try to solve their problems as quickly as possible without conducting the right analysis intended to measure the impact, both social and fiscal, in the medium and long term of the measures taken to do so.

7.3 Policy lessons and recommendations

Some policy lessons and recommendations have arisen from the research work developed in the current Thesis and are presented below.

The first policy lesson of this research, which also contributes to theoretical discussions, is the fact that the support provided by an independent supra-governmental 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. In this respect, Spain has been widely criticised for overinvesting in inefficient and unprofitable infrastructure (Acerete et al., 2013) and, in fact, some measures have recently been adopted to avoid this problem in the future. On the one hand, an Independent Advisory Board has been set up in the Ministry of Transportation with the role of informing about the rationale and sensibility of new large public works. On the other hand, the Government is

¹⁶ In this reserve account the participation loan would be amortized during a series of years until the end of the contract, with which the repayment of the participation loan would not be solely charged to the cash flow of the last six months.

currently taking steps towards the implementation of the National Evaluation Office (NEO). This body, depending on the Ministry of Economy and Finance, will be responsible for analysing the financial sustainability of both the PPP contracts to be concluded and the agreements to restore the balance of PPP contracts already awarded, with a view to ensure the effectiveness of public investments. However, it should be noted that the reports drawn up for this purpose, although mandatory in certain cases, are not binding.

A practical recommendation that may contribute to better design PPPs in many countries and regions is to ensure 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 rather be aligned with the achievement of the greatest added value for society as a whole.

Another recommendation, at EU level, is the necessity for the EU to continue promoting the use of financial instruments to deliver transport infrastructure through successful public-private partnerships. In this respect, two main aspects should be tackled. On the one hand, the financial instruments should be adapted to the current trends in the development of PPP projects in Europe, or new instruments taking into consideration the special needs of these projects should be implemented. In this sense, the scope of the LGTT has been relatively limited given the increasing use of shadow toll and availability-based mechanisms with respect to toll-charging schemes. On the other hand, the access for this type of projects to EU grants and its blending with EIB loans should be facilitated in order to increase their impact.

The second lesson from this research is that a good governance approach along with the right ex-ante design of the contract substantially contributes to mitigate the impact of unexpected problems once the contract is awarded. In the case analysed, the government's reluctance to approve the final designs provided by the PPP contractors, even though they met the minimum requirements established, delayed the financial close of the projects and subsequently the beginning of the works. This fact along with the traffic shortfalls caused by the economic recession were the main causes that threatened the projects' viability. It is clear that, if the government had included in the contract the technical requirements that in the end it wanted, the problems would have been much limited. The government could have included all the works considered necessary in the tendering specifications of the projects instead of denying perfectly valid projects' designs while deferring the beginning of the works and putting the feasibility of the projects at risk. As the government still wanted to get the works done, it decided to impose modifications of the contracts

by requesting the PPP contractors to carry out additional works to comply with the desired requirements. This change prompted the reestablishment of the economic balance of the contracts three years after the projects were awarded.

The third lesson is that undertaking proper designs of the support mechanisms to be awarded is essential to guarantee the public interest. In the case study analysed, the government decided to grant subordinated loans, the repayment of which, in theory, can only be questioned in the event of projects filing for bankruptcy, as occurred with part of the motorways that were recently taken over by the government. In addition, the rebalancing included other measures, such as rate increases and traffic compensations between different years, intended to increase the retribution of the concessionaires and to diminish the risk of non-repayment of the loans. However, the analysis carried out shows that, despite the fact that the PPP projects are performing well, the conditions under which these loans were granted do not guarantee their repayment at the end of the contract term.

In this respect, the government is encouraged to consider the following recommendations when providing SPPLs to PPP projects. Firstly, it should allow the PPP contractors to pay off the principal of the loan after the three-year grace period. In order to ease the SPPL repayment, the amortization could be flexible depending on the repayment of the senior debt and the economic performance of the project. Given how the interest on these loans is calculated, this option would mean a loss of economic return for the government, as the outstanding amount of the loan would decrease over the years while, as a general rule, traffic would gradually increase (see equation (6)). Thus, a second option is proposed. The government should require the PPP contractor to either account for a provision on the liabilities side of the balance sheet to safeguard the amortization of the loan, or oblige him to set up a debt service reserve account at the end of the grace period. Thirdly, irrespective of the option preferred by the government, it should set clear limits on the dividend policy of PPP companies benefiting from SPPLs. Particularly, equity holders should not be allowed to receive dividends or withdraw equity before the principal of the loan was being repaid or provisioned, and certain financial ratios previously established are met.

The fourth and final lesson is that the government's exposure to risk when providing support to PPP projects should be assessed before deciding both the type of support and its magnitude. Indeed, an independent entity rather than the MT should be in-charge of measuring the contingent liabilities coming out of these loans. These contingent liabilities should, once estimated for all the projects, be accounted within the national budget at the time the loan is granted. This way, governments will have

the correct incentive to provide SPPLs at the right price, and only when they add value.

A final recommendation that could address some of the weaknesses identified for the specific case of Spain is the creation of a dedicated and independent PPP unit with good technical, legal and financial expertise and the legal capacity to support different governmental departments —central Government and regional government ones— in the preparation, delivering and management of PPP projects while protecting the public interest. Though nowadays there is a government agency (SEITT) that has recently begun to manage the bankrupted road PPP contracts taken over by the Spanish government, this body is still far away from being a thorough PPP unit. The forthcoming NEO, on its part, has been designed to help determine *ex ante* the efficiency and profitability of potential PPP projects and may also be very useful in ensuring the public interest in future renegotiations and re-establishment of contractual balances of PPP projects. However, it has not been given competence to regulate, control and supervise these projects during their life cycle. We therefore recommend strengthening the SEITT's capacity and scope to effectively help both the Spanish and regional governments to overcome their potential lack of technical, legal and financial capacity and monitor, supervise and evaluate PPP projects to ensure that their potential benefits are realized and communicated to the public. The combined implementation of these two entities, if they are endowed with sufficient capacity, may ensure an independent supervision and evaluation of the PPP projects, similar to the one carried out by the supra-national authority previously seen, that can help prevent national or regional governments from adopting decisions mostly based on political criteria.

7.4 Future research areas

This research has identified a number of issues which could be subject of future research. The areas that should be pursued to expand the current research are summarized below.

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. The methodology could also be used to analyse how EU financial support has influenced the success of PPP projects in other sectors such as rail, ports and airports.

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.

Third, the unavailability of certain data limited the scope of the analysis. Given the fact that success should not be measured only by economic performance, this analysis could be applied to other key non-economic criteria of success for infrastructure projects, such as environmental, social, and quality aspects. In a similar way, the influence of other success factors on the economic performance of PPP projects deserves to be explored in order to reinforce the main hypothesis of this research. Particularly, some of the variables discarded due to the difficulties encountered to collect them —such as construction delays, cost overruns and variations in the estimated demand— are worth to be tested.

Finally, future research works should focus on using more quantitative approaches to find an optimal equilibrium between commitment and flexibility in PPP projects in order to ensure that decisions are taken to maximize sustainability. This analysis should value the impact on different stakeholders.

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