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Critical renegotiation triggers of European transport concessions

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## **Abstract**

In this paper, we assess the critical factors for the renegotiation of transport infrastructure concessions. We depart from a literature review on the renegotiation of infrastructure concessions and of the main renegotiation triggers and the methodologies used to assess them. By collecting data from a total of 32 transport PPP projects, in 13 European countries, we identified a total of 37 renegotiations. Our findings corroborate the literature in that a country's economic and legal environment has an important impact on the likelihood of renegotiation. The occurrence of elections is shown to have an indirect impact on increasing renegotiations. Furthermore, both the uncertainty associated with developing new PPP projects with budgetary motivations, and the operational stages of long term contracts, play a critical role in contractual renegotiation.

**Keywords:** Public Private Partnerships; Renegotiations; Transport; Europe; Probit

## **1 Introduction**

Although private companies have long been involved in the provision of services and infrastructures, public procurement has seen fundamental changes over the past thirty years. One can observe a worldwide tendency of governments to create and implement public-private partnership (PPP) policies and projects, which has received increasing attention from academia and policymakers (Hodge and Greve, 2007, Grimsey and Lewis, 2007). In spite of the lack of consensus of the definition, a public-private partnership (PPP) can generally be defined 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” (WBI and PPIAF, 2014).

The PPP model for project delivery has increased over the past decades, especially for transport infrastructure projects (COST Action TU1001, 2013b). In 2014, the aggregate PPP European market amounted to EUR 18.7 billion. Furthermore, 80% of European Investment Bank loans made to PPP schemes between 1990 and 2014 were for transport sector projects (EPEC, 2015b, EPEC, 2015a).

Transport infrastructure concessions frequently have a long life cycles of over 25 years and are exposed to various changes arising from the political, social and economic spheres. In particular, these contractual agreements often depart from base-case scenarios which rely on demand and macro-economic forecasts which do not come to pass in many cases (Cruz and Marques, 2013c). Furthermore, concession contracts usually involve large investments and are

susceptible to opportunistic behaviour from both the private and the public partners (Guasch et al., 2007, Guasch et al., 2008).

We use the definition of Guasch et al. (2014) in that "*a renegotiation of PPP contracts involves a change in the original contractual terms and conditions, as opposed to an adjustment that takes place under a mechanism defined in the contract*". Not surprisingly, Guasch (2004) finds renegotiation especially common in transportation concessions, and it occurs in 55 % of concessions, with the private operator being the initiator of renegotiations in 61 % of all cases. Such high renegotiation rates are in part explained by the attempt to write prescriptive contracts, in order to address the inherent incompleteness of long term agreements, or simply because incompleteness was not foreseen (Hart, 2003). Thus, one key aspect of PPPs falling short on achieving value for money, is that they often fail to account for uncertainties and needed changes (Grimsey and Lewis, 2005, Grimsey and Lewis, 2007).

This paper discusses and explores which are the critical factors in renegotiations of transport infrastructure concession contracts. By identifying these factors we can mitigate *ex-post* transaction costs and improve the project's added value. While every project is unique, understanding the reasons that trigger contract renegotiations contributes to the development of better contractual frameworks.

Section 2 presents a literature review on contract incompleteness and on the renegotiation of infrastructure concession projects. It also discusses the empirical contributions to the understanding of critical renegotiation triggers of concession contracts. In Section 3 we present the methodology and the data used in our analysis and later discuss the results in Section 4. Finally, we derive conclusions in Section 5.

## **2 Literature review on contract renegotiations**

Contracts are, in practice, incomplete, to the extent that it is not possible to anticipate all the future events for any given contractual arrangement. And the problem of renegotiating incomplete contracts as the future unfolds is that it imposes various costs (Hart, 1995). These are burdensome for both public and private partners, potentially compromising the initial decision to undertake the PPP mechanism and they are ultimately passed on to the taxpayer (Albalade and Bel, 2009).

Moreover, public contracts are generally inflexible when faced with unexpected circumstances, requiring formal renegotiation which leads to a higher tendency to litigate (Spiller, 2008). PPP contracts have often been made highly prescriptive (e.g. long term traffic forecasts as a basis for financial compensations) which leads to situations where the public grantor is captured by unforeseeable contingency clauses. One must also take into consideration the high degree of

volatility of the environmental variables (e.g. institutional maturity, uncertainty of demand, and trust between partners) affecting long term contracts. By understanding that renegotiations are an eventuality, it is crucial in PPP implementation to identify how they may be used as a tool that allows for adapting to uncertainty (Domingues and Zlatkovic, 2014).

Contractual renegotiation has typically been seen as undesirable, as it imposes high transaction costs and may also induce opportunistic behaviour from both the private and public parties. On the other hand, a successful renegotiation that leads to revising the terms of trade within the contract can be welfare-enhancing, rather than welfare-reducing (De Brux, 2008). While one would expect both partners to dialogue in order to exit this prisoners' dilemma, the issue of trust and communication has been central in overcoming the setbacks of contract incompleteness (Dassiou and Stern, 2009, Hart and Tirole, 1988).

## **2.1 Renegotiation of infrastructure concessions**

Increasing attention has been given to the issue of the renegotiation of PPPs, with the first studies departing from a database of over 1,000 concessions awarded in Latin America between 1985 and 2000, covering the telecommunications, energy, transport and water sectors (Estache et al., 2003, Guasch, 2004). The complexity of these contractual arrangements allowed for multiple analyses of the problem. Guasch et al. (2003) studied firm-led renegotiations and Guasch et al. (2007) their counterparts. Guasch et al. (2008) narrowed the sample to analyse firm-led renegotiations of concessions in the transport and water sectors, given their higher renegotiation frequency. In a different direction, Estache et al. (2009) researched the impact of multi-criteria auctions of road and railway concessions in Latin America. At a more theoretical level, the predictions of Guasch et al. (2006) are broadly consistent with the empirical results in Guasch et al. (2003). Finally, Engel et al. (2006) researched a political-economic explanation for renegotiations of Chilean highway concessions and later on, Engel et al. (2009) expanded the sample to other infrastructures and services (e.g. airports, public transport, jails, water reservoirs).

For the rest of the world, research on triggers of concession renegotiations is more recent and, to a large extent, concentrated in one early adopter of the PPP model: Portugal. Cruz and Marques (2013a) classified determinant renegotiation factors, and looked at those endogenous factors that affect the case study of a light rail transit system in Lisbon's metropolitan area. Conversely, Cruz and Marques (2013b) analysed the exogenous factors influencing renegotiation of Portuguese concessions in the transport, health, water and energy sectors. Sarmiento (2014) introduced new variables and explored their likelihood to trigger the renegotiation of Portuguese transport PPPs. Macário et al. (2015) departed from the successful renegotiation of a Portuguese urban rail concession to assess the transferability of best practices to other modes. De Brux (2011) studied the impact of renegotiations on the likelihood of contract renewal in the French

car park sector. Domingues and Zlatkovic (2014) reviewed the critical success and renegotiation factors of infrastructure concessions and compared them with nine European transport PPPs.

## 2.2 Critical renegotiation triggers

The increasing usage of the PPP model has provided literature with a multitude of projects that are notable for both their successes, and their failures. Given that many projects are currently in their operational stage, case study analysis is a powerful bottom-up approach for assessing the critical elements of the renegotiation process of infrastructure concessions. The novelty of the findings allow for testability and empirical validity (Eisenhardt, 1989). This is the case of the literature on European PPPs (Cruz and Marques, 2013a, Domingues and Zlatkovic, 2014, Macário et al., 2015). Nonetheless, the majority of the empirical research so far consists of developing dummy dependent variable models to estimate the probability of renegotiation (i.e. probit models). The purpose of the model is to determine which variables have a greater influence on the probability of the renegotiation of concession contracts (Cruz and Marques, 2013b).

Conceptually, Cruz and Marques (2013a) classify the critical renegotiation triggers as being exogenous or endogenous. The former concern aspects that are external to the contract (e.g. macro-economic shocks, regulation, governance and institutions, political cycles, sector, mode or project specificities), whilst the latter relate to contractual clauses that influence the likelihood of renegotiation (e.g. risk allocation matrix, financial guarantees, termination clauses, and key performance indicators or investment requirements). Similarly, Domingues and Zlatkovic (2014) propose a typology consisting of four key areas. Exogenous factors are divided into three groups: 1) Institutional and regulatory frameworks, 2) Political and social environment, and 3) Macro-economic environment. Finally, endogenous factors are explained by 4) Contract design.

**Fout! Verwijzingsbron niet gevonden.** presents the main literature on renegotiation of PPPs using probit models. It compares the statistical significance of different variables and their contribution to increasing (positive), or decreasing (negative) the likelihood of triggering the renegotiation of concession contracts. The study of Guasch and Straub (2009) deserves special attention, given that it considers two panels of data, differentiated by who initiated the renegotiation process. The first symbol in column 5 refers to firm-led renegotiations, whilst the second concerns renegotiations triggered by governments.

Table 1 - Statistical significance of independent variables on the probability of renegotiating concession contracts

Geographic Area		Latin America						Portugal	
Variables \ Author		1	2	3	4	5	6	7	8
Institutional and regulatory frameworks	Bureaucratic quality	▼▼		▼▼	▼▼	▼▼			
	Government effectiveness						▲▲		
	Regulatory quality						▼▼		
	Price-cap regulation	▲▲	▲▲	▲▲	▲▲	▲			
	Regulatory body	▼▼	▼▼	▼▼	▼▼	▼▼		▼▼	
	Age of regulator							▼▼	
	Autonomous regulator		▲▲						
	Specific legislation		▲						▲
	Rule of law	▲							▲▲
	Index of corruption	▼▼		▲▲	▼▼	▼▼/▲▲	▼▼		▼▼
	Contract viability								▼▼
	Risk rating								▼▼
	Bidding process	▼		▲▲	○			▲▲	
	Number of bidders						▲▲	○	▲▲
	Award criteria		▲▲	▲▲					
	Multi-criteria		○				▲▲		
	Reputation		▲▲						
Social and political environment	Electoral year (+/- 1)	▲		▲▲	▲	▲▲			▲
	Right-wing government								▲
	Government change								○
	Majority government								▲
	Political stability								▼▼
	Unemployment rate						▲		
	Optimism bias							▲▲	
	Unilateral change							▲▲	
Macro-economic environ.	GDP growth	▼▼	○	▼▼	▼▼	▼▼			▲▲
	Deficit								▼
	Public debt								▲▲
	Exchange rate	▲▲	○	▼▼	▲▲				
Contract design	Invest. requirements	▲▲	▲▲	▼	▲▲	▲/○			
	Contract duration	○	▼▼		○		○	▲▲	▼
	Investment amount						▲▲	▲▲	○
	High leverage								▼▼
	First renegotiation								▲▲
	Age at renegotiation	▲▲		▲▲	▲▲	▲▲	▼	▲▲	○
	Availability Payments								▼
	Foreign shareholders		▲▲						▼
	Operational stage								▲▲
	EIB loans								▲▲
	Transport sector	▲▲			▲▲	▲▲/▼▼	▲▲		○
	Excl. private financing	▲▲	○	▼▼	▲	○/▼▼			
	Income guarantee	▲▲	○	▲▲	▼				
	Arbitration process	○		▼▼	○				
Construction delays							▲▲		
Notes	1) Guasch et al. (2003); 2) Guasch (2004); 3) Guasch et al. (2007); 4) Guasch et al. (2008); 5) Guasch and Straub (2009); 6) Estache et al. (2009); 7) Cruz and Marques (2013b); 8) Sarmiento (2014)								
	▲ / ▲▲	Variable statistically significant and positive in some / most models							
	▼ / ▼▼	Variable statistically significant and negative in some / most models							
	○	Variable was found not to be statistically significant.							

### **2.2.1 Institutional and regulatory frameworks**

Institutional quality and governance is typically captured by indexes (e.g. bureaucratic quality, rule of law, government effectiveness, etc.) elaborated by either supranational organizations or consultancy firms (e.g. World Bank, Transparency International, PRS group). The existence of a regulatory body is one of the most significant variables and is particularly relevant for Latin American concessions awarded after the late 1980s. This relates to the usage of price-cap regulation, which is also statistically significant in most models. While price-cap regulation *de facto* describes the existing regulatory framework, it has often been used as an endogenous explanatory variable for risk allocation. Since price-cap regime allocates risk to the operator, whilst a rate-of return regulation transfers risk to the government, there are higher chances of renegotiation in the former case (Guasch, 2004). Other variables try to capture tender aspects, such as the existence of a bidding process, as opposed to a negotiated one, or whether award criteria are prone to interpretational subjectivity and reputation effects.

Corruption deserves special attention for two reasons. Firstly, higher indexes correspond to less corruption, which explains the negative sign in most models. Secondly, the influence of country-level corruption depends on who the initiator of the renegotiation was. Guasch and Straub (2009) find that, while a more corrupt environment clearly leads to more firm-led renegotiations, it also significantly reduces the incidence of government-led ones.

The likelihood of renegotiation, independent of which partner started the litigious process, increases with inadequate regulatory frameworks and deficient institutional environments (Guasch et al., 2003, Guasch et al., 2007). Nonetheless, institutional maturity can increase over time with experience and with the development of governance institutions which support the contracts (Dassiou and Stern, 2009).

### **2.2.2 Social and political environment**

While social environment may play an important role in projects' success (e.g. environmental concerns and willingness to pay), political cycles seem crucial in concession renegotiations. This effect is best captured by the existence of renegotiations in (lagged) electoral years, which explains other political characteristics (e.g. ideologies, majorities, optimism bias).

Electoral cycles may either induce incumbents to invest, in order to guarantee their re-election, or newly elected officials may renegotiate for political ideology or in order to meet social demands (Engel et al., 2009, Guasch et al., 2007, Engel et al., 2006, Guasch and Straub, 2009).

Also, scarce public budgets typically lead to private investment obligations or governmental guarantees, which provide incentives for the opportunistic behaviour to renegotiate (Guasch et al., 2008, Guasch et al., 2003). Hence, politicians often saw in PPPs the perfect tool for

delivering infrastructure, while avoiding up-front payments and resulting in off-balance sheet treatment (Grimsey and Lewis, 2005).

### **2.2.3 Macroeconomic environment**

Infrastructure concessions are highly exposed to the macroeconomic environment. For instance, an economic downturn will negatively affect demand, which then translates into fewer revenues. Furthermore, fluctuations of a few percentage points in macroeconomic growth, inflation or exchange rates can have an important impact on a project, moving it from success to failure (Guasch et al., 2008, Guasch et al., 2007). The variable most used to describe the macroeconomic environment is GDP growth, followed by variation in exchange rates.

### **2.2.4 Contract design**

The combination of the three previous dimensions largely contributes to the final contract design. Strong institutions are not only critical for deterring opportunistic renegotiations, but they can also improve the quality of the partnership (e.g. adequate risk allocation, periodic contract revision, clauses regarding termination and the revision of terms of trade, and mechanisms for performance monitoring). Budgetary motivations will also likely induce the public partner to include financial clauses which may create pernicious incentives for the private partner (e.g. investment requirements, exclusive private financing, income guarantees). Finally, with electoral cycles come potential changes in the perception of the project usefulness that may require changes in the terms of the initial deal (e.g. forms of repayment, arbitration process).

Table 1 shows us that the design of concession contracts is particularly affected in two dimensions. The first, and far more consensual one is that the older the concession, the more likely it is to be renegotiated. The simple reason for this is that information will be revealed within time - be it economic, technological, social or political – which will force changes in the terms of the deal. The second dimension concerns the risk allocation matrix, which is to a large extent affected by all previous groups of variables. Here, financial aspects are preponderant (e.g. investment requirements and amounts, exclusive private financing, and income guarantees), but also sector and project specificities which influence how risks are allocated between partners (e.g. construction delays, demand and revenue risks during operational stage, and clear arbitration process).

## **2.3 Endogeneity of PPP contracts in renegotiations**

One important aspect when using Probit models has to do with the potential endogeneity of PPP contract design and subsequent renegotiations. Contract endogeneity in PPPs is comprised of two problems: an *ex-ante* self-selection problem, and an *ex-post* moral hazard one. The former arises because each party tends to choose specific contract clauses that are advantageous to them, given their own characteristics. For instance, a self-selection effect could make more

efficient firms prefer price caps, which is more risky, but is also more profitable. The latter problem emerges when both parties act strategically, according to the structure of the contract. For example, shorter contracts may provide an incentive for firms to be more efficient in order to renew the concession, while minimum income guarantees for longer contracts may reduce firms' incentives to be more efficient (Guasch et al., 2003, Guasch and Straub, 2006).

Guasch et al. (2003) use as endogenous variables several contract conditions, such as the use of price caps, projects exclusively financed by the private sector, the existence of an arbitration process and a bidding procurement process, the existence of a minimum income guarantee (reducing private sector risk on revenues), and the duration of contracts. The instrumented variables were the sector, corruption, bureaucracy quality, rule of law, and the existence of a regulatory body. All endogenous variables increase the occurrence of renegotiations, with the exception being the bidding procurement process (which reduces the occurrence of renegotiations), and the arbitration process (which has no significant impact on the occurrence of renegotiations). This study was complemented by Guasch *et al.* (2007, 2008), and Guasch and Straub (2006, 2009), who focussed on the determinants of government-led renegotiations and found largely similar results (but corruption was shown to have an impact on increasing renegotiations).

Finally, De Brux et al. (2011) use contract experience (a proxy for public sector experience in contractual agreements, which is less prone to renegotiation), political colour, and the change of the mayor as instruments for the average number of renegotiations. The authors conclude that only contract experience is a good instrument.

### **3 Methodology and data**

To assess the determinants of PPP renegotiations, we collected data from a total of 32 projects in 13 European countries. We gathered this data from COST<sup>1</sup> publications, with information on renegotiations of transport PPPs (COST Action TU1001, 2013a, COST Action TU1001, 2014). We identified 17 PPP projects renegotiated, the majority of which implemented in Mediterranean countries (e.g. Portugal, Spain, Greece, and Croatia) but also in northern Europe (e.g. United Kingdom and Sweden). Regarding the transport mode, 14 cases are from the road sector, 3 from the rail sector and the remaining case is port related.

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<sup>1</sup> COST is a framework supporting cooperation among scientists and researchers across Europe. Action TU1001 focused on Public Private Partnerships in Transport. Detailed information on the projects can be found in the referenced COST publications.

Probit (and logit) models on panel data whereby each year (our dependent variable) was labelled as either being a renegotiation or no-renegotiation year. Specifically, we assumed that the model takes the form of:  $\Pr (Y = 1 | X) = \Phi (X' \beta)$  [1], where  $\Pr$  denotes the probability, and  $\Phi$  is the cumulative distribution function of the standard normal distribution. The parameters  $\beta$  can be estimated by maximum likelihood. It is possible to motivate the probit model as a latent variable model. Suppose there existed an auxiliary random variable:  $Y^* = X' \beta + \varepsilon$  [2], where  $\varepsilon \sim N(0, 1)$ . Thus,  $Y$  was viewed as an indicator for whether this latent variable was positive:

$$Y = \begin{cases} 1 & \text{if } Y^* > 0 \text{ i.e. } -\varepsilon < X' \beta \\ 0 & \text{otherwise} \end{cases} \quad [3]$$

We identify for each PPP project whether or not it was renegotiated ever since the concession contract was signed. While only 17 out of the 32 projects were renegotiated, some were renegotiated multiple times throughout their lifetime. In this model, we have 37 renegotiation events taking the value of 1. Non-renegotiation years take the value 0, and are the years in which the 32 PPPs were not renegotiated. We had 345 non-renegotiation years, and hence a total of 382 observations.

Addressing the determinants of renegotiations, our first test solely used the project variables. The following variables were used:

*Greenfield* is a variable that assumes 0, if the project is a brownfield, meaning that the project involves the refurbishment of an existing facility or building on a site where there has previously been a structure. The variable assumes 1, if the project is Greenfield, that is, if the project is the construction of an entirely new infrastructure. We expect this variable to assume a positive coefficient, as entirely new projects will be riskier and have a higher degree of complexity and uncertainty.

*Concession age* represents a PPP's total number of years, beginning with the contract day, and ending with the renegotiation request. During the life-cycle of a PPP, the probability of renegotiation may increase due the passing of time, PPPs are more prone to renegotiation, as the initial forecast tends to be less accurate in the long term and the projects are more subject to instability. This evidence is supported by several authors (Guasch et al., 2007, Guasch, 2004, Cruz and Marques, 2013b, Guasch and Straub, 2009).

*Operational stage* equals 0, when the renegotiation occurs during the construction stage, and 1, during the operational stage. A renegotiation is expected to occur more frequently during the operational stage for two reasons: this stage is the longest part of the concession period and embeds most uncertainty (Sarmiento, 2014). Also, the first years of operation allow testing the initial demand expectations which may have influence on the project's cash flow.

*Contract duration* is the length of each PPP contract expressed in years. Longer concessions are likely to be renegotiated more frequently due to the imprecision of long-run forecasting.

*Number of bidders* stands for the number of companies that take part in bidding for the project. Strong competition at the bidding phase could lead to underbidding, which increases the probability of renegotiation. This may be due to the winner's curse, in that renegotiation can be viewed as the consequence of aggressive bids, with opportunistic behaviour on the part of some bidders who believe that they will be able to renegotiate later on and thus compensate their initial losses (Hong and Shum, 2002). Results from Guasch et al. (2007) and Cruz and Marques (2013b) show that the existence of a bidding process tends to increase the probability of renegotiation. Therefore, following the results of Estache et al. (2009) and Sarmiento (2014), we expect this variable to have a positive coefficient.

*Financial motivation* is a dummy variable, assuming 1, if the main purpose from the government to use a PPP was to obtain private sector funds in order to avoid budgetary constraints. This way, if the PPP model was primarily selected for that reason, we may assume that the project will be less reliable and, therefore, will have more renegotiations. It is a rather subjective assessment of an intention to give investments an "off-balance sheet" treatment which, of course, is never formally assumed. Other motivations include testing new forms of public procurement and political ideology.

*Renegclause* is a dummy variable assuming 1, if the PPP contract has specific renegotiation clauses, such as traffic or revenues guarantees. Contracts with more renegotiation clauses will inadvertently create more incentive to renegotiate.

*KPI* equals 0, if the contract has no key performance indicators (KPI) that have to be met by the private sector in order to be compensated by the investment or service. KPIs range from user satisfaction to financial criteria (e.g. debt service) and operational aspects (e.g. road safety and availability). Contracts with KPIs are more demanding for private sector efficiency, and therefore they should reduce the probability of renegotiation.

Regarding the country economic and legal variables, we used the following variables:

*GDP growth* is the annual growth of real GDP (i.e. adjusted for inflation) for the country where the PPP project takes place. An economic recession will likely reduce demand, potentially compromising the project's cash flow, and trigger the contract's renegotiation. A higher GDP growth should therefore reduce the likelihood of contractual renegotiations, as found in Guasch et al. (2007).

*CorruptionQ* is a measure of a country corruption, provided by the World Bank. It measures each country's corruption in a quartile in comparison to other countries. A higher score, with a country in a high quartile, represents a less corrupted country. If operators believe that

governmental decision making is subject to influence, then the odds for renegotiation as a way to capture additional rents may increase (Kaufmann et al., 2002). According to Guasch *et al.* (2003, 2008), Estache et al. (2009) and also Sarmiento (2014), there is a direct effect of a lower incidence of corruption on reducing renegotiation. Based on this, and as a higher corruption index represents lower corruption, we expect a negative coefficient. That is to say, an increase in the index represents a reduction in corruption, which leads to a lower probability of renegotiation.

*GovefficQ* was also provided by the World Bank, and measures each country's government efficiency. A higher score, with a country in a high quartile, represents a more efficient government. Under a more efficient government, PPP contracts should be more robust and should have less margin for renegotiation (Estache et al., 2009).

*Rule of lawQ* is a proxy for the quality of contract (enforcement), the source also being the World Bank. An increase in the score signifies an improvement in the country's situation. Rule of law represents the quality and strength of the legal system - it shows the judicial limits of governments for realising their policy programmes through the legislative arm of government. Better enforcement is expected to dissuade, or reject inappropriate claims for renegotiation.

As these last three variables have a high correlation (shown in a correlation matrix that is not formally reported), which could induce multi-collinearity, we include these variables in our tests, one at the time.

In order to carry out a robustness check, we run a second probit model, but this time adding some PPP regulatory variables:

*PPPsupportunit* equals 0, if, at the time of renegotiation, the country had no PPP unit. This unit is defined as "any organisation set up with full or partial aid of the government to ensure that the necessary capacity to create, support, and evaluate multiple PPP agreements exists" (OECD, 2010). Therefore, a PPP unit is a government department that oversees the complete life cycle of the PPP (Farrugia et al., 2008). Both these studies emphasise the importance of PPP-dedicated units for the ultimate success of PPPs. In this way, the literature shows that the existence of a PPP unit improves the country's ability to deal with PPP complexity and pitfalls. The literature suggests that the existence of a regulatory body tends to reduce the occurrence of renegotiation (Guasch et al., 2003, Guasch et al., 2007, Guasch et al., 2008, Guasch, 2004, Guasch and Straub, 2009, Cruz and Marques, 2013b). Therefore, we expect this variable to be negative.

*PPPspecificlegislation* is a dummy variable with 0, if the country, at the time of the renegotiation, did not have a specific legal framework for PPP. The absence of this specific

legislation can be a factor for increasing public sector difficulties in assessing PPPs, and may increase renegotiation.

*Deficit* is given as a percentage of GDP. A high deficit could increase renegotiation for two reasons: Firstly, renegotiation can enable governments to circumvent budgetary rules by postponing expenditures. Secondly, there is a binding budget constraint in most of these countries due (in part) to the intensive use of PPPs (Kappeler and Nemoz, 2010, Sarmiento and Renneboog, 2014). Furthermore, governments may focus on fiscal objectives, rather than on efficiency.

Finally, in order to assess endogeneity, we run an instrumental variable probit (IV probit), in order to test the endogeneity of the contracts. We use this two-step approach, as it is possible that one or more of the regressors is correlated with the error term, as derived from the ex-ante self-selection problem (see Guasch et al. (2003) for more details on this). Although the treatment of endogeneity in the nonlinear probit models is still open to discussion, we expect this test to control for the self-selection of variables (Wooldridge, 2012). We performed two tests, using the economic and legal variables as instrumental variables, and *election year* as the instrument variable. We make this assumption from the viewpoint that elections determine who (re) negotiates the contract on behalf of the public sector under a given ideological agenda. Importantly, *election year* is exogenous, in the sense that it is determined by law and political events, rather than by the risk of renegotiation, or by private sector action. The first test was done using an IV probit, with each instrumental variable used individually (due to the multicollinearity problem described above), and election year as the instrument variable. This is the standard test for endogeneity. The second test was based on Guasch et al. (2007), and consists of running the previous probit regressions and then taking the predicted values and reintroducing them in the probit panel, estimating new equations with these instrumented variables.

*Election year* is a dummy variable as to whether the renegotiation occurred in a year with a government election. In an election year, the number of renegotiations may increase as private parties may find a more indulgent government. This argument is supported in the conclusions of different works (Guasch et al., 2003, Guasch et al., 2007, Guasch et al., 2008, Guasch and Straub, 2009, Sarmiento, 2014).

Table 2 exhibits the descriptive statistics of our data. The Breusch–Pagan test for heteroskedasticity rejects the null hypothesis. The Jarque-Bera test on variables’ normality is statistically significant, and thus we can safely consider that the data have a normal distribution.

Table 2 – Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Reneg	382	0.0968586	0.2961531	0	1

Greenfield	382	0.4764398	0.5000996	0	1
Concession age	382	8.23822	5.717616	1	28
Operational stage	382	0.7225131	0.448346	0	1
Contract duration	382	31.09162	10.59983	9	53
N° bidders	382	3.298429	2.600212	1	20
Financial motivation	382	0.7670157	0.4232867	0	1
RenegClause	382	0.4057592	0.4916823	0	1
KPI	382	0.447644	0.4979034	0	1
GDP growth	382	2.577879	4.456866	-7.910232	11.6141
PPPspecificlegislation	382	0.4895288	0.5005459	0	1
PPPsupportunit	382	0,4267016	0,4952468	0	1
Election year	382	0,2905759	0,4546236	0	1
Deficit	382	3,492796	5,34831	-18,4	15,2
CorruptionQ	382	79,50236	15,09758	40,9	100
GovefficQ	382	82,55838	11,04819	29,3	99
RuleoflawQ	382	82,05157	13,19504	19,6	100

## 4 Discussion of results

To answer our research question regarding what are the determinants of PPP renegotiations, we run a probit model and present the results of both the coefficients and the marginal effects for each variable in Table 3. Marginal effects represent the impact of a unit change in the value of a regressor on the choice probability and allow us to understand their relative importance. Given that they are calculated at the sample mean, we do not discuss them individually in a quantitative way. Instead, results are discussed from the standpoint of the variable's contribution to trigger contract renegotiation.

Of the concession variables, the *Greenfield*, *Operational stage*, *Contract duration*, *Financial motivation* and *RenegClause* are positively and statistically significant. As expected, higher risk and greater uncertainty produces more renegotiation. With greenfield projects, a new project is less likely to have forecast accuracy, which increases the chances of new contractual conditions during the lifetime of the concession. It is the operational stage that comprises the longest part of the concession period and that leads to the most uncertainty, what justifies the positive coefficient in our regression. Longer contracts represent long-term projections and forecasts, increase concession uncertainty, and tend to produce more renegotiation. The results also show that when public decision-makers choose PPPs mainly for financial motivations, they end up renegotiating more. Unlike our initial prediction, *concession age* shows a negative sign. This result can be traced back to the previous variables when looking at several highways in our sample of contracts renegotiated during the early years. Here we find risks associated with greenfield projects (e.g. delays due to expropriations and grantor obligations, environmental and heritage reasons, etc.), and the socio-economic environment (e.g. financial crisis and toll

increases). Finally, and as expected, contracts with renegotiation clauses are more prone to renegotiation, as these clauses work as a protection for the private sector.

Table 3 – Significance of variables on probability of renegotiations and marginal effects

VARIABLES	(1) Reneg	(2) Reneg	(3) Reneg
Greenfield	0.54** (0.23)	0.53** (0.22)	0.58** (0.25)
Concession age	-0.12*** (0.03)	-0.11*** (0.03)	-0.12*** (0.03)
Operational stage	0.76*** (0.28)	0.74*** (0.28)	0.75*** (0.28)
Contract duration	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)
N° bidders	-0.09 (0.06)	-0.10 (0.06)	-0.10 (0.06)
Financial motivation	0.74** (0.34)	0.71** (0.35)	0.77** (0.35)
RenegClause	0.75*** (0.24)	0.73*** (0.23)	0.71*** (0.24)
KPI	-0.19 (0.23)	-0.17 (0.23)	-0.13 (0.24)
GDP growth	-0.09*** (0.03)	-0.09*** (0.02)	-0.10*** (0.02)
CorruptionQ	-0.02*** (0.01)		
GovefficQ		-0.03*** (0.01)	
RuleoflawQ			-0.02*** (0.01)
Constant	-1.49* (0.79)	-0.67 (0.90)	-1.26 (0.81)
Observations	382	382	382
VARIABLES	marginal effects		
Greenfield	0.0603** (0.0274)	0.0582** (0.0266)	0.0647** (0.0280)
Concession age	-0.0127*** (0.00323)	-0.0120*** (0.00320)	-0.0129*** (0.00320)
Operational stage	0.0646*** (0.0209)	0.0619*** (0.0207)	0.0627*** (0.0207)
Contract duration	0.00520*** (0.00160)	0.00520*** (0.00159)	0.00518*** (0.00158)
N° bidders	-0.0101 (0.00663)	-0.0102 (0.00650)	-0.0102 (0.00651)
Financialmotivation	0.0601*** (0.0214)	0.0567*** (0.0214)	0.0606*** (0.0209)
RenegClause	0.0931*** (0.0357)	0.0893** (0.0347)	0.0858** (0.0341)
KPI	-0.0204 (0.0271)	-0.0180 (0.0267)	-0.0137 (0.0274)
GDP growth	-0.00961*** (0.00292)	-0.00999*** (0.00277)	-0.0109*** (0.00274)
CorruptionQ	-0.00232** (0.000904)		
GovefficQ		-0.00327*** (0.00115)	
RuleoflawQ			-0.00252*** (0.000919)
Observations	382	382	382

Robust standard errors in parentheses. \*\*\* stands for  $p < 0.01$ , \*\* stands for  $p < 0.05$ , and \* for  $p < 0.1$ . Own table.

Results from Table 3 also show the impact of the economic and legal variables on the probability of renegotiation. GDP growth is statistically significant in reducing the likelihood of contract renegotiations. The three governance variables (*CorruptionQ*, *GovefficQ* and *RuleofLawQ*) are used separately due to the potential multi-collinearity effect, as describe before (specifications 1, 2 and 3, respectively). An increase in the value represents a better position of each country in overall terms. Thus, we expected all of these three variables to be negatively correlated with the occurrence of renegotiation. Results are according to this prediction, as the coefficients are negative. More corruption increases the likelihood of PPP renegotiations. Furthermore, less efficient governments are more prone to face renegotiation. This can be explained by the fact that such governments will be less prepared, both for negotiating contract clauses, and also for monitoring the project. The private sector usually holds asymmetric information about the projects, and lower government efficiency can increase this asymmetry. Better enforcement should dissuade, or reject inappropriate claims for renegotiation, as the results for Rule of law indicate.

In order to test the robustness of the probit model, we include some control variables in the PPP regulatory framework. Notably, we test the influence of the existence of a national PPP dedicated unit (*PPP supportunit*), the existence of a specific PPP law (*PPPspecificlegislation*), and the country's public deficit as a percentage of GDP (*Deficit*). The results are presented in Table 4.

The inclusion of these three variables does not change the results of the other variables from Table 3. As expected, the existence of a PPP-dedicated unit and a PPP law reduces the incidence of renegotiation. A better PPP regulatory environment helps governments reduce uncertainty and asymmetric information, thus leading to a better-negotiating position for the public sector. On the contrary, a higher public deficit tends to increase the likelihood of renegotiation. Governments facing a more constraint fiscal situation may agree on renegotiation as a way of postponing expenditure, or of reducing public payments by reducing service levels, or by increasing tariffs.

Table 4 – Robustness checks

VARIABLES	(1) Reneg	(2) Reneg	(3) Reneg
Greenfield	0.53** (0.25)	0.55** (0.25)	0.56** (0.27)
Concession age	-0.10*** (0.03)	-0.10*** (0.03)	-0.11*** (0.03)
Operational stage	0.63** (0.28)	0.63** (0.28)	0.64** (0.28)
Contract duration	0.05*** (0.01)	0.05*** (0.02)	0.05*** (0.02)
N° bidders	-0.02 (0.06)	-0.03 (0.06)	-0.03 (0.06)
Financial motivation	0.84** (0.43)	0.82* (0.43)	0.85** (0.43)

VARIABLES	(1) Reneg	(2) Reneg	(3) Reneg
PPPspecificlegislation	-0.57** (0.27)	-0.61** (0.27)	-0.52* (0.27)
PPPsupportunit	-0.98*** (0.27)	-0.95*** (0.28)	-0.97*** (0.27)
RenegClause	0.47* (0.24)	0.46* (0.24)	0.44* (0.24)
KPI	-0.17 (0.25)	-0.17 (0.25)	-0.14 (0.26)
GDP growth	-0.12*** (0.03)	-0.13*** (0.03)	-0.13*** (0.03)
Deficit	0.08** (0.04)	0.08** (0.04)	0.09** (0.04)
CorruptionQ	-0.02** (0.01)		
GovefficQ		-0.03** (0.01)	
RuleoflawQ			-0.02** (0.01)
Constant	-1.62* (0.89)	-0.89 (0.99)	-1.58* (0.87)
Observations	382	382	382

Note: Robust standard errors in parentheses. \*\*\* stands for  $p < 0.01$ , \*\* stands for  $p < 0.05$ , and \* for  $p < 0.1$ . Own table.

All contract characteristics and all aspects of the institutional and macroeconomic environment can be argued to have an impact on the probability of renegotiation (Guasch et al., 2005). In order to address the endogeneity of contracts, we need to find suitable instruments. As we have seen before, the literature tends to use corruption or variables related with institutional parameters. Considering the variables used in our study, and the results presented above, we opted to use the *CorruptionQ*, *GovefficQ* and *RuleofLawQ* variables as the instrumented variable. We also used as an instrument the “*election year*” variable. Accordingly, we then run the previous probit regressions and next take the predicted values and reintroduce them in the probit panel, estimating new equations with these instrumented variables. Table 5 presents the results of our first endogeneity test, by using this IV Probit model.

The instrument used is shown to be statistically significant and have a negative impact on significant variables, such as *corruption*, *government efficiency* and *rule of law*. In other words, elections seem to reduce the results of these three variables, and therefore, indirectly increase the chance of renegotiation. The use of this test also shows that other variables which in previous tests were found to be statistically significant, after the instrument, remain significant.

Table 5 – Endogeneity test

VARIABLES	(1) Reneg	(2) CorruptionQ	(3) Reneg	(4) GovefficQ	(5) Reneg	(6) RuleoflawQ
CorruptionQ	-0.08*** (0.02)					
GovefficQ			-0.10*** (0.03)			
RuleoflawQ					-0.08*** (0.02)	
Electionyear		-3.76*** (1.30)		-2.77*** (0.98)		-3.02** (1.24)
Greenfield	0.62*** (0.21)	5.22*** (1.34)	0.57*** (0.21)	3.67*** (1.01)	0.62*** (0.20)	5.34*** (1.28)
Concession age	-0.06* (0.03)	-0.03 (0.15)	-0.04 (0.03)	0.10 (0.11)	-0.05* (0.03)	-0.04 (0.14)
Operational stage	0.56** (0.25)	3.43** (1.69)	0.50** (0.25)	2.08 (1.27)	0.50** (0.23)	2.88* (1.62)
Contract duration	0.04*** (0.01)	0.15* (0.08)	0.03** (0.01)	0.10* (0.06)	0.03** (0.01)	0.15** (0.08)
N° bidders	-0.04 (0.05)	-0.64** (0.26)	-0.05 (0.05)	-0.59*** (0.19)	-0.04 (0.04)	-0.57** (0.25)
Financial motivation	0.56* (0.31)	1.27 (1.68)	0.37 (0.33)	-0.69 (1.26)	0.43 (0.30)	0.39 (1.61)
PPPspecificlegislation	-0.80 (0.55)	-15.53*** (1.34)	-0.74 (0.52)	-10.95*** (1.01)	-0.55 (0.42)	-10.51*** (1.28)
PPPsupportunit	-0.36 (0.22)	-1.85 (1.31)	-0.11 (0.23)	0.73 (0.99)	-0.15 (0.21)	0.11 (1.26)
RenegClause	0.88*** (0.25)	8.23*** (1.48)	0.80*** (0.23)	5.40*** (1.11)	0.74*** (0.20)	6.09*** (1.42)
KPI	-0.05 (0.22)	1.48 (1.50)	-0.01 (0.23)	1.62 (1.13)	0.12 (0.24)	3.31** (1.44)
Constant	3.28 (2.62)	76.64*** (4.00)	5.52 (3.36)	80.80*** (3.01)	4.06 (2.55)	76.75*** (3.84)
Observations	382	382	382	382	382	382

Note: Robust standard errors in parentheses. \*\*\* stands for  $p < 0.01$ , \*\* stands for  $p < 0.05$ , and \* for  $p < 0.1$ . Own table.

Table 6 shows the results of a robustness check for endogeneity, using the predicted values of the previous regressions and introducing them to the probit panel, as described in the methodology section.

Table 6 – Robustness checks on endogeneity

VARIABLES	(1) Reneg	(2) CorruptionQ	(3) Reneg	(4) GovefficQ	(5) Reneg	(6) RuleoflawQ
CorruptionQ	-0.08*** (0.02)					
GovefficQ			-0.10*** (0.03)			
RuleoflawQ					-0.08*** (0.02)	
Residuals		-12.75*** (4.40)		9.41*** (3.31)		-10.23** (4.22)
Greenfield	0.62*** (0.21)	5.22*** (1.34)	0.57*** (0.21)	3.67*** (1.01)	0.62*** (0.20)	5.34*** (1.28)
Concession age	-0.06* (0.03)	-0.03 (0.15)	-0.04 (0.03)	0.10 (0.11)	-0.05* (0.03)	-0.04 (0.14)
Operational stage	0.56** (0.25)	3.43** (1.69)	0.50** (0.25)	2.08 (1.27)	0.50** (0.23)	2.88* (1.62)
Contract duration	0.04*** (0.01)	0.15* (0.08)	0.03** (0.01)	0.10* (0.06)	0.03** (0.01)	0.15** (0.08)
N° bidders	-0.04 (0.05)	-0.64** (0.26)	-0.05 (0.05)	-0.59*** (0.19)	-0.04 (0.04)	-0.57** (0.25)
Financial motivation	0.56* (0.31)	1.27 (1.68)	0.37 (0.33)	-0.69 (1.26)	0.43 (0.30)	0.39 (1.61)

	(0.31)	(1.68)	(0.33)	(1.26)	(0.30)	(1.61)
PPPspecificlegislation	-0.80 (0.55)	-15.53*** (1.34)	-0.74 (0.52)	-10.95*** (1.01)	-0.55 (0.42)	-10.51*** (1.28)
PPPsupportunit	-0.36 (0.22)	-1.85 (1.31)	-0.11 (0.23)	0.73 (0.99)	-0.15 (0.21)	0.11 (1.26)
RenegClause	0.88*** (0.25)	8.23*** (1.48)	0.80*** (0.23)	5.40*** (1.11)	0.74*** (0.20)	6.09*** (1.42)
KPI	-0.05 (0.22)	1.48 (1.50)	-0.01 (0.23)	1.62 (1.13)	0.12 (0.24)	3.31** (1.44)
Constant	3.28 (2.62)	58.82*** (7.05)	5.52 (3.36)	67.66*** (5.31)	4.06 (2.55)	62.45*** (6.77)
Observations	382	382	382	382	382	382

Robust standard errors in parentheses. \*\*\* stands for  $p < 0.01$ , \*\* stands for  $p < 0.05$ , and \* for  $p < 0.1$ . Own table.

The importance of strong governance in our results is consistent with theory. The World Bank proxies (i.e. corruption, rule of law, government efficiency, etc.) used for the Latin American experience remain significant and positive in our European sample. This is also the case with the development of PPP specific legislation and support units. Also, variables used to capture the macro-economic environment are consistent with literature. Economic recessions and budgetary deficits increase the likelihood of contract renegotiations. Regarding the political environment, we find that governments engaging in PPP projects with financial motivations are more likely to renegotiate them. Variables that capture project's specificities (e.g. greenfield, operation stage) were considered within contract design. While they are found both positive and significant, they can be seen more as a reflection of unrevealed information rather than poorly designed contracts. To the best of our knowledge, we test for the first time the influence of renegotiations clauses and KPI's in the contract. Whereas the former is both positive and significant, the latter is negative but not statistically significant.

## 5 Conclusions

In this paper, we assessed the critical factors for the renegotiation of transport infrastructure concessions. By collecting a database of European PPP projects, we identified a total of 37 renegotiations events. As expected, the probability of a renegotiation increases with the level of the uncertainty of the project. As the project variables determine more uncertainty regarding future conditions, they are shown to have a positive and statistically significant impact. More risky projects (as financiers typically perceive greenfield projects, for example), projects at the operational stage, longer contracts and projects built under a PPP scheme with financial motivations, all have a higher probability of being renegotiated. Furthermore, the existence of renegotiation clauses in contracts itself proves to be a trigger for renegotiation. Whether it results in an improved contract that is beneficial for both partners or it creates an incentive for opportunistic behaviour remains to be answered.

Additionally, we found that both the country's economic and legal environment also have an impact on the likelihood of renegotiation. Economic growth contributes to the stability of the

project's cash flow and allowing its debt service. This stresses the need for both realistic demand forecasts and adequate risk allocation between parties. Countries with low corruption, more efficient governments, and a better rule of law, tend to reduce the odds of facing a PPP renegotiation. These variables were also subject to endogeneity tests. The occurrence of elections (an exogenous variable for all concessions), tends to increase corruption and reduces both government efficiency and the rule of law. Indirectly, elections are shown to have an impact on increasing renegotiations. As elections carry ideological changes, this may trigger contractual renegotiation and they can also work as a mechanism that encourages the development of governance institutions. We find evidence of the former case in our sample, but not of the latter.

As PPPs are increasingly being used by governments around the world to face the “infrastructure gap”, concern about efficiency and renegotiations has grown. This paper address a very relevant topic, although the literature is still scarce on this aspect, and it mainly focus on the South American experience. Notwithstanding, PPPs have been a key public policy in Europe. This paper should be useful for both academics and practitioners alike, and it should help increase our understanding of renegotiation and its determinants. However, further research is still required before concrete conclusions can be reached. Additional research on PPP renegotiations using comprehensive data is still needed, especially concerning the possible relationship between bidding and renegotiation (the opportunistic behaviour of the private sector to win a concession, as reflected by underbidding and overbidding, depending on the award criteria). In addition, on account of the limited data available for this study, we were unable to address the issue of the financial effort for the public sector when involved in PPP renegotiations (e.g. increasing future payments above those initially agreed in the contract). Thus, it is clear that research on PPP renegotiation is still at an early stage.

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