

Exogenous Determinants for Renegotiating Public Infrastructure Concessions: Evidence from Portugal

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Abstract: Renegotiations are frequently perceived as the Achilles' heel of concessions. After two decades of concessions development, empirical evidence suggests a recurrent need to renegotiate contracts. What drives renegotiation? Why does it occur? What are the results? The literature still lacks data on renegotiation patterns and on its main causes and results, thus not answering these questions. This paper intends to fulfill this gap by identifying some of the key determinants of renegotiations and presenting the main results. Using an econometric analysis on a real database of 87 Portuguese concessions, the research identified some variables that help explaining the high probability of renegotiation, such as the concession duration and investment, or the existence of a regulator when the contract was signed. The research also found empirical evidence of the high costs involved in renegotiations, as well as of poor control and poor management of concessions by the government. DOI: 10.1061/(ASCE)CO.1943-7862.0000710. © 2013 American Society of Civil Engineers.

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Introduction

Since the late 1980s, private involvement in public infrastructure delivery has been growing, allowing governments to engage in large-scale investments. In broad terms, two different sets of schemes have been adopted: full privatization and public-private partnerships (PPPs). Full privatization, also called divestiture, involves a permanent legal transfer of assets from public to private ownership, where the government's role becomes solely that of a regulator. In PPP contracts, the relationships are more complex and can have several configurations. Some economists look at PPP arrangements as a particular case of "vertical disintegration or contracting out by governments" (Bettignies and Ross 2009). The European Commission establishes two distinct partnership types: purely contractual and institutionalized PPPs. Contractual PPPs, as the name suggests, refer to a relationship managed by contracts. Conversely, in institutional PPPs, the relationship is established through a newly created distinct entity where both parties coexist as shareholders (Cruz and Marques 2011).

All of these procurement models can be found in infrastructure delivery, but over the last two decades, contractual PPPs have gained momentum, mostly in Latin America and Mediterranean countries, but also in Canada, Australia, the United Kingdom and, more recently, the United States (Shen and Wu 2002). Among the main advantages of concessions compared to other types of PPP

is the idea that a contract between the parties allows them to understand the "rules of the game," avoids discretionary behavior by regulators (Gómez-Ibáñez 2003) and, in theory, can prevent opportunistic behavior by either the concessionaires or the governments (Marques and Berg 2010).

However, the reality shows that concessions often suffer from a major shortcoming: renegotiations (Guasch 2004; Ho 2004; Guasch et al. 2007, 2008; Engel et al. 2003, 2009; Marques and Berg 2010). Mostly in Latin countries, concession contracts are founded upon explicit financial forecasts known as the "concession OBC." This case is also the basis for assessing the best risk-sharing agreement. In theory, if the public sector is best able to deal with that risk, then it should be responsible for managing it; otherwise, the risk should be transferred to the private sector (Grimsey and Lewis 2002, 2005; Meda 2007; Marques and Berg 2011). Once risk allocation is determined and the deal is closed, the outline business case (OBC) is set for the concession duration. Both the government and operators' performance will be measured by taking the OBC as a reference (e.g., if investments are made in line with the investment plan, if governmental subsidies are provided as accorded or if revenues behave as forecasted).

The problem arises when assumptions made in the OBC are no longer valid and vary beyond the pre-defined intervals, e.g., minimum limits for demand forecasts. The government and/or the operator are then entitled to the right of renegotiating the contract. In some cases, ordinary contractual revisions are allowed, e.g., periodic updating of user charges, but these revisions are not a form of renegotiation because they are explicit in the original contract (Guasch 2004).

The causes for renegotiations might be related to exogenous and endogenous variables. Exogenous refer to the project characteristics (e.g., dimension, complexity, sector), while endogenous factors have to do with contractual clauses, such as the existence of a clause ensuring a determined internal rate of return (IRR) limiting the value-at-risk.

This paper is devoted to identifying the main exogenous drivers for concession renegotiations based on the Portuguese concessions developed over the last 15 years. The paper is organized as follows:

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Section 2 summarizes the literature on renegotiations; Section 3 presents an empirical model to identify the main drivers for renegotiation as well as some data for the global description of the renegotiation process; Section 4 examines the main events triggering renegotiations and the results of the process; and finally, Section 5 draws general conclusions and provides some policy implications.

Problem of Renegotiation: Literature Review

Initiators of Renegotiation

Tirole (1999) examines renegotiations using transaction costs, explaining that renegotiation occurs because the cost of writing complete contracts that can cope with all possible contingencies is very high. The question is not so much the impossibility of anticipating all the likely possibilities and providing appropriate contingencies to them, but the high cost of doing so. Renegotiations become inevitable when competition *for the market*, locking in public and private partners in long-lasting and incomplete contracts with large relation-specific investments, replaces competition *in the market*. Demsetz (1968), Williamson (1976), Tirole (1986), Dewatripont (1988), and Hart and Moore (1988) discuss the importance of renegotiation for the particular case when the object of the contract is a monopoly.

The difficulty of foreseeing all possible contingencies and of estimating the probability of the occurrence of certain events makes it problematic and expensive [as supported by the transaction costs theory, e.g., Tirole (1999)] to write complete contracts, especially if relation-specific investments are undertaken (Hart and Moore 1988). The more complex the sector and the global environment surrounding the project, the more complex the contract (Crocker and Reynolds 1993). Complexity might be measured in several dimensions: e.g., demand uncertainty, difficulty in measuring the quality of service, number of stakeholders, governance model. Depending on who the renegotiation initiator is, the literature review can be analyzed using two different approaches: the concessionaire or the government.

Concessionaire-Led Renegotiations

Assuming a priori that renegotiations might occur may lead to opportunistic behavior in preparing the bids, executing the contract and rebidding the concessions (Williamson 1976). In the bidding process, competitors may depend upon the possibility of renegotiation and may bid aggressively. The most optimistic bid, which overestimates revenues or underestimates costs, typically wins the concession, thereby increasing the chances that renegotiation will be required. This phenomenon is known in the literature as the *winner's curse* [see more in Hong and Shum (2002) and Ubbels and Verhoed (2008)].

However, opportunistic behavior can also take place during the course of the contract and rebidding the concession (Williamson 1976). In the presence of high transaction costs and a low probability for concession capture by the public sector, concessionaires can engage in rent, seeking to compensate for underbidding. Several examples of this behavior can be found in the literature (Guasch 2004; Bajari and Tadelis 2001; Bajari et al. 2007). When selecting the bids, the public partner does not know the production or cost functions of the concessionaire; rather, in most cases, it has only rough estimates of the lifecycle costs of the project, which does not allow for determining whether the proposals are financially robust. The Buenos Aires water and wastewater system is a classic example: the winning consortium rapidly decreased the

water costs by 26.9%, with large benefits for consumer welfare, but weak regulatory supervision and information asymmetry jeopardized the concessions sustainability (Alcazar et al. 2000). The economic crisis that affected Argentina during this period also contributed to the problems faced by the concessionaire. Another example is the airport concessions in Argentina and Honduras, where the winning bids overpriced the airports and were unable to fulfill the investment plans and the assumed debt amortization before the government sellers (Lipovich 2008). The contract was renegotiated, developing more favorable conditions for the concessionaire.

After awarding the concession, renegotiation takes place under a *noncompetitive atmosphere* (Guasch 2004). The concessionaire already has more precise information on its production or cost function and on business determinants, unlike the government or the grantor entities. Municipally awarded concessions also lack technical expertise. Williamson (1985) argues that this information asymmetry mostly benefits the incumbent, not just in renegotiating but also for rebidding purposes. The lack of a competitive environment gives the incumbent a strategic advantage, which is leveraged by the asymmetry of information. The concessionaire is more likely to impose its own requirements, affecting the original contract award legitimacy (Marques and Berg 2010).

These theories place most of the renegotiation power on the concessionaire, basing their assumptions on information asymmetry, which might provide significant bargaining power in complex systems such as health or transportation, and on quasi-rent appropriation.

Government-Led Renegotiations

Governments can also use renegotiations opportunistically. Engel et al. (2006) examined government-led renegotiations as a way to bypass budgetary constraints and administrative impositions. Instead of using debt to finance improvements or changes, governments can engage in renegotiations without affecting the public budget, at least in the short term. An empirical study linked the probability of government-led renegotiations to the occurrence of elections. In the proximity of elections, there are incentives for governments to increase public spending without supervision and with no effects on the annual budgets. One can argue that this scheme decreases social welfare and increases the public burden in the years ahead. In fact, the use of PPP arrangements as purely financing instruments only increases the cost of investment over the infrastructure lifespan. Private funding is usually more expensive than financing investments with public instruments simply because private equity is higher than risk-free rates under normal conditions.

Guasch and Straub (2009) examined infrastructure concessions in Latin America and the Caribbean and found that between 1985 and 2000, more than 41% of concessions were renegotiated, with the government being the main initiator of the process. This behavior can affect the confidence of the private sector in the government commitment, ultimately leading to higher capital costs and underinvestment, as concluded by Estache and Wren-Lewis (2008).

Investors view policy change as a potentially significant risk. The case of the water supply system in Limeira, Brazil (Guasch 2004) or the recent Venezuelan nationalization of oil companies by President Chavez in 2008 provides evidence that governments can engage in unilateral destitutions. The larger the investments made by concessionaires, the more the bargaining power the government has because the concessionaire value at risk is higher.

Main Determinants of the Probability of Renegotiation

Data

For this study, the data for 87 projects in transportation (roads, rails, and ports), health, water supply, and energy (distribution and production) were collected. The collection of data included several methods: analysis of public reports (Court of Audit 2008; DGTF 2011), annual reports of concessionaires, and interviews with stakeholders. The sample includes all the concessions granted by the Portuguese government between 1984 and 2008, and many—but not all—of those granted by municipalities, for which data are harder to obtain. Among the local government concessions, only water concessions are included, while schools, leisure and sports centers, local markets, social housing, waste, local transportation and other types of infrastructure are excluded. Although the projects considered probably represent less than half of the total PPP projects in Portugal, they account for the majority of the total expenditure in terms of investment and annual burden for the public budget.

Portugal developed an extensive PPP program between 1994 and 2010. In 2011, the costs with PPPs were over 1% of its

Table 1. Information Structure

Projects' main features	Regulatory environment	Renegotiation process
Sector	Regulatory body	Number of renegotiations for each contract
Type of PPP	Type of regulation	Date for each renegotiation
Contract length		Initiator of renegotiation process (government, operator, or both)
Total investment		Main reasons for renegotiating the contract
Concessionaire		Cost of renegotiation
Date of contract sign		Status of renegotiation process (claim, dispute, or agreement)
Date of operation beginning		
Bidding process (competition versus negotiation)		
Number of bidders		

GDP, which proves the importance of this procurement model in infrastructure policy. Unlike the United Kingdom or Canada, in Portugal there is no public agency responsible for launching and managing all PPPs, leading to a poor governance model.

Determinants for the Probability of Renegotiation

Information was collected for each project regarding its sector, size, regulatory environment and whatever was renegotiated (Table 1). Unfortunately, the level of detail in each concession varies by sector. For example, water and wastewater concessions are granted on a municipal level and are therefore subjected to a lower degree of transparency than other sectors, where concessions are granted by the national government and are subject to the Court of Audit periodical auditing (at less more frequently) and to the Directorate-General for Treasury and Finance (DGTF).

Although contracts have been renegotiated in every sector, the extent of the problem varies considerably. In road, rail and water projects, 100% of the contracts have been renegotiated at least once, while in ports, health and energy, fewer than 25% have been renegotiated (see Table 2).

These numbers have to be carefully interpreted because the number and type of contracts in each sector is diverse. There were only three projects in the rail sector—two light rail systems and a commuter rail—whereas many concessions were awarded in roads (13) and even more in water services (29). Port, health and energy concessions are among the least renegotiated contracts.

What drives renegotiations? And why do some sectors seem to perform better than others?

The literature on contract theory and contract incompleteness supports the idea that longer concessions will tend to be more renegotiated, mostly due to the difficulties in forecasting for long periods, particularly for demand. The project return and profitability have a significant underlying degree of uncertainty because demand affects revenues, which become more difficult to estimate in the long run.

In the same way, larger concessions with higher investments can be more exposed to risk, e.g., cost overruns, which is well known in infrastructure construction. The construction of large infrastructure projects, such as highways, water supply systems, oil and gas pipelines, airports, hospitals, among others, is exposed to a great deal of uncertainty, especially regarding duration and costs [see more in Skamris and Flyvbjerg (1997) and Flyvbjerg et al. (2003)]. Larger projects are usually more complex and atypical and are consequently less standardized and more prone to contingencies.

One might expect that contracts signed some years ago have higher renegotiation rates essentially for two reasons. First, they

Table 2. Summary of Renegotiations Data by Sector (Court of Audit 2008; DGTF 2011; ERSAR 2010; Lemos et al. 2004)

Sector	Number of concessions	Average investment per concession (million Euros)	Average contract length (years)	Average number of renegotiations per contract	Average time until first renegotiation (years)	Contract completion until first renegotiation (%)	Average number of bidders	Number of concessions renegotiated	Percentage of concessions renegotiated (%)
Transportation	37	374.2	24.8	2.0	3.3	13	2.8	19	51
Roads	13	674.3	30	2.07	2.4	8	4.1	13	100
Rails	3	1,384.4	26.7	2.33	3.7	14	3.1	3	100
Ports	21	44.1	21.36	0.19	7.0	33	2.0	3	14
Health	5	18.1	12.20	0.20	1.0	8	3.2	1	20
Water	29	33.2 ^a	27.97	1.69	1.5	5	3.6	49	100
Energy	16	416.4	36.60	0.15	15.0	41	1.3	3	19
Total	87	247.8 ^b	27.3 ^b	1.8 ^b	6.3 ^b	23	2.8 ^b	58	67

^aEstimation.

^bWeighted average.

have been in place for more years and are therefore more susceptible to instability (economic, political, and social) and forecast failure, and second, one can argue that contracting agencies had less know-how in the first contracts because they were written at the beginning of the learning curve. As previously mentioned, the main uncertainties are construction costs and demand, which are usually well known in the first few years, soon after the facility is opened. Additionally, if bidding is insincere, the concessionaire will try to open the contract early.

Nevertheless, the average time to the first renegotiation is relatively low when compared with the contract duration. Renegotiations tend to happen very early in the contract's life, with the exception of energy and port concessions, which are renegotiated only at 41% and 33% of the contract's lifespan. Road and water contract renegotiations occurred at 8% and 5% of the contract duration (2.4 and 1.5 years after signature).

Contracts for infrastructure PPP are usually long (more than 20 years). Most of the observed contracts support this evidence, with the exception of the health sector, where there are three contracts (out of five) with durations of 7 and 10 years. These contracts mainly concern the management of the infrastructure (with few investments) and therefore require a shorter period for full cost recovery. Road, water, energy and rail contracts have a higher average duration (see Table 2).

A multivariate model was developed to identify and test the assumptions from the literature review and the authors' assessments of what are the main variables that impact the risk or probability of renegotiation.

Although the choice of explanatory variables was conditional on the availability of the data and in spite of the relatively small sample size, the authors' concern was to capture the effects related to (1) the project complexity/size (investment), (2) the evidence of aggressive bidding (type of award procedure and number of bidders), and (3) the level of regulatory expertise (the proxy used was the age of the regulatory agency). The explanatory variables are described in Table 3.

The coefficients for investments (*inv*) and contract length (*leng*) are expected to be positive because these variables are proxies for the project's size and complexity. It is unclear whether the sign for the coefficient for time since award should be positive or negative. The probability for unforeseen contingencies increases over time. Force majeure events, revenue deviations from forecasts, or policy instability have cumulative probabilities of higher

occurrence over time. Conversely, many of the most important uncertainties about construction costs and demand are often resolved fairly early in the contract life.

The existence of a strong regulatory body may decrease the rate of renegotiations. The role of the regulator can be analyzed at two different times: *pre-award* and *post-award*. Before the financial closure of the concession, the regulator may have an important role in designing the contract, safeguarding the public interest and, eventually, in using previous know-how to ensure that the contract delivers higher social value and in decreasing the freedom for ex post opportunism by the concessionaire.

After the award, a regulator can monitor the contract development and verify its compliance with the defined terms. Simplistically, one may argue that the existence of a regulator during the award may decrease the probability for posterior renegotiations. A regulator's involvement in supervising eventual renegotiations, acting as an independent third agent, can also safeguard the public interest. The quality of the regulator is more difficult to measure. The type of regulatory framework in each contract (cost plus, price cap, or some type of discretionary regulation) does not necessarily imply a higher value of one type over the other. These factors depend on each specific project. Assuming the weaknesses of such variables, the authors used the age of the regulatory body as a proxy for experience and know-how.

Finally, the coefficients for competitive bid procurement and for the number of bidders are both expected to be positive. If the competition during bidding is high, so as the competition for the project, there will be more incentives for bidders to lowball their bids to get the contract.

Proposed Model and Results

Model

The purpose of the empirical model is to determine which variables have a greater influence on the probability of renegotiation of concession contracts. A general-to-specific approach was followed, taking the nonsignificant variables to have a 10% significance threshold in each interaction (one at the time) to refine the model.

A dummy dependent variable model (Probit) was developed to estimate the probability of renegotiation y (dummy dependent variable), $\Pr(Y = 1|X) = F(X'\alpha)$. F is the cumulative distribution function of a normal distribution

$$y = \begin{cases} 1, & y^* > 0 \\ 0, & y^* < 0 \end{cases}, \quad y^* = \sum_{i=1}^n \alpha_i X_i + \varepsilon \quad (1)$$

where y^* = latent variable model; n = number of explanatory variables; X_i explanatory variable i ; α_i = model parameters; and ε = error term following a normal distribution (a posteriori normality tests confirmed this initial assumption, see Fig. 1).

Preliminary tests were performed with both a Logit and a Probit model. The Probit model was based on the results of the Akaike information criterion (AIC). AIC is defined by formula $AIC = 2k - 2 \ln(L)$, where k is the number of parameters in the model and L is the maximized value of the likelihood function for the model. Preliminary tests revealed that AICProbit < AICLogit (41.02 and 43.04, respectively).

Results from the Model

Following a general-to-specific modeling approach, a first model was developed that incorporated all of the preceding variables. The statistical significance of the variables was tested at a 5% level, and those not significant were withdrawn for the second model. In the first iteration, only the number of bids (*nbid*) was not significant

Table 3. Explanatory Variables

Explanatory variable	Type	Unit	Acronym	Expected sign
Time since concession award	Discrete	Years	taw	+
Contract length	Discrete	Years	leng	+
Investment	Continuous	Million Euros	inv	+
Number of bidders	Discrete	Units	nbid	+
Age of regulatory agency	Discrete	Years	rage	-
Existence of regulatory agency by contract signature	Dummy	1-Yes 0-No	ereg	-
Type of award procedure	Dummy	1-Public tender 0-Direct award	aproc	+

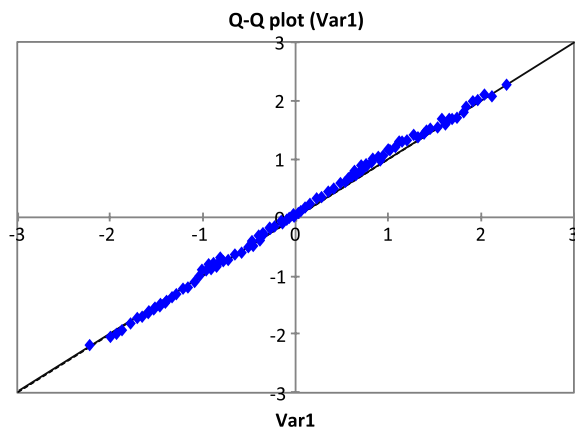


Fig. 1. Q-Q test for normality

Table 4. Results of Probit Estimation for Models 1 and 2

Variables	Model 1		Model 2	
	Coefficient	Standard error	Coefficient	Standard error
taw	1.627 ^a	0.709	1.645 ^a	0.135
leng	0.763 ^b	0.362	0.722 ^b	0.037
inv	2.836 ^a	3.583	3.407 ^a	0.007
nbid	0.152	0.500		
areg	-1.008 ^b	0.468	-1.015 ^b	0.086
ereg	-2.882 ^b	5.047	-3.136 ^a	7.586
aproc	3.739 ^a	7.939	4.855 ^a	11.427
Log likelihood	24.516		24.609	
R ²	0.890		0.890	
AIC	40.516		38.609	

^aSignificant at 1%.

^bSignificant at 5%.

at a 5% level. Results from the Probit estimation are presented in Table 4.

Discussion of the Results

The results from the empirical model are largely consistent with expectations: the coefficients for *taw*, *inv*, *nbid* and *aproc* all have positive signs, as expected, and the coefficients for *areg* and *ereg* are negative. The coefficient for *leng* is positive, which suggests that the tendency of uncertainty to increase over time is more important than the fact that some risks are resolved early in the concession life.

These results supply evidence of the following: (1) concessions with higher investments and longer durations are more likely to be renegotiated. In some way, the complexity of the concession has a direct correlation with the incidence of renegotiation; (2) a higher regulatory agency age correlates with a lower probability of renegotiation; (3) the existence of a regulatory agency when the contract is signed decreases the probability of renegotiation. The supervision of the contract design by an independent third party can help concession grantors to avoid contractual gaps that lead to ex post opportunism by concessionaires; and (4) public tenders increase the probability of renegotiation, unlike direct awards.

The number of bidders was not statistically significant, although the coefficient was positive as expected, supporting the hypothesis that the more competitive the award, the higher the probability for renegotiation. These results contradict those of Artana et al. (1998) who concluded that poor competition in the award process leads to a higher probability of renegotiating. Nevertheless, neither of these analyses account for specific contractual clauses that might play a decisive role in the probability of renegotiation. The authors considered that these clauses have endogenous variables (inside the contract) and, therefore, are beyond the scope of this research (Cruz and Marques 2013).

Main Causes for Renegotiation

Events Triggering Renegotiations

As mentioned earlier, renegotiations arise when the initial assumptions made are no longer valid. The previous section created a profile for concessions with higher probabilities of renegotiation, but no information was provided on the causes that lead to renegotiation. Using the same data set, Table 5 summarizes the main causes of renegotiation by sector.

The events that trigger renegotiations differ across sectors. In road and rail concessions, the government changing its mind about the project features and design is the main reason for renegotiation. Changes in design were divided into two types: requests by the grantor agency (sectorial ministry—health, public works and transportation) and requests by other governmental agencies, particularly the ministry of environment (MoE), due to environmental reasons. The MoE has its own supervisory power in environmental permitting issues. Large projects require environmental permits, and a few of the road concessions were launched before securing those permits. Changes had to be made, and concessionaires claimed renegotiations. In most cases, however, it was the sectorial ministry that decided to change some of the project features for

Table 5. Main Causes for Renegotiations by Sector (Court of Audit 2008; DGTf 2011; ERSAR 2010; Lemos et al. 2004)

Sector	Changes in design		Demand below forecast	Delays in expropriation	Force majeure	Competition issues	Additional investments/Costs	Excessive market power
	Grantor	Other agencies						
Transportation								
Roads	9	5	2	4	1	1 ^a		
Rails	3		1	1				
Ports			2				1	
Health	1 ^b							
Water	3 ^c		24					
Energy								1
Total	16	5	29	5	1	1	1	1

Note: In some cases the process of renegotiation was due to more than one reason.

^aA concession tender was launched incorporating a road section that was already part of an operating concession.

^bThe changes did not directly regard the physical infrastructure, but the portfolio of medical services provided.

^cChanges were related to the services provided (e.g., exclusion of wastewater treatment), with implications in infrastructure design and investment.

Table 6. Initiator of Renegotiation

Sector	Initiator of renegotiation		Both
	Government	Operator	
Transportation	6	26	2
Roads	6	21	0
Rails	0	2	1
Ports	0	3	0
Health	1	0	0
Water	3	44	2
Energy	3	0	0
Total	12	70	3

political purposes. Examples of these changes include adding new lines or changing the location of stations (rails), highway entrances and exits, enforcing contractual tariffs (roads), changing from a no-toll regime to a tolled one (roads), changing the scope of the concessions (excluding water and waste treatment in water concessions, for example, or eliminating an oncology unit in a hospital PPP that was on the original contract). In all these cases, the concession was already awarded, meaning that the compensation had to be paid to the concessionaire.

Optimist bias in demand forecasts is also a significant cause for renegotiating and is the most relevant in water concessions by far. The need to present projects with positive NPVs leads to optimism in estimating demand. After the concession is awarded (in roads and rails, a couple of years after the beginning of the operation) and revenues are below the forecasts, the initial assumptions of the OBC change, leading the concessionaire to ask for economic and financial re-equilibrium.

Delays in expropriation are also a typical factor for renegotiation, mainly in the road sector. The government typically has the responsibility of delivering the necessary land for the construction of the infrastructure to the concessionaire on prespecified date. If land was not available in due time for administrative reasons, which caused delays in the construction, concessionaires could claim compensation for financial losses (from construction delays) and revenue losses due to the postponement of the beginning of operations.

The other causes for renegotiation are less frequent: a road concessionaire due to a heavy rain period that caused construction delays invoked force majeure. Competition issues were the cause for a renegotiation of a road concession due to overlapping of road sections with a previous concession, and, in the energy sector, the government invoked excessive market power to renegotiate three energy concessions (electric producer). The government requested that the minimum guaranteed price paid to producers should

be lower. The regulator is still analyzing the renegotiation, and no results are known yet.

As in the energy sector, the health sector has not been significantly affected by renegotiations. Few contracts were signed (five), the first of which was signed in 2006, but the first renegotiation only took place in 2010 for the Cascais Hospital because some portfolios of services were changed. The results of the renegotiation are not known at this date, but they were triggered by the government's decision to change the portfolio of services in the hospital by creating an oncology service that was not described in the initial contract. As a consequence, the concessionaire decided to ask for the renegotiation of the contract, demanding adequate compensation for implementing and managing the new service.

Renegotiation Initiator

Based on the main causes for renegotiations, it does not come as a surprise that the main initiators of renegotiations are the operators (or concessionaires). Most of the causes are related to a financial loss by the concessionaires, which encouraged them to ask for a renegotiation of the concession. Nevertheless, the government initiated a significant number of renegotiations in road concessions. In energy, the government also asked for the renegotiation due to excessive market power (see Table 6). This fact, plus a low renegotiation rate, may lead to the assumption that there is probably excessive rent appropriation in the energy sector, but the data are insufficient to prove this theory.

Main Results and Costs of Renegotiations

Main Results of Renegotiations

The renegotiation process results in new rights and/or obligations that can take several forms. Typically, the costs to the concessionaire are reduced through one of several methods, including an increase in tax benefits, a decrease in royalties, a decrease in contract scope or an increase in revenues (either directly, through lump sums, annual payments or tariff increases, or indirectly, through contract extensions or delays in investments). It is not unusual that the final output of the renegotiation process is a mix of two or more of these mechanisms. Table 7 presents the main results from renegotiations developed in each sector. It clearly shows that the two preferred mechanisms are direct payments (especially for road concessions) and increases in tariffs (mainly in the water sector).

The preference towards direct payments in road concessions results from the fact that these contracts have special safeguards to ensure that the IRR for shareholders is not affected by the governments' change in the scope of the project. When additional expenditure is required due to governmental project changes, the

Table 7. Main Results of Renegotiations by Sector

Sector	Direct payment		Changes in contract scope (with cost reductions for operator)	Contract extension	Contract reduction	Increase in tariffs for final users	Decrease in rents (for operator)	Delay in investments
	(lump sum or annual payment)	Tax benefits						
Transportation								
Roads	23	1	1	1				
Rails	4		1		1			
Ports				1			1	1
Health	1 ^a							
Water				6		41	2	
Energy						4 ^a		
Total	31	1	2	2	1	45	1	1

^aIn dispute.

Table 8. Costs of Renegotiation in Roads and Rails

Type of renegotiation	Roads	Rails	Total
Claims	1,912.06	113	2,025.06
Agreements	666.6	45.18	711.78
In dispute	521.02		521.02
Total	3,099.68	158.18	3,257.86
Governmental payments	16,527.30	322.70	16,850.0
[Relative weight (%)]	(18.8)	(49.0)	(19.3)

Note: Units are million Euros.

only mechanism that ensures that IRR is not affected in the short term (same fiscal year) is providing lump sum payments to concessionaires. In water concessions, the usual outcome is a tariff increase, although there are some cases where contract extensions were given. The preference of municipalities for nondirect compensation methods can be explained by two reasons. First, municipalities have a smaller financial cushion compared with the government and thus have less cash availability for lump sum payments. Second, the price elasticity of demand for water services is significantly lower, than, for example, tolls on highways or fares on commuter rails.

Renegotiation Costs

The costs of renegotiations are difficult to calculate, not just because there are different forms but also because the increases in costs are often offset, at least in part, by some benefits. To correctly assess the true cost of a renegotiation, one must perform a social cost-benefit analysis to assess whether the change increases the society's welfare. Unfortunately, that analysis requires levels of information that are not available for most of the concessions. Nevertheless, some data are available regarding changes in the value of the assumed payments (by the government to concessionaires) as well as estimates for the increasing return to concessionaires that come from contract extensions.

Table 8 summarizes the renegotiations claims, agreements, and disputes still ongoing for roads and rails compared with the governmental payments forecast when the concessions were signed. This analysis was performed only on roads and rail because comparable data were not readily available for other sectors.

The costs for renegotiation presented in Table 8 should be compared with the governmental payments defined in the contracts: 16,527.3 billion Euro for roads and 322.7 million Euro for railways. The cost of renegotiating contracts might be as high as 18.8% for roads and 45% for railways (some of the claims are still unresolved, and thus the values might be higher).

In railways, it was essentially due to the cost of renegotiating the Fertagus concession (commuter rail), which was initially designed to have a zero cost to the government, but ended up costing more than 100 million Euro. In most of the water sector concessions, users directly absorbed the cost of renegotiating because most processes ended in water tariff increases (six resulted in contract extensions).

Ultimately, the society always bears the costs of renegotiating, either directly by users (water price or tolls increases) or indirectly through governmental payments (lump-sums or annual payments).

Conclusion

The evidence from Portugal's renegotiations supports the concern that renegotiations are a major problem in regulation by contracts. The renegotiation rate in Portugal has been high, particularly in transportation and water projects, where 100% of the contracts have

been renegotiated. Even though some of them have been recently signed, their experience offers substantial support to concession critics. The need to renegotiate contracts in the long term to readjust them to evolving circumstances is unquestionable, but the fact that most renegotiations tend to happen in the first couple of years suggests that time uncertainty is not the main driver.

Econometric analysis carried out intended to identify the key determinants of renegotiation and their impact on the probability of renegotiation has shown that the probability of renegotiating increases with the size of the concession as well as with the lack of regulation when contracts are signed. The correlation between the type of award and ex post renegotiation also supports both the winner's curse and the strategic underbidding theories. The pressure to achieve efficiency gains through competition seems to foster aggressive bidding and results in additional compensation for the concessionaire within a few years of the contract.

However, the pattern of renegotiation is not consistent across sectors. Road, rail and water contracts have been widely renegotiated. The port concessions have low renegotiation rates, but these contracts operate in a true competitive market that requires only small investments. Furthermore, they were awarded directly rather than competitively in the late 1990s and early 2000.

The levels of renegotiation found in Portugal are higher than those found by Guasch (2004) for Latin America: 40% of all projects were renegotiated, and the transport and water sector contracts had renegotiation rates of 53% and 76%, respectively, in Latin America, whereas, in Portugal, the average renegotiation rate was 67%, and the sectorial rates for transport and water were 100% in both cases. The differences also extend to the main initiator. Guasch found that the main initiator was the government, which is opposite to the finding of this paper that point out the concessionaire as the main initiator of renegotiation.

The main reasons for renegotiating are consistent with the following observations: (1) the government did not enforce contractual agreements, whether by delays in expropriations (several road concessions), changing the project physical design or the concessions scope (road and water projects) or by not being able to increase prices (Lusoponte concession); and (2) forecasts included an optimism bias. These forecasts were prepared by the governmental agencies and were incorporated in the terms of the concession. In fact, during the research it was possible to find a poor governance of contracts by the public sector. There was not a detailed monitoring of the contracts, and in many cases the government was not able to enforce penalties for contract non-compliance.

The concession terms *recapture* and *rebidding* are rarely used, although these might be attributed to high transaction costs, including disputes in courts (Anderlini et al. 2001) and difficulties in ensuring the continuity of the service because for most infrastructure concessions, such as energy, water, telecom, transportation and health services, the continuity of service provision is crucial. Another factor is related to political reluctance in assuming the failure of the concession, and considering that renegotiations tend to happen early in the contracts, it will most likely occur within the same government that awarded them.

For those advocating that concessions are a way to enforce policy measures that are difficult to achieve under public management (e.g., toll increases), this experience shows that not only does it still become difficult for governments to enforce those measures but also that they have to compensate the concessionaires when they cannot comply with their own obligations. Furthermore, the absence of real cases where the government retakes the concession significantly reduces its bargaining power because concessionaires are aware of the low probability behind that scenario. There is

clearly a need to develop adequate instruments for the government to recapture the concession when there is evidence that the contract is not adequate to the project.

More evidence is required regarding renegotiations. More than definitive answers, this work, and similar previous works such as Guasch (2004), have confirmed the relevance of renegotiations and have highlighted the importance of acknowledging the high probability of this phenomenon in concession development. Whether led by opportunistic behavior by the government or the concessionaire, or even under cooperative renegotiation, the success of the concession model is intrinsically connected with the ability for parties to address the inevitability of changing contracts. If competition for the market allows capturing some cost efficiencies by the public sector, the high costs of renegotiations may erode those savings.

Econometric analysis fails to identify endogenous aspects of contracts, as argued by Guasch (2004). The estimation presented here looks at the exogenous aspects of concessions: is there a regulatory body, did it exist when the contract was signed, what is the investment, and for how long, among other questions. Although the analysis provided some interesting conclusions, there should be caution in interpreting the results. Many variables are not accounted, and it is dangerous to infer relations of direct causality. In each contract, the existence of specific renegotiation clauses might trigger the process of economic and financial re-equilibrium, such as a guarantee of revenues or a limitation on the project internal rate of return, which is particularly relevant because the probability of renegotiation might be more related to the existence and characteristics of these mechanisms rather than to the exogenous variables.

This study suffers from the obvious limitations of considering just one country—Portugal. Extrapolations must be carefully analyzed. Nevertheless, the consistency found in the renegotiation patterns with previous studies (Guasch 2004) regarding the sectors where more renegotiations took place, as well as the impact of the explanatory variables on the probability of renegotiation, highlight the relevance of the concluding remarks. Therefore, potential lessons can be extracted to other countries, particularly those with similar administrative and legal frameworks (e.g., Spain, France, Italy, South America countries, among others). For example, the importance of the regulator is clear and governments should not engage in developing PPP programs without the adequate supervision and regulation of an oversight authority. On the other hand, the information concerning the costs of the renegotiation process should not be extrapolated quantitatively; nevertheless, it is possible to claim that there are significant costs with renegotiation for the public sector.

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