RENEGOTIATION OF CONCESSION CONTRACTS: EMPIRICAL EVIDENCE FOR PUBLIC TRANSPORT INFRASTRUCTURE IN PERU *

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abstract

This paper identifies the determinants of renegotiation of concession contracts in transport infrastructure for public use in Peru. Based on the literature of concession contracts, this paper uses a probit model to estimate the probability of renegotiating these contracts. The results indicated that the probability of renegotiate these concession contracts depends on the number of bidders who participated in the bidding process for each concession, the competition factor (decision variable) that determines the winner of the bid; the bidder's previous experience on other concession contracts; the percentage of land given to the operator at the beginning of the concession; the regulatory mechanism; the degree of autonomy of the regulator (in terms of experience and financial resources), and the exchange rate.

Keywords: Concesiones, Renegociación, Infraestructura, Transporte, Perú

JEL Codes: K41, L51, L91 y L98

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1. INTRODUCTION

The high rate of renegotiation of concession contracts means a bypass of the competition in the bidding process that granted a firm the right to operate as a monopoly in a given market. Transaction costs and information asymmetries are present in both the design and regulation/supervision of services delivered under concession. These aspects determine strategic actions of the parties (government, firm, or both), whose renegotiation process is made behind the competition and with unexpected positive impacts on social welfare.

This paper explores which variables determine the renegotiation of concession contracts in the transport sector in Peru. The econometric methodology estimates the probability of renegotiation of concession contracts, which is conditional on a number of institutional, economic, and political factors. The contribution of this paper is to assess this issue by using a rich database focused on concession contracts in the infrastructure for public transport in Peru. Obviously, the great advantage of this data is the homogeneity of the data controlling for economic sector and country.

Our results suggests that, apart from a series of unforeseen contingencies that have played an important role in the onset of renegotiations, some firms have planned in advance to engage in a renegotiation process, since they know their ability to bargain, leading to unrealistic bids that has to be reviewed immediately after beginning the firm's operation. The possibility of renegotiate concession contracts in Peru is based on contracts gaps that allow for opportunistic behavior of the parties. In other words, it is possible that participants in the bidding process have anticipated the possibility of renegotiation, thus bidding not only based on their costs, but also on their bargaining power.

The importance of understanding the determinants of the renegotiation of concession contracts is because the concession is granted to a firm based on ex-ante competition that replaces the inexistent ex-post competition. Hence, it is in the bidding stage of the concession that the government puts in dispute the monopoly power that characterizes any infrastructure industry. According to Demsetz (1968), if the variable that defines the winner is the fee for the service, and if there is sufficient number of bidders, the result will be efficient. Any ex-post renegotiation of the contract provides a different solution to that generated in the competitive equilibrium of the bidding process, situation which introduces a doubt about the economic efficiency of these post-contractual revisions.

The experience in the Peruvian case shows that the policy of concessions in transport infrastructure for public use, implemented since the mid-90s, has reduced the country's infrastructure deficiencies. The office for regulating and supervising concession contracts in the transport sector in Peru is OSITRAN. It was created in 1998. By 2010 OSITRAN supervised 21 private concession contracts, which involve the same number of private companies or operators responsible

for the operation and use of each infrastructure (Table 1). The committed investment of these 21 contracts is US$ 4,849.5 million.[1]

Table 1. Concessions for Transport Infrastructure to Private Firms (US$ millions)

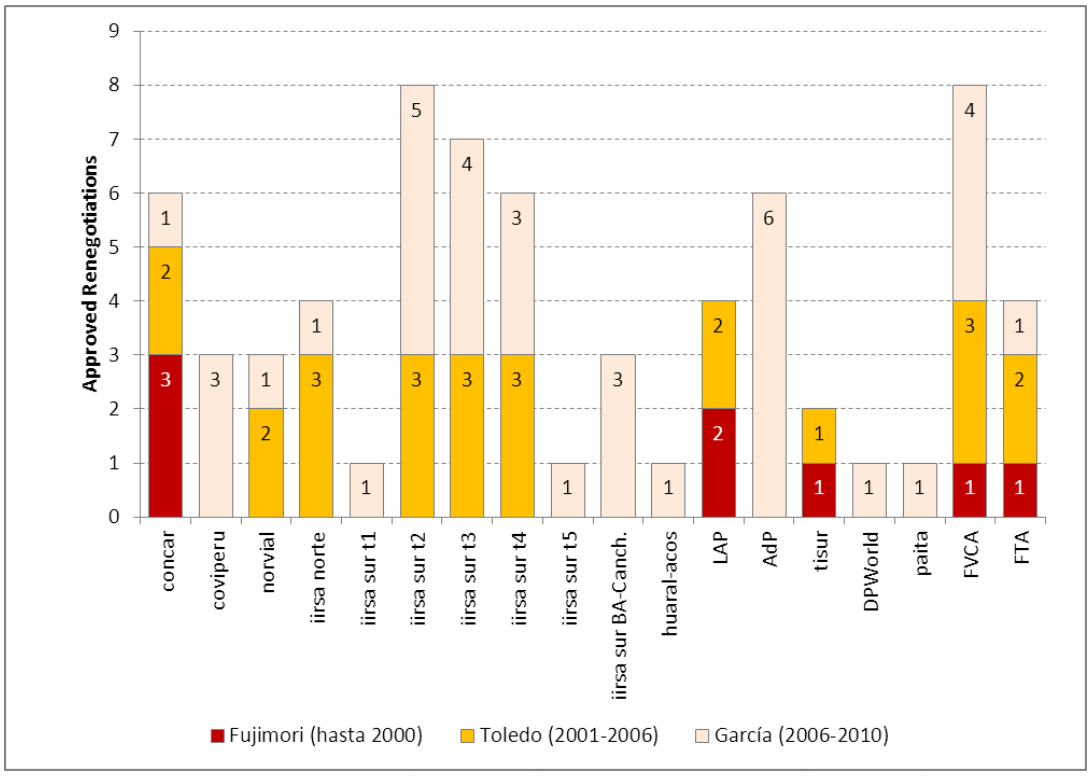
Sector	Year	Duration	Financing	Committed Investment
Concar: Arequipa – Matarani	1994	6 years	Co-financing	5.8
Red Vial Nº 5: Ancón-Huacho-Pativilca	2003	25 years	Self-financing	73.1
Red Vial Nº 6: Pucusana-Cerro Azul-Ica	2005	30 years	Self-financing	228.6
IIRSA Norte: Paita-Yurimaguas	2005	25 years	Co-financing	258.2
IIRSA Sur, Tramo 2 : Urcos-Inambari	2005	25 years	Co- financing	484.5
IIRSA Sur, Tramo 3: Inambari-Iñapari	2005	25 years	Co- financing	472.9
IIRSA Sur, Tramo 4: Azángaro-Inambari	2005	25 years	Co- financing	391.4
Empalme 1 B: Buenos Aires-Canchaque	2007	15 years	Co- financing	31.0
IIRSA Sur, Tramo 1: Marcona – Urcos	2007	25 years	Co- financing	98.9
IIRSA Sur, Tramo 5: Ilo, Matarani – Azangaro	2007	25 years	Co- financing	183.4
Red Vial Nº 4: Pativilca - Puerto Salaverry	2009	25 years	Self-financing	360.0
Tramo Vial: Ovalo Chancay - Huaral – Acos	2009	15 years	Co- financing	34.3
Tramo Vial: Mocupe - Cayaltí – Oyotún	2009	15 years	Co- financing	17.4
Autopista del Sol: Trujillo – Sullana	2009	25 years	Self-financing	360.0
Aeropuerto Jorge Chávez	2001	30 years	Self-financing	1,061.7
Primer Grupo de Aeropuertos Regionales	2006	25 years	Co-financing	38.2
Terminal Portuario de Matarani	1999	30 years	Self-financing	6.0
Terminal de Contenedores Muelle Sur Callao	2006	30 years	Self-financing	617.1
Terminal Portuario de Paita	2009	30 years	Self-financing	227.0
Ferrocarril del Centro	1999	40 years	Self-financing	FRA II
Ferrocarril del Sur y Sur Oriente	1999	35 years	Self-financing	FRA II

Note: Concession to CONCAR for the Arequipa-Matarani section was projected at 74 meses. It was then passed to the IIRSA Sur Tramo 5 concession.
Source: Montesinos (2010), from Gerencia de Regulación – OSITRAN

[1] Montesinos (2010) detalla el contenido básico de los contratos de concesión supervisados por OSITRAN.

Over the years there has been a growing trend in the modification of the concession contracts supervised by OSITRAN. By 2010, 18 contracts had been renegotiated (Figure 1).

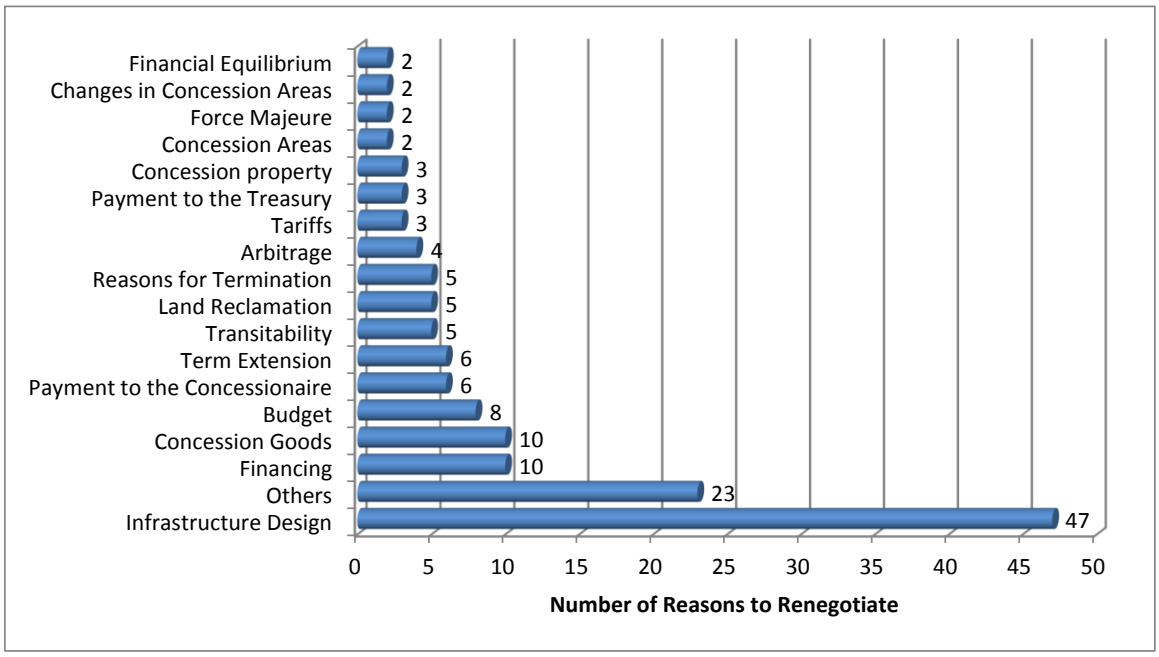
Figure 1. Renegotiated Concessions for Transport Infrastructure in Peru



Note: From left to right, concessions "concar" to "huaral-acos": highways; "LAP" and "AdP": airports; "tisur" to "paita": ports; and the last two: railways.
Source: Montesinos (2010), from Gerencia de Asesoría Legal – OSITRAN

A review of the 69 changes made to contracts until 2010 reveals that the modification of the infrastructure design is the main reason to renegotiate (34%). It is followed by issues related to the financing of the concession and related to different goods that the government should provide to the private operator (7% each). It follows the category "Budget" with 5% of the amendments and the items "Payments to the Concessionaire" and "Term Extension" of the concession (4% each). Non-delivery of total land to the operator leads to delays in the contractually agreed schedule of activities (3%). Finally, under category "Other" we have a number of reasons to renegotiate, such as modifications to technical design of the concession, reasons for revocation of the concession contract, percentage of the payment to the Treasury, insurance and guarantees, mandated services, among others. Figure 2 depicts these findings.

Figure 2. Characterization of Renegotiation of Concession Contracts



Source: Montesinos (2010).

Following Guasch (2004) and Guasch et al. (2006 and 2008), and depending on the availability of information for the Peruvian case, the empirical estimation requires to analyze how contracts are designed, how were they awarded, how the regulator oversees the contracts, and how is the regulatory environment in which concession contracts operate.

In terms of the design of contracts, although it is impossible to discuss clause by clause, it is interesting to assess whether the characteristics of some of them are crucial in the course of the renegotiation process. Such is the case of the mechanism of regulation (either price cap or rate of return), the commitment to deliver land and other goods to the concessionaire, including guarantees, the type of financing, and the duration of the concession contract. Other variables that we are interested on are these related to the bidding process itself, such as the number of bidders who participated in the auction, the nationality of the bidder, its economic importance and degree of experience in the business, and the competition factor used in each bidding.

With regard to the regulatory environment in Peru, we are interested on the experience and financial autonomy of the regulator, the period of time that the regulator dispose to provide its opinion on each renegotiation, and the economic environment of the country. Regarding the latter, we might be of interest electoral cycles, GDP per capita, inflation, and the exchange rate.

Finally, this paper is as follows. Section 2 reviews the theoretical literature and empirical evidence for renegotiation contracts in Latin America. Section 3 describes the main variables related to renegotiations in concessions in Peru. Section 4 describes the econometric model and variables used in our empirical work. Section 5 reports our main results. Finally, Section 6 concludes.

2. CONTRACT RENEGOTIATION: THEORY AND EVIDENCE

Why should we renegotiate contracts if they were carefully designed for institutions that seek the greatest welfare for society, in a legal world where opportunistic behavior would only discredit to the parties? Precisely, renegotiations exist because these assumptions are not necessarily fulfilled in practice. There are transaction costs, information asymmetries, and bounded rationality of economic agents that affect both the design of concession contracts and the design of the institutional framework. These caused incomplete contracts that determine strategic actions of the parties, which ultimately become the modification of contracts.

These economic aspects are always present in the structure of flows of a concession contract. Indeed, the agency responsible for designing the contract (in the case of Peru, PROINVERSION) faces the challenge of arriving at a contract as complete as possible, so that the allocation of risks between the parties is efficient. However, it will inevitably arrive at an incomplete contract because not all contingencies can be foreseen. Additionally, during the process of awarding the contract, bidders will behave strategically since the granting entity (PROINVERSION again) that do not necessarily have the same degree of knowledge about the business as firms' have. Finally, once the contract is awarded, the concessionaire, the regulator (OSITRAN), or the State (Ministry of Transport and Communication) interact in the interest of a full compliance of the contract. However, during this interaction they have the opportunity to request a revision of the contract, sometimes based on solid arguments sometimes not, but equally valid in the eyes of the judiciary while these contracts leave room to opportunistic behavior.

Theoretical advances on these topics are useful to understand the various aspects behind the modification of contracts (Klein, 1998). Transaction cost economics (Coase, 1937, Williamson, 1985) establishes that is too costly both to design and enforce complete contracts. Hence, we may expect expected to sign contracts that are subject to modification at the request of some of the parties. The theory of incomplete contracts based on property rights paradigm also delivers the same predictions about the incompleteness inherent in many contracts (Hart and Moore, 1988). Additionally, Tirole (1999) also mentions that to enforce a contract courts must fully understand the terms of it and be able to verify all the actions under each possible contingency.[2]

Recent work of Bond (2009), Anderlini et al. (2007) and Laffont and Meleu (2001) modeled these reasons that give rise to the revision of contracts. Bond (2009) assumes ineptitude of judges, which could (at some cost) to accept a bribe for not enforcing a contract. The author also finds that contracts "very powerful" (i.e., pretending to be too complete) often expose to contracting parties to

[2] Saavedra (1998) provides an application of strategic behavior and the incentives to invest in highways concessions. A more general discussion about the role of non-contractible investments in the quality of service is found in Hart, Shleifer and Vishny (1997).

corruption, reducing the incentives of the contract. Contrary to this view, Anderlini et al. (2007) consider an incomplete contract in which judges seek to maximize social welfare, but they will be willing to avoid some clauses, possibly leading to a renegotiation. As the contracting parties cannot reach an ex ante perfect agreement, courts observe ex post if there is a contingency and decide whether to cancel or hold the contract. If the contract is annulled by the court, the parties can renegotiate a new contract ex post. Finally, Laffont and Meleu (2001) develop models of regulation and contracting with adverse selection, in which the optimal application of penalties depend on the efficiency of efforts for compliance.

From the empirical point of view, Jeon and Laffont (1999) and Bajari and Tadelis (2001) develop models that show the impact of risk allocation in the renegotiation process. They find that high powered incentive schemes (such as price-cap) lead to an increased incidence of renegotiation than low powered incentive schemes (such as rate of return). Furthermore, these studies show that renegotiation is more likely when the concession project has bank financing than when it has treasury financing or it is based on guarantees.

Political opportunism is also related to the renegotiation of concession contracts, as mentioned by Engel et al. (2009) on their work on the renegotiation of concession contracts for public infrastructure in Chile. The expectations of renegotiation by bidders and their proximity with the government are considered by Guasch et al. (2000), who show that the bargaining power of the operator and its degree of acquaintance with the government can lead to inefficient companies strategically to bid harder. Thus, renegotiation skills and bargaining power of the winning bidder plays an important role in the bidding stage, which according to these authors explain why many concessions in Latin America have been renegotiated just after they were awarded.

The factor of competition or selection criteria used when awarding a concession is another variable considered in the work of Guasch et al. (2000), Guasch (2004) and Engel et al. (2001). They show that renegotiation is less likely if this factor is highly dependent on the information on bids and more flexible in terms of tariff policy. These findings suggest including in the bidding a minimum price or a minimum amount of transfers to the operator. Engel et al. (2001) develop the criterion of minimum present value of revenues, an attractive mechanism for granting the concession to a bidder who offer the lowest value.

Guasch et al. (2003) and Guasch (2004) analyze the impact of institutional constraints on the incidence of renegotiation. They focus on variables such as government capture, corruption, macroeconomic shocks and the quality of compliance with the standards and laws. Among the main results, they found that the probability of renegotiation will be higher as long as the greater the government capture, the more costly to enforce contracts, the more clauses in investment commitments, and the more formal rules in contracts arbitrage. By contrast, according to these authors, the probability of renegotiation will be lower as long as there exists an appropriate

regulatory body at the time of awarding the concession and there exist clauses that guarantee a minimum revenue to the concessionaire.

The aforementioned variables that influence the likelihood of contract renegotiation led to the importance of institutions in the concession process, such as the regulatory framework, autonomy of the regulatory agency (location, financing, operations), regulator attributes (including safety), appeal mechanisms, discretion given to the regulatory agency, and a transparent regulatory process. Properly established, all these elements limit the probability of capture and renegotiation and can provide certainty and predictability for all actors involved, particularly to potential investors.

These studies are the closest references to identify the main determinants of the renegotiation of concession contracts. They used a database of nearly 1,000 contracts awarded in 17 countries in Latin America and the Caribbean during the period 1985-2000, for water and sanitation infrastructure, telecommunications, energy and transportation. Table 2 provides the main results in terms of sectors and countries that produce more contract renegotiations, especially water and sanitation (74.4%) and transport (54.7%). The same table shows that approximately 29.8% of concession contracts in the region were modified during the 15 years considered in the database.

Table 2. Renegotiated Concessions in Latin America and the Caribbean (1985-2000)

Country	Telecomm	Energy	Transport	Water	Total	% renegotiated
Argentina	0/17	0/31	34/40	11/14	45/102	**44.1**
Bolivia	0/0	2/17	0/5	1/2	3/24	**12.5**
Brazil	0/87	0/7	28/50	42/50	70/194	**36.0**
Chile	0/12	4/81	6/27	0/3	10/123	**8.1**
Colombia	0/0	0/0	28/44	0/7	28/51	**54.9**
Costa Rica	0/0	0/31	1/1	0/0	1/32	**3.1**
Dominican Rep	0/1	7/10	1/3	0/0	8/14	**57.0**
Ecuador	0/0	0/2	0/0	0/0	0/2	**0.0**
Guatemala	1/1	0/0	2/2	0/0	3/3	**100.0**
Honduras	0/1	6/8	0/0	0/0	6/10	**60.0**
Jamaica	0/2	0/0	0/0	0/0	0/2	**0.0**
Mexico	0/63	2/51	46/91	46/58	94/263	**35.7**
Panama	0/0	0/0	1/5	0/0	1/5	**20.0**
Peru	1/85	3/17	3/5	0/0	7/107	**6.5**
Trinidad y Tobago	0/1	1/1	0/0	1/1	2/3	**66.7**
Uruguay	0/0	0/0	0/2	1/1	1/3	**33.3**
Venezuela	1/3	0/0	1/1	0/0	2/4	**50.0**
Total	3/273	25/256	151/276	102/137	281/942	**29.8**
% renegotiated	**1.1**	**9.7**	**54.7**	**74.4**	**29.8**	

Source: Guasch (2004).

Guasch (2004) found that on average the contracts are renegotiated for the first time after 2.2 years of awarded, being faster in the water sector (1.6 years). The same database shows that renegotiations are more common when the contract was awarded through a competitive bidding process (46% of cases) than when it was a direct award (8% of cases). The same author shows that

in general the concessionaire started a renegotiation with 61% of requests for amendment, while governments started them 26% of the time. This situation is exacerbated with a price cap rate of regulation mechanism, where 83% of renegotiations are initiated by the operators, a percentage that contrasts with a 26% under a rate of return regulation mechanism.

Contractual issues also affect the renegotiation of concession contracts. Table 3 shows that this was more common as the award was based on the lower price for final users (60% of cases) that when it was based on a higher payment to the state (11% of cases). The same orders of magnitude on renegotiations are found in two cases: when they contain committed investment versus when they considered indicators of performance, and when whether or not contracts consider regulatory institutions.

Table 3. Contracts Renegociations in Latin America

Variable	Impact on Renegotiation (%)
Competition factor	60
Lower tariff	11
Higher contribution	
Regulatory criterium	70
Investment commitments	18
Performance Index	
Regulatory Scheme	42
Price cap	13
Rate of return	
Existence of a regulator	17
Yes	61
No	
Impact of law and norms	
Regulatory body by law	17
Regulatory body by decree	28
Regulatory body by contract	40

Source: Guasch (2004).

3. CHARACTERIZING CONTRACTS RENEGOTIATION IN PERU

Since the beginning of the first concession contracts of transport infrastructure in Peru in the mid-90s, a number of problems arise during the execution of the concession. These problems, being warned by one of both parties, generated the need to resolved them through various mechanisms, such as agreements between the parties, contractual interpretations and / or amendments to the contract.

As described in Figure 1, from 21 concession contracts in the transport sector by 2010, 18 of them (86%) have been renegotiated through the subscription of 69 addenda (of which 57% were at the request of the concessionaire, 26% at the grantor's, and 17% for both parties). The same scenario is identified by Guasch (2004) for the transport sector in Latin America, with 57%, 27% and 16% of requests for the operator, government and both, respectively. A closer look shows that most of the renegotiations in Peru is concentrated in highways contracts with 43 amendments, followed by changes in contracts for rail infrastructure, airports and ports with 12, 10 and 4 amendments, respectively.

In most contract renegotiations (13 of 18) the first amendment to the contract tooks place before the first year of signing the contract, which in average corresponds to less than half of the time reported in Guasch (2004) for the same sector. Indeed, as shown in Table 3, the faster contract renegotiations were in IIRSA Norte highway and airport LAP with 13 days lag between the signing of the contracts and the first solicitude to change it. The average lag was 430 days. Additionally, we see that the average difference in days between the signing of the contract and its amendment is 490 days, i.e. just over a year and three months only.

Table 4. Number of Days between the Signing of the Contract and its First Amendment

Concession	Type	Who	Dates			Differences	
			Contract	Solicitude	Addenda	Contract - Solicitude	Contract - Addenda
IIRSA Norte	highw.	Conces.	jun/17/05	jun/30/05	dic/28/05	13	194
LAP	airp.	Conces.	feb/14/01	feb/27/01	abr/6/01	13	51
FVCA	ferrov.	State	sep/20/99	nov/22/99	may/10/00	63	233
FTA	ferrov.	State	sep/20/99	nov/22/99	mar/10/00	63	172
IIRSA Sur T4	highw.	State	ago/4/05	oct/24/05	mar/1/06	81	209
IIRSA Sur T2	highw.	State	ago/4/05	nov/3/05	feb/24/06	91	204
IIRSA Sur T3	highw.	State	ago/4/05	nov/3/05	mar/1/06	91	209
Huaral-Acos	highw.	Conces.	feb/20/09	sep/15/09	abr/30/10	207	434
PAITA	ports	Conces.	sep/9/09	abr/23/10	dic/9/10	226	456
COVIPERU	highw.	Both	sep/20/05	jun/28/06	ago/28/07	281	707
NORVIAL	highw.	Conces.	ene/15/03	nov/21/03	nov/8/04	310	663
BAires-Cancha	highw.	Conces.	feb/9/07	dic/17/07	ene/16/08	311	341
AdP	airp.	State	dic/11/06	nov/23/07	feb/5/08	347	421
TISUR	ports	Conces.	ago/17/99	mar/26/01	jul/26/01	587	709
IIRSA Sur T5	highw.	Conces.	oct/24/07	jun/2/10	nov/25/10	952	1,128
IIRSA Sur T1	highw.	Conces.	oct/23/07	jul/24/10	oct/22/10	1,005	1,095
DP World	ports	Conces.	jul/24/06	nov/11/09	mar/11/10	1,206	1,326
CONCAR	highw.	Conces.	sep/19/94	feb/21/95	jun/21/95	155	275
					Average:	333	490

Source: Montesinos (2010), from Gerencia de Asesoría Legal – OSITRAN

As emphasized in the previous section, we must recognize that intrinsic aspects to the contract (the regulatory mechanism, the type of financing, investment commitment or incorporation of guarantees, competitive factors, among others) and not intrinsic aspects of the contracts (autonomy regulator, level of corruption, regulatory experience, etc.) could determine its renegotiation. Consequently, we first should verify whether the type of regulatory mechanism in Peru is relevant or not. Behind this we do have two hypotheses: i) the renegotiation process often includes an automatic transfer from costs to tariffs, and ii) operators subject to price cap regulation show a preference for regulator/government with weak capacity and weak commitment skills.

A second subject of interest is to assess whether the current regulatory institutional environment has marginal impact on the probability of renegotiation of contracts. Government decisions in the last decade show an attitude toward more control and less autonomy of the regulators.[3]

Third, it is possible to compare the specific content of certain contractual clauses related to committed investments. The specification of such commitments may have some political appeal, as the success of them is associated with significant improvements in the performance of the sector, creating new jobs and increasing the economic activity. Guasch (2004) reported that the inclusion of this variable has a marginal effect of between 10% and 20% of the probability of changing a concession contract.

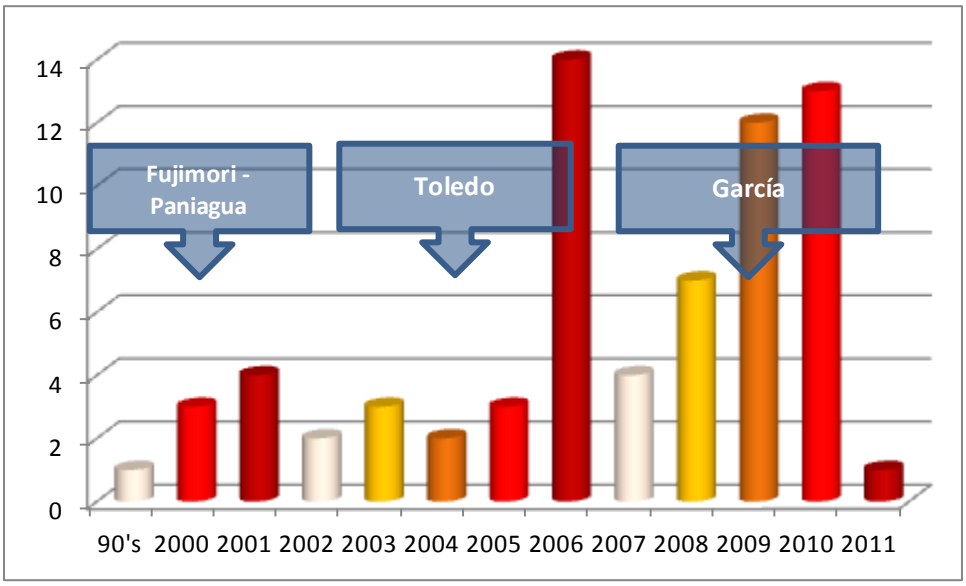
With the exception of the railway infrastructure, other transport concession contracts in Peru include investment commitments. However, the guarantees on them vary across contracts. Through these guarantees the government transfers the risk of compliance on committed investments to the operator. It will be of interest to test the hypothesis whether the magnitude of the guarantees impact on the probability of renegotiation, since guarantees are often subject to renegotiation (Engel et. al, 2007).

On the other hand, Figure 3 shows that prior to presidential elections there is a significant amount of amended contracts. This suggests that the election period may have some impact on the probability of renegotiation of contracts, either side of the grantor or the operator's side (or both). We observe that in the period Paniagua-Fujimori (1990-2001) there were a small number of contract modifications (8), situation that change in the period Toledo (2001-2006). Thus, during the administration of President Toledo there was a 200% increase in the number of amendments and a 40% increase in the number of concession contracts. Finally, during period García (2006-2011), the

[3] The evidence shows persistent problems that affect the efficiency of the regulatory management and thus the autonomy and independence of OSITRAN. For example, until the presidential elections of 2011 the decisions of the Boards of Directors of OSITRAN and the decisions of the Dispute Tribunals (*Tribunales de Solución de Controversias*) could be judicialized, the Board of Directors of OSITRAN was incomplete for several years, and the Executive imposed short deadlines to OSITRAN by decree for the issuance of its decisions regarding amendment to contracts.

number of addendums increases by 54% from the previous government, while the number of concession contracts increased by 57% (11 contracts).

Figure 3. Number of Renegotiated Contract and Presidential Periods



Note: the year 2011 contains information until February.

Source: Own elaboration based on Montesinos (2010).

Finally, it is interesting to know if the competition factor and the tariff regime have an impact on the renegotiation of contracts. Guasch (2004) found that the competition factor has a marginal effect between 20% and 30% of the probability that a contract be renegotiated of grant. With regard to alternative factors of competition, there are several options that may be considered when designing a concession contract. As a matter of fact, Kerf et al. (1995) listed the following alternatives: i) the highest payment to the Treasury; ii) the lower cost of construction or operation of the facilities; iii) the largest amount of new investment by the concessionaire; iv) the lowest tariff charged to users; v) the lowest net present value of future income ; vi) the lowest subsidy that the government must give to the operator; vii) the maximum coverage for the new service; and, viii) the minimum duration of the concession period.

The choice of these factors is not exclusive and, instead, they could be complementary. Still, as Kerf et al. (1995) remarked, this choice will depend on criteria such as whether the transaction involves an existing infrastructure or a new project, the amount of risk and property to be transferred to the operator and the government's objectives in the transaction. If the transaction involves existing assets, a common practice in Latin America is to use as a factor of competition the highest compensation to the Treasury (assuming that the tariff regime is specified in the concession contract). In this case, the payment to the Treasury may take the form of an annual fee during the life

of the concession. This is the case of several concessions in Peru, such as Jorge Chavez International Airport, Port Terminal Matarani, Railways, and some highways concessions (Table 5). However, to award a contract based on this factor has three undesirable effects. First, it may limit competition for the market ex ante, as it imposes a higher value for the concession that may not fit with an efficient firm. Second, while it generates more revenue to the Treasury, it determines higher prices to users. Third, it can lead to aggressive biddings for unprofitable infrastructures, being a rational strategy if governments are unable to commit to a policy of no renegotiation.

Table 5. Public Infrastructure Concessions According to Factor of Competition

Sector	Factor of Competition
Highways	
Red Vial Nº 5 - Tramo Ancón-Huacho-Pativilca	The Highest Initial Payment to the Treasury
Red Vial Nº 6 - Pucusana-Cerro Azul-Ica	The Highest Initial Payment to the Treasury
IIRSA Norte: Paita-Yurimaguas	The Lowest Payment to the Firm (PAO & POMA)
IIRSA Sur, Tramo 2 : Urcos-Inambari	The Lowest POMA
IIRSA Sur, Tramo 3: Inambari-Iñapari	The Lowest Payment for POMA
IIRSA Sur, Tramo 4: Azángaro-Inambari	The Lowest Payment for POMA
Buenos Aires-Canchaque	The Lowest Payment for the Service
IIRSA Sur, Tramo 1: Marcona – Urcos	The Lowest Payment to the Firm (PAO & POMA)
IIRSA Sur, Tramo 5: Ilo, Matarani – Azangaro	The Lowest Payment to the Firm (PAO & POMA)
Red Vial Nº 4 - Pativilca - Puerto Salaverry	Total of Kilometers Built
Tramo Vial - Ovalo Chancay - Huaral – Acos	The Lowest Payment for the Service
Tramo Vial - Mocupe - Cayaltí – Oyotún	The Lowest Payment for the Service
Airports	
Aeropuerto Jorge Chávez	The Highest Payment to the Treasury
Primer Grupo de Aeropuertos Regionales	The Lowest Payment for POMA
Ports	
Terminal Portuario de Matarani	The Highest Initial Payment to the Treasury
Terminal de Contenedores Muelle Sur Callao	The Lowest Tariff Index
Terminal Portuario de Paita	The Lowest Tariff Index
Railways	
Ferrocarril del Centro	The Highest Payment to the Treasury
Ferrocarril del Sur y Sur Oriente	The Highest Payment to the Treasury

Note: PAO is the payment for infrastructure and POMA is the payment for maintenance and operation.

Source: Montesinos (2010), based on Gerencia de Regulación – OSITRAN

As an example of the danger of using this element of competition, we have the case of the 30-year concession for the International Airport Jorge Chávez, whose contract was renegotiated just 51 days after the date of subscription. The concessionaire offered to pay 46.5% of its revenue, in addition to commit investment of over US$ 1.000 million and the construction of a second runway at

the eleventh year of the grant. To date, the company has renegotiated four times the concession contract and there is no news about the second runway.

Another option for the factor of competition in the bidding process is the tariff system to be applied to users. This criterion is often used in either new infrastructure projects or the provision of existing service. In Peru, this factor has been considered as a first option for awards the container terminal Muelle Sur in Callao and Paita Port Terminal. However, if being a tie in this factor of competition, the decision is then based on the committed investments on the infrastructure. Indeed, when the purpose of the government is to increase the investment in infrastructure, commitments on new investment is often used as a competitive factor. This usually happens when the government considers that the market value of the infrastructure is greater than its book value. In such cases, the government uses these commitments to show the public that the concessionaire invests in the privatized company. However, according to Kerf at al. (1995), this factor of competition to award a concession has significant disadvantages, one of which is the difficulty of enforcing such commitments. Renegotiation is then behind the door.

4. THE MODEL AND THE DATA

4.1 Methodology

The probability of renegotiation is estimated by a model which ideally is of type:

$$y_{ist} = \beta_0 + \delta A_t + \lambda C_i + \eta I_s + \beta_i \sum_i X_{ist} + \varepsilon_{ist}$$

where y_{ist} is the dependent variable (*dummy* that takes the value of 1 if the contract is renegotiated); A_t, C_i *and* I_s respectively are fixed effects on time, type of contract, and economic sector; X_{ist} are the explanatory variables. The error term is independent and identically distributed. Therefore, we have a binary dependent variable, defined in the broadest sense as a dependent variable whose value range is significantly restricted (Wooldridge, 2009). Because of the statistical problems by using ordinary least squares, [4] our interest lies mainly in the probability of response $P(1/(x_1, \dots, x_k)$ or $P(y = 1/x)$ where x denotes the total set of explanatory variables. A binary response model is of the form:

$$P(y = 1/x) = G(\beta_0 + \beta_1 x_1 + \cdots + \beta_K x_K) = G(\beta_0 + x'\beta)$$

where $0 < G(z) < 1$ is a function that takes values strictly between zero and one, for all real numbers z. This ensures that the estimated response probabilities are strictly between zero and one. The

[4] These estimators generate predictions inconsistent with a probability (values less than 0 or greater than 1), heteroskedastic errors and a constant partial effect on any explanatory variable.

literature suggests several nonlinear functions for G. We use the cumulative distribution function of standard normal (probit model), which is expressed as:

$$F(x'\beta) = \int_{-\infty}^{x'\beta} \frac{1}{\sqrt{2\pi}} e^{\frac{s^2}{2}} ds$$

where $G = F(x'\beta)$. As is relevant to explain the effects of x on the probability of response $P(y = 1/x)$, it should be noted that the marginal effects are not linear. It is therefore possible to obtain the marginal effect evaluated at the means or at medians of each explanatory variable. If $\bar{x}$ corresponds to the vector of mean sor medians, whatever the case, then the marginal effect of a change in an explanatory variable on the probability of renegotiating a contract would be given by:

$$\left.\frac{\partial p}{\partial x_k}\right|_{x=\bar{x}} = \beta_k \cdot f(\bar{x}'\beta)$$

The data consists of 21 concession contracts for infrastructure sector (roads, ports, railways and airports) nationwide in Peru, for a period of 17 years (between 1994 and 2010), representing a total of 132 observations. That is, the full sample corresponds to each of the years of operation of each concession contract, as shown in Table 6.

Table 6. Active Concession Contracts in the Data

Concesión	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Carretera Arequipa-Matarani	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			15
Ferrocarril del Centro						x	x	x	x	x	x	x	x	x	x	x	x	12
Ferrocarril del Sur y Sur Oriente						x	x	x	x	x	x	x	x	x	x	x	x	12
Terminal Portuario de Matarani						x	x	x	x	x	x	x	x	x	x	x	x	12
Aeropuerto Jorge Chavez								x	x	x	x	x	x	x	x	x	x	10
Red Vial 5										x	x	x	x	x	x	x	x	10
Red Vial 6												x	x	x	x	x	x	6
IIRSA Norte												x	x	x	x	x	x	6
IIRSA Sur T2												x	x	x	x	x	x	6
IIRSA Sur T3												x	x	x	x	x	x	6
IIRSA Sur T4												x	x	x	x	x	x	6
Aeropuertos Regionales Grupo 1													x	x	x	x	x	5
Terminal de Contenedores de Muelle Sur Callao													x	x	x	x	x	5
Buenos Aires-Canchaque														x	x	x	x	4
IIRSA Sur T1														x	x	x	x	4
IIRSA Sur T5														x	x	x	x	4
Red Vial 4																x	x	2
Ovalo Chancay -Huaral Acos																x	x	2
Mocupe-Cayaltí-Oyontún																x	x	2
Trujillo-Sullana																x	x	2
Terminal Portuario de Paita																	x	1
																Total de observaciones		132

Source: Own elaboration.

Methodologically, the econometric estimation carries out a probit analysis, in which the dependent variable (called *renego*) is a binary variable in year t (for t = 1, 2, ..., 17) that takes the value of one if the concession contract i (for i = 1, 2, ..., 21) belonging to sector s (roads, rail, port and

airport) was renegotiated, and the value of 0 otherwise. In order to ensure consistency, we estimated first the complete model by using all explanatory variables. Since many of them may be collinear, we also estimate a reduced model to evaluate the significance and marginal impact of variables related to the contract and the bidding process. Further details of the generation of these variables are in Appendix 1.

4.2 The Bidding Process

It was observed in Table 5 (section 3) that four different factor of competition were used in the process of awarding concessions in Peru: the highest payment to the Treasury, the lowest subsidy from the Treasury (i.e, the lowest payment for maintenance and operation, new investments, and payment for the service), the lowest tariff index to users, and the total miles committed to be built. In this sense, the variable *faccom* takes the value of 1 when the selection criterion involves some sort of monetary transfers, and the value of 0 otherwise. We are interested in testing whether the factor of competition that determines the winner ex ante at the beginning of the operation of the concession is a determining variable in the ex post renegotiation contract.

The characteristics of the bidders who competed for the award of infrastructure may have an impact on the likelihood of renegotiation. Thus, the variable *expepost* represents the experience of the winner in concession contracts in Peru, measured as the number of months since awarded its first concession. One might expect that the greater experience of the bidders in the business, the stronger strategic skills on renegotiation.

The variable *origen* captures the concessionaire's ability to renegotiate, which we measure as its nationality as a proxy. This variable takes the value of one if the firm is a Peruvian company, and 0 if it is either foreign or a domestic-foreign partnership. The data presented in Table 7 shows that a 77.1% of the total modified contracts are related to foreign operators. Thus, the hypothesis is to verify whether being a foreign firm, thus with strong economic power, would be an advantage to strengthen closer ties to the government, and facilitate renegotiation.

The variable *contradju* represents the number of concessions granted prior to the same firm. It captures any learning effect from past experience, as well as the reputation that this firm would had built in the past. Such experience would give the concessionaire a higher level of knowledge at the time to renegotiate contracts. However, the expected sign of this variable is uncertain. Table 7 shows that from the total of renegotiated contracts, in more than 50% of them the operator already had another awarded concession.

Finally, the variable *postores* represents the number of bidders that participate in the bidding process. The idea is to check whether a greater degree of ex ante competition in bidding processes lead to more efficient concessionaires and thus it reduces the likelihood of renegotiate

such contracts. It is worrisome that in more than 50% of the renegotiated contracts, there was only one bidder. Hence, we expect a negative sign in the variable.

Table 7. Renegotiation According to the Bidding Process

value	VARIABLES				
	faccom	*postores*	*contradju*	*origen*	*expepost*
0	8 (16.7%)			11 (22.9 %)	
1	40 (83.3%)	25 (52.1%)	25 (52.1%)	37 (77.1%)	
2		14 (29.2%)	1 (2.1%)		
3		9 (18.7%)	1 (2.1%)		52.7
4			3 (6.3%)		months
5			7 (14.5%)		(average)
6					
7			11 (22.9%)		
Renegotiations: 48 (100%)					

Source: Own elaboration.

4.3 *The Content of the Contracts*

A number of variables that are intrinsic to concession contracts are considered. These variables govern the relationship between the concessionaire and the regulator. First, the variable *mecareg* represents the tariff regulatory mechanism that is included in the concession contract. It is common practice to consider a tariff cap (price cap) mechanism to regulate tariffs in utilities and concession infrastructure in Peru. However, only some of the concession contracts consider tariff revision under the RPI-X mechanism. In that sense, *mecareg* takes the value of one when the contract does not include the productivity factor (X) into the regulatory mechanism, and 0 otherwise.

The evidence shows that an 85.4% of the renegotiated contracts consider a regulatory mechanism that includes the calculation of X (Table 8). In this sense, it will be of interest to test the hypothesis that these contracts reduce the probability of being modified.

Table 8. Renegotiation According to the Content of the Contracts

value	VARIABLES				
	mecareg	*terrenos*	*financ*	*garan*	*duracion*
0	7 (14.5%)	29 (60.4%)	20 (41.7%)		25.2
1	41 (85.4%)	19 (39.6%)	28 (58.3%)		years
< = 15%				40 (83.3%)	(average)
> 15%				8 (16.7%)	
Renegotiations: 48 (100%)					

Source: Own elaboration.

The variable *financ* captures the impact of the source of the capital in the project financing, taking the value of one if the project is privately funded (i.e, it is a self-financing concession) and the value of 0 if the project is co-financed by both the Treasury and the private party (i.e. a properly PPP). As shown in Table 8, there no strong differences in renegotiations regarding these two project financing arrangements. However, what it makes interesting to analyze the impact of this variable on the probability of renegotiation is that 58% of the amended contracts are self-financing concessions.

The variable *garan* represents the ratio of guaranteed investments to committed investments in the contract. Hence, one may expect that the greater guaranteed investments to be borne by the concessionaire, the higher financial costs and thus the more likely to engage in a contract renegotiation.

Table 8 shows that in over 60% of the amended contracts, the delivery of land to the concessionaire at the time of signing the contract was incomplete. As seen in the previous section, the non-initiation of the award with all cleaned up land is one of the main reasons for renegotiation. In this regard, we expect a negative sign on the variable *terrenos*, i.e. the probability of renegotiating is reduced to the extent that contracts are awarded with 100% of the land committed to the concessionaire.

Finally, the variable *duration*, expressed in years, captures the impact that the duration of a concession may have on the probability of renegotiate such a contract. We expect that long-term contracts be more likely to be renegotiated than medium-term contracts.

4.4 Institutional Environment

The group of variables to be considered in this case seeks to identify any impact on the renegotiation of concession contracts caused by the political and regulatory environment. First, the variable *aportereg* represents the payment from concessionaires to the regulator. This variable is a proxy of the extent of financial dependence, so that the autonomy of the regulator. It allows us to evaluate whether this financial dependence hampers the work of the regulator, in particular discouraging the modification of contracts.

A second variable related to the institutional environment is the experience of the regulator (*expereg*), expressed in years from the beginning of OSITRAN. We expect a negative sign on this variable. However, we should observe that this variable may be a complement to other aspects of the institutional environment that are not considered in the regression model, therefor if these other variable are weak the impact of *expereg* may change, indicating that the weakness of the regulator facilitates renegotiations of contracts. One explanation to the fact that the number of amended contracts has been increasing year after year, as depicted in Figure 3 (section 3), would be this regulatory weakness in Peru.

In order to capture whether the autonomy of the regulator actually reduces opportunistic actions by concessionaires, we include the variable *expapor* into the model. This variable comes from the interaction of the two previous mentioned. This variable aims to capture the autonomy of the regulator along with the degree of regulatory knowledge in the sector. We expect a negative sign on this variable, i.e, more resources with greater technical expertise in regulation should lead to a lower likelihood of contract renegotiation.

To capture the propensity to renegotiate concession contracts in electoral periods, we introduce the variable *electoral*, which takes the value of one in an electoral year, and 0 otherwise. However, the data shows that only 21.7% of the renegotiation contracts of infrastructure in Peru were carried out at electoral periods, suggesting that not necessarily we may expect a positive sign on this variable. The reason to this most probably finding is the reduced number of years in our data.

4.5 Economic Environment

The model considers variables that capture the impact of economic cycle on the probability of renegotiation. These variables are the per capita gross domestic product (*pbiper*), exchange rate (*tipcam*) and inflation (*inflac*). In this case, it would be interesting to measure to what extent the greater economic instability plays a role in explaining the renegotiation of contracts. Some contracts consider the exchange rate and consumer price indices (either domestic or international) to index revenues and operating costs. Thus, changes in these economic variables may trigger the interest for writing amendments to the contracts.

4.6 Summary

Table 9 summarizes the main statistics of the variables in the regression analysis. The correlation matrix of these variables is shown in Appendix 2.[5]

[5] In addition, we ran regressions including the timing to OSITRAN to introduce changes into concession contracts (*plazopi*), economic importance of the bidder (*imporpos*), and percentage of acceptance of the regulator's views on concession projects (*porcacep*). These regressions are available upon request.

Table 9. Descriptive Statistics

variable	obs	average	std. desv.	min	max
DEPENDENT					
renego	132	0.36	0.48	0	1
INDEPENDENT					
About the Bidding Process					
faccom	132	0.77	0.43	0	1
postores	132	1.85	0.94	1	5
contradju	132	2.80	2.48	1	7
origen	132	0.74	0.44	0	1
expepost	132	53.87	44.09	0.67	198.23
About the Contract					
mecareg	132	0.79	0.41	0	1
terrenos	132	0.46	0.50	0	1
financ	132	0.66	0.48	0	1
garan	132	0.15	0.23	0	0.83
duracion	132	25.02	6.10	12.6	30
Institucional Environment					
electoral	132	0.28	0.45	0	1
expereg	132	8.11	3.42	0	12
aportereg	132	642506.7	1101504	0	5630873
Economic Environment					
pibper	132	3654.93	1054.84	1944.23	5132.87
inflac	132	3.07	2.58	0.2	23.7
Tipcam	132	3.12	0.27	2.2	3.52

Source: Own elaboration.

5. ECONOMETRIC RESULTS

Table 10 reports the results of the econometric estimation. We present here two alternative models. The first one contains all the explanatory variables, while the second one contains variables that selectively characterize the bidding process and the awarded contract, and show the best settings for these variables. The same table presents the marginal effects of both models.

From the variables related to the bidding processes, the one that represents the number of bidders who participated in the contest (*bidders*) shows the most robust results, both in statistical significance and expected sign. This result tells us that the higher the number of bidders, the lower the probability of renegotiation by about 35%. Regarding the variable factor of competition (*faccom*), it is only significant in the reduced model (2). This result suggest that awarding contracts based on the lowest tariff from users increase the likelihood of renegotiation by 68%, compared to the alternative of using a factor of competition the highest payment to the Treasury. Guasch (2004) obtained the same result. He argues that user tariffs are usually a weak anchor for concessions. Additionally, the variable *contradju* is statistically different from zero in model (1). This result shows

that participation in previously awarded contracts reduces the likelihood of a subsequent renegotiation by 7%. Finally, variables *origin* and *expepost* showed no significance in any of the models.

Table 10. Econometric Estimation and Marginal Effects

Variables	Coefficients		Marginal Effects	
	(1)	(2)	(1)	(2)
faccom	-0.658	-2.013**	-0.233	-0.684***
	(1.351)	(0.899)	(0.499)	(0.209)
postores	-1.066*	-0.992***	-0.348*	-0.356***
	(0.568)	(0.38)	(0.178)	(0.133)
contradju	-0.216*		-0.0705*	
	(0.119)		(0.0387)	
origen	0.809		0.227	
	(0.712)		(0.164)	
expepost	0.00438		0.00143	
	(0.0154)		(0.00503)	
mecareg	-0.413	-2.111*	-0.144	-0.703***
	(2.758)	(1.154)	(1.006)	(0.243)
terrenos	-1.676*	-1.546*	-0.494**	-0.503**
	(0.999)	(0.834)	(0.251)	(0.224)
finance	-0.501		-0.17	
	(0.96)		(0.335)	
garan	-4.739	-0.376	-1.547	-0.135
	(4.147)	(1.355)	(1.357)	(0.488)
duracion	-0.063		-0.0206	
	(0.0797)		(0.026)	
electoral	-0.0281		-0.00913	
	(0.342)		(0.111)	
expapor	-3.70e-07**	-5.37e-08**	-1.21e-07**	-1.93e-08**
	(0.000000169)	(0.0000000232)	(0.0000000531)	(0.00000000805)
expereg	4.085***		1.333***	
	(1.369)		(0.456)	
aportereg	3.49e-06*		1.14e-06*	
	(0.00000189)		(6.02E-07)	
pibper	0.00509***		0.00166***	
	(0.00168)		(0.000561)	
inflac	-0.195**		-0.0638**	
	(0.096)		(0.0317)	
tipcam	11.96**		3.904**	
	(4.724)		(1.568)	
Constant	-17.84	8.555***	-0.233	-0.684***
	(13.15)	(3.091)	(0.499)	(0.209)
Observations	132	132		
MV	-66.43	-75.52		

Notes: All regressions include fix effects by time, contract, and sector; robust error son parenthesis; * statistics significance at 1%; ** statistics significance at 5%; *** statistics significance at 10%; MV: Maximum likelihood estimator.

Source: Own elaboration.

We found a similar situation with variables related to the characteristics of the concession contract. Only the variable *terrenos* appears as significant in the complete model (1). This variable shows a marginal effect of 50% in both models, which confirms the hypothesis that as the concessionaire do not receive legally cleaned up land, there will be more likely to renegotiate the contract. The variable *mecareg* turns out to be highly significant in model (2), with a marginal effect of 70% when using a price-cap mechanism that includes the productivity factor X. This result shows that when there are adverse events that affect the demand for the service, the concessionaire will look for modify the contract to restore its financial equilibrium. Variables *financial, garan,* and *duracion* turn out to be not significant in any of the models.

Three of the four variables related to the institutional environment were significant in all estimated models. Thus, variable *expapor*, which measures the autonomy of the regulator, has the expected sign despite its low marginal impact on the probability of renegotiation: 0.00121% in model (1). Since this is a variable that results from multiplying *aportereg* and *expereg*, both variables are also significant when used in model (1). In particular, the positive marginal effect of *expereg* on the probability of renegotiating a contract suggest that being a long standing regulator at office constitutes a threat of capture by the concessionaire. In fact, each year of experience increases the likelihood of renegotiation by 1.3%.

Finally, the three macroeconomic variables were significant. This is how economic growth, lower inflation and a higher exchange rate induce an increase in renegotiations of concessions in Peru. It is well known that a higher exchange rate negatively alters financial balance of the firm, leading to request the amendment of the contract. However, signs of the marginal effects of inflation and growth are contrary to expected.

6. CONCLUDING REMARKS

This work is motivated by the alarming effect of the renegotiations of concession contract observed in transport infrastructure in Peru. Both the design and regulation/supervision of contracts are some of the aspects that determine strategic actions of the parties (concessionaires, regulator, or government), thus leading to the amendment of contracts. Because these renegotiations do not necessarily have a positive impact on economic welfare, this paper estimates the impact on the probability of change in the contracts of several variables relating to the contract itself, the bidding process, and the economic and institutional environment.

To estimate the probability of renegotiation, we use a probit model and a database of 21 concession contracts for transport infrastructure of public use in Peru, which are in operation from 1994 to 2010. The economic sectors involved in these concessions are roads, airports, railways and ports.

The econometric results found that the probability of renegotiation of infrastructure concession contracts in Peru mainly depend on: i) the number of bidders who participated in the bidding; ii) the factor of competition that determines the winner of the bid; iii) the bidder's previous experience in the operation of other contracts; iv) the percentage of land given to the operator at the beginning of the concession; v) the regulatory mechanism used to regulate tariff in the concession; vi) the degree of autonomy of the regulator (in terms of experience and financial resources at its disposal); and, vii) economic environment variables such as GDP per capita, inflation and exchange rate.

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APPENDIX 1. VARIABLES USED IN ECONOMETRIC REGRESSIONS

Variables	Definition	Source
ABOUT THE AWARD OF A CONCESSION		
Number of bidders	Number of bidders	PROINVERSION
Number of awarded contracts	Previous awarded concessions to the same operator into the same sector (in joint biddings we consider the firm with more awaded contracts)	OSITRAN
Origen	*Dummy* equal to 1 if the winning bidder is Peruvian	Concession Contract
Factor of competition	*Dummy* equal to 1 if the factor of competition involves a monetary transfer (higher payment to the Treasury, lower subsidy from the Trasury, economic bid, etc.)	Bidding legal bases
Economic importance	Number of countries where the concessionaire operates (in joint biddings we consider the firm with more countries)	Web page of the bidder
Acceptance of the regulator's recommendation	Ratio of accepted comments of the regulator over the number of renegotiated contracts	OSITRAN
Legal term to provide a recommendation	Number of days for the regulator to provide a recommendation regarding an amendment	OSITRAN
ABOUT THE CONTRACT		
Mecanismo regulatorio	*Dummy* equal to 1 if the regulatory mechanism considers an inflation adjustment without considering the factor X	Concession contract
Concessionaire's experience	Almost continuous variable with the number of month from the subscription of the contract	Concession Contract
% of land surface	*Dummy* equal to 1 if the delivery of land to the concessionaire is 100%, and there is explicit commitment to no expropriation	Concession Contract
Type of financing	*Dummy* equal to 1 if the concession is self-funded	Concession Contract
Guarantee on revenues	Continuous variable	Concession Contract
Duration of the concession	Years awarded the concession to the concessionaire	Concession Contract

ABOUT INSTITUTIONAL ENVIRONMENT		
Electoral	*Dummy* equal to 1 in years where the renegotiation coincides with the election year	*default*
Regulator's experience	Years since OSITRAN was created	*default*
Contribution to regulation	Amount in New Soles (current) pay from the concessionaire to the regulator	OSITRAN
ABOUT THE ECONOMIC ENVIRONMENT		
PIB per cápita	Current GDP/Population	Central Bank /INEI
Inflation	Average yearly variation	Central Bank
Exchange rate	Current exchange rate	Central Bank

APPENDIX 2. CORRELATION MATRICES, MAIN MODEL

	renego	faccom	mecareg	postores	imporpos	contra~u	terrenos	origen	expepost	financ	garan
renego	1.0000										
faccom	0.1216	1.0000									
mecareg	0.1226	-0.0252	1.0000								
postores	-0.1460	-0.6397	-0.1229	1.0000							
imporpos	0.1335	0.0899	-0.2000	-0.0671	1.0000						
contradju	0.1262	0.1710	0.3767	-0.2931	0.3332	1.0000					
terrenos	-0.1005	-0.3109	-0.1881	0.2622	-0.4278	-0.5008	1.0000				
origen	0.0491	0.0006	0.3724	-0.1684	-0.2724	0.2455	0.3375	1.0000			
expepost	-0.0275	-0.1268	-0.0660	0.2499	-0.1819	0.0084	0.4034	0.1999	1.0000		
financ	-0.1208	-0.2476	-0.3732	0.6143	-0.4020	-0.4472	0.6025	-0.0581	0.3993	1.0000	
garan	-0.1375	-0.0152	-0.5826	-0.2255	-0.2009	-0.1317	0.3472	0.1798	0.1583	0.2273	1.0000
duracion	0.0203	0.6520	-0.4251	-0.2310	0.1237	-0.2466	-0.0057	-0.3115	-0.1482	0.2029	0.0424
electoral	-0.0159	-0.0521	0.0350	-0.0250	0.0207	0.0107	-0.0710	-0.0181	0.0200	-0.0493	-0.0261
expereg	0.0395	0.0971	0.0662	-0.2190	0.1971	0.3694	-0.4589	-0.2040	0.2560	-0.3981	-0.1695
aportereg	-0.1205	0.1180	-0.3401	0.1116	0.2364	-0.1446	-0.3231	-0.3626	0.1148	0.0163	-0.1297
plazopi	-0.0604	0.1496	-0.0936	0.0053	-0.0270	-0.1153	0.2410	0.1280	0.1276	0.2579	0.1210
porcacep	-0.1485	-0.4519	-0.0888	0.1891	-0.3795	-0.4095	0.4763	0.0085	0.1450	0.3381	0.3248
pibper	0.0298	0.0015	0.0959	-0.1758	0.1565	0.3552	-0.4132	-0.1762	0.2405	-0.3862	-0.1601
inflac	-0.0935	-0.2452	0.0955	0.1476	-0.0796	-0.0500	0.1305	0.0905	-0.0850	0.0693	0.0287
tipcam	0.0221	0.2436	-0.1582	-0.0060	-0.0623	-0.2143	0.2099	0.0686	-0.1089	0.2414	0.1078

	duracion	electo~l	expereg	aporte~g	plazopi	porcacep	pibper	inflac	tipcam
duracion	1.0000								
electoral	-0.0125	1.0000							
expereg	0.1085	0.1623	1.0000						
aportereg	0.1596	0.0410	0.2140	1.0000					
plazopi	0.0873	-0.4553	-0.3642	-0.0820	1.0000				
porcacep	-0.2354	0.0220	-0.1496	-0.1509	-0.0020	1.0000			
pibper	0.0130	0.2384	0.9454	0.1988	-0.4390	-0.0994	1.0000		
inflac	-0.3035	-0.0959	-0.2764	-0.0868	0.1163	0.1048	-0.0801	1.0000	
tipcam	0.2675	-0.2790	-0.5003	-0.0881	0.3595	-0.0276	-0.7088	-0.5285	1.0000

APPENDIX 3. ECONOMETRIC OUTPUT

Probit Model (1)

```
. probit renego anio contrato infraca infrafe infrapu infraae faccom postores contradju origen expepost mecareg terreno
> s financ garan duracion electoral expapor expereg aportereg pibper inflac tipcam, robust

note: infraae omitted because of collinearity
Iteration 0:   log pseudolikelihood = -86.523594
Iteration 1:   log pseudolikelihood = -68.684201
Iteration 2:   log pseudolikelihood =  -66.62236
Iteration 3:   log pseudolikelihood = -66.433284
Iteration 4:   log pseudolikelihood = -66.432093
Iteration 5:   log pseudolikelihood = -66.432093

Probit regression                                 Number of obs   =        132
                                                  Wald chi2(22)   =      40.35
                                                  Prob > chi2     =     0.0098
Log pseudolikelihood = -66.432093                 Pseudo R2       =     0.2322
```

renego	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
anio	-4.739638	1.564306	-3.03	0.002	-7.80562	-1.673655
contrato	-.3276682	.1979776	-1.66	0.098	-.7156972	.0603607
infraca	-2.144355	2.445029	-0.88	0.380	-6.936523	2.647814
infrafe	4.582974	2.920482	1.57	0.117	-1.141065	10.30701
infrapu	5.073212	3.272574	1.55	0.121	-1.340916	11.48734
infraae	(omitted)					
faccom	-.6580522	1.350977	-0.49	0.626	-3.305919	1.989814
postores	-1.066001	.5680524	-1.88	0.061	-2.179363	.0473617
contradju	-.215815	.11909	-1.81	0.070	-.4492271	.0175971
origen	.8091406	.7124905	1.14	0.256	-.5873153	2.205596
expepost	.0043831	.0153592	0.29	0.775	-.0257203	.0344865
mecareg	-.4134746	2.757578	-0.15	0.881	-5.818228	4.991279
terrenos	-1.675734	.9994446	-1.68	0.094	-3.634609	.2831419
financ	-.5012822	.9595728	-0.52	0.601	-2.38201	1.379446
garan	-4.738724	4.147329	-1.14	0.253	-12.86734	3.389891
duracion	-.0629699	.0797026	-0.79	0.429	-.2191842	.0932444
electoral	-.0280874	.3418804	-0.08	0.935	-.6981607	.641986
expapor	-3.70e-07	1.69e-07	-2.19	0.028	-7.00e-07	-3.94e-08
expereg	4.084748	1.369195	2.98	0.003	1.401175	6.768321
aportereg	3.49e-06	1.89e-06	1.85	0.064	-2.08e-07	7.18e-06
pibper	.0050903	.0016835	3.02	0.002	.0017907	.0083899
inflac	-.1953657	.0960266	-2.03	0.042	-.3835744	-.0071569
tipcam	11.95982	4.724434	2.53	0.011	2.700101	21.21954
_cons	-17.83962	13.145	-1.36	0.175	-43.60336	7.924112

```
Note: 2 failures and 0 successes completely determined.
```

Probit Model (2)

```
. probit renego anio contrato infraca infrafe infrapu infraae faccom postores mecareg terrenos garan expapor, robust

note: infraae omitted because of collinearity
Iteration 0:   log pseudolikelihood = -86.523594
Iteration 1:   log pseudolikelihood = -76.235564
Iteration 2:   log pseudolikelihood =  -75.53271
Iteration 3:   log pseudolikelihood =  -75.52413
Iteration 4:   log pseudolikelihood =  -75.52413

Probit regression                                 Number of obs   =        132
                                                  Wald chi2(11)   =      17.33
                                                  Prob > chi2     =     0.0984
Log pseudolikelihood =  -75.52413                 Pseudo R2       =     0.1271
```

renego	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
anio	.045959	.0448272	1.03	0.305	-.0419006	.1338186
contrato	-.213667	.0785421	-2.72	0.007	-.3676068	-.0597272
infraca	-2.601482	1.308402	-1.99	0.047	-5.165902	-.0370609
infrafe	3.288385	1.205092	2.73	0.006	.9264485	5.650321
infrapu	-.9648535	1.323485	-0.73	0.466	-3.558836	1.629129
infraae	(omitted)					
faccom	-2.012666	.8989135	-2.24	0.025	-3.774504	-.2508282
postores	-.9917636	.38038	-2.61	0.009	-1.737295	-.2462325
mecareg	-2.110985	1.153547	-1.83	0.067	-4.371896	.1499251
terrenos	-1.545776	.8335805	-1.85	0.064	-3.179564	.0880115
garan	-.37632	1.354966	-0.28	0.781	-3.032004	2.279364
expapor	-5.37e-08	2.32e-08	-2.31	0.021	-9.93e-08	-8.18e-09
_cons	8.5553	3.090553	2.77	0.006	2.497928	14.61267

Marginal Effects (1)

```
. dprobit renego anio contrato infraca infrafe infrapu infraae faccom postores contradju origen expepost mecareg terren
> os financ garan duracion electoral expapor expereg aportereg pibper inflac tipcam, robust

note: infrafe dropped because of collinearity
Iteration 0:   log pseudolikelihood = -86.523594
Iteration 1:   log pseudolikelihood = -69.794472
Iteration 2:   log pseudolikelihood = -67.170577
Iteration 3:   log pseudolikelihood = -66.495588
Iteration 4:   log pseudolikelihood =  -66.43273
Iteration 5:   log pseudolikelihood = -66.432093
Iteration 6:   log pseudolikelihood = -66.432093

Probit regression, reporting marginal effects           Number of obs =    132
                                                        Wald chi2(22) =  40.35
                                                        Prob > chi2   = 0.0098
Log pseudolikelihood = -66.432093                       Pseudo R2     = 0.2322

------------------------------------------------------------------------------
             |               Robust
     renego |      dF/dx   Std. Err.      z    P>|z|     x-bar  [    95% C.I.   ]
-------------+----------------------------------------------------------------
        anio |  -1.547257   .5235371    -3.03   0.002    13.0303  -2.57337 -.521143
   contrato* |  -.1069674   .0634378    -1.66   0.098     11.553  -.231303  .017368
    infraca* |  -.9990849   .0088135    -1.32   0.188    .568182  -1.01636 -.981811
    infrapu* |   .1749506   1.968532     0.09   0.925    .136364   -3.6833   4.0332
    infraae* |  -.4552065   .1336586    -1.57   0.117    .113636  -.717173  -.19324
     faccom* |   -.232971   .4993023    -0.49   0.626    .765152  -1.21159  .745643
   postores* |  -.3479963   .1783238    -1.88   0.061    1.84848  -.697504  .001512
   contra~u* |  -.0704529    .038677    -1.81   0.070    2.79545  -.146258  .005353
     origen* |   .2268623   .1644287     1.14   0.256    .742424  -.095412  .549137
    expepost |   .0014309   .0050255     0.29   0.775    53.8719  -.008419  .011281
    mecareg* |   -.143766   1.005795    -0.15   0.881    .787879  -2.11509  1.82756
   terrenos* |  -.4936636   .2506028    -1.68   0.094    .462121  -.984836 -.002491
     financ* |  -.1703356   .3353939    -0.52   0.601    .659091  -.827696  .487024
      garan  |  -1.546958   1.357293    -1.14   0.253    .152879   -4.2072  1.11329
   duracion  |  -.0205565   .0259542    -0.79   0.429    25.0242  -.071426  .030313
   electo~l* |   -.009133   .1106619    -0.08   0.935    .280303  -.226026   .20776
    expapor  |  -1.21e-07   5.31e-08    -2.19   0.028    6.0e+06  -2.2e-07 -1.7e-08
    expereg  |   1.333468   .4562382     2.98   0.003    8.11364   .439257  2.22768
   aporte~g  |   1.14e-06   6.02e-07     1.85   0.064     642507  -4.1e-08  2.3e-06
     pibper  |   .0016617   .0005613     3.02   0.002    3654.93   .000562  .002762
     inflac  |  -.0637772   .0317346    -2.03   0.042    3.06955  -.125976 -.001579
     tipcam  |   3.904288   1.567644     2.53   0.011    3.11545   .831762  6.97681
-------------+----------------------------------------------------------------
      obs. P |   .3636364
     pred. P |   .2632666  (at x-bar)
------------------------------------------------------------------------------
(*) dF/dx is for discrete change of dummy variable from 0 to 1
    z and P>|z| correspond to the test of the underlying coefficient being 0
```

Marginal Effects (2)

```
. dprobit renego anio contrato infraca infrafe infrapu infraae faccom postores mecareg terrenos garan expapor, robust

note: infraca dropped because of collinearity
Iteration 0:   log pseudolikelihood = -86.523594
Iteration 1:   log pseudolikelihood = -76.607302
Iteration 2:   log pseudolikelihood = -75.602615
Iteration 3:   log pseudolikelihood = -75.524626
Iteration 4:   log pseudolikelihood =  -75.52413
Iteration 5:   log pseudolikelihood =  -75.52413

Probit regression, reporting marginal effects           Number of obs =    132
                                                        Wald chi2(11) =  17.33
                                                        Prob > chi2   = 0.0984
Log pseudolikelihood =  -75.52413                       Pseudo R2     = 0.1271

------------------------------------------------------------------------------
             |               Robust
     renego |      dF/dx   Std. Err.      z    P>|z|     x-bar  [    95% C.I.   ]
-------------+----------------------------------------------------------------
        anio |   .0165123   .0160129     1.03   0.305    13.0303  -.014872  .047897
   contrato* |  -.0767671   .0274932    -2.72   0.007     11.553  -.130653 -.022881
    infrafe* |    .936799   .0564426     2.64   0.008    .181818   .826174  1.04742
    infrapu* |   .5824207   .4770377     0.90   0.370    .136364  -.352556   1.5174
    infraae* |   .7420624   .1376963     1.99   0.047    .113636   .472183  1.01194
     faccom* |  -.6843466    .208508    -2.24   0.025    .765152  -1.09301 -.275678
   postores* |  -.3563245   .1328648    -2.61   0.009    1.84848  -.616735 -.095914
    mecareg* |  -.7033843   .242611     -1.83   0.067    .787879  -1.17889 -.227875
   terrenos* |   -.502614   .2244011    -1.85   0.064    .462121  -.942432 -.062796
      garan  |  -.1352057   .4876668    -0.28   0.781    .152879  -1.09102  .820604
    expapor  |  -1.93e-08   8.05e-09    -2.31   0.021    6.0e+06  -3.5e-08 -3.5e-09
-------------+----------------------------------------------------------------
      obs. P |   .3636364
     pred. P |   .3236155  (at x-bar)
------------------------------------------------------------------------------
(*) dF/dx is for discrete change of dummy variable from 0 to 1
    z and P>|z| correspond to the test of the underlying coefficient being 0

.
```