

# Renegotiation of Concession Contracts in Latin America

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## Abstract

Guasch, Laffont, and Straub construct a regulation model in which renegotiation occurs due to the imperfect enforcement of concession contracts. This enables the authors to provide theoretical predictions for the impact on the probability of renegotiation of a concession, regulatory institutions, institutional features, economic shocks, and the characteristics of the concession

contracts. Then they use a data set of nearly 1,000 concessions awarded in Latin America and the Caribbean countries from 1989 to 2000 covering the sectors of telecommunications, energy, transport, and water to test these predictions. Finally, the authors derive some policy implications of their theoretical and empirical work.

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This paper—a product of the Finance, Private Sector, and Infrastructure Unit, Latin America and the Caribbean Region—is part of a larger effort in the region to foster private sector participation in infrastructure. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Joy Troncoso, room I5-108, telephone 202-473-7826, fax 202-522-2106, email address [jtroncoso@worldbank.org](mailto:jtroncoso@worldbank.org). Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. Luis Guasch may be contacted at [jguasch@worldbank.org](mailto:jguasch@worldbank.org). April 2003. (41 pages)

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# Renegotiation of Concession Contracts in Latin America\*

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### 1 Introduction

Traditionally the provision of infrastructure services in most developing countries -as well as developed ones- was provided by government owned enterprises. However, these enterprises, at least in developing countries- have proven to be fairly inefficient and used for political objectives. A plethora of studies of the relative performances of public and private enterprises done in the past thirty years find significantly superior performance by private (and/or privatized) enterprises, at least with respect to productive efficiency (see for example Megginson and Netter (2001) and Kikeri and Nellis (2002)). Explanations differ as to why this is so. Aside from the incentive-for-profit reason and arguably a more professional know-how in management and operating procedures and use of appropriate technology, the most important reason may be that privatization renders difficult and/or costly the day-to-day intervention in enterprise operation by governments and politicians, making manipulations less likely. But perhaps the leading reason behind the strategy to bring private sector participation in infrastructure has been the urgent need for sizable investment. To improve performance and coverage, most of the state owned enterprises urgently needed significant investments. Given the scarcity of public funds for investments and the competing investment needs in the social sectors, most countries have opted for the transfer of the provision of infrastructure services to the private sector. Private sector participation can and has been accomplished in a variety of forms, ranging from management contracts, to concessions and to full privatizations with significant success. Practically, at least in Latin America and the Caribbean region, seldom a call to the private sector to take over and operate on an infrastructure service has had no takers.

The reform process to improve and extend infrastructure services has been additionally fueled by the realization by developing countries that infrastructure levels and quality significantly matter for economic growth and poverty alleviation, and that their current levels and quality are not adequate to secure those desired levels of growth. The belief and the facts are that infrastructure services —electricity, water, telecommunications, roads, railroads, ports and airports— are critical to the operation and efficiency of a modern economy. They enter as critical inputs in the provision of goods and services and impact significantly in the productivity, cost and competitiveness of the economy. Policy decisions regarding their provision have ramifications throughout the economy, and poor infrastructure services often limit competitiveness in other markets. There are plenty of empirical studies illustrating the impact of infrastructure on economic growth, among the more recent are Canning (1998), Calderon, Easterly and Serven (2002), Calderon and Serven (2002). A 1 percent increase in the stock of infrastructure can increase GDP by

up to 0.20 percent. Concerning the stock and quality levels of infrastructure as of 2000 in Latin American and Caribbean countries, Calderon and Serven (2002) show that while it has improved somehow since 1980, it is still deficient and has lost significant ground relative to East Asia and OECD countries. Those authors show that during the 1980-2000 period the Latin America infrastructure gap relative to East Asia grew by 40% for roads, 70% for telecommunications and nearly 90% for power generation, and that this widening gap can account for nearly 25% of the GDP output gap (GDP growth of East Asian economies was almost twice as large as that of Latin American countries over that period). Thus infrastructure matters and quite significantly. In response to this and given the mentioned scarcity of public funds, most developing countries have been turning to the private sector for financing and operation of infrastructure services.

Private sector participation has often been accompanied by sector restructuring prior to the transfer and by the implementation of a legal and regulatory framework. This was done to protect users from the abuse of dominant position by the new private operators, which in a number of cases would be operating as the only provider as a result of natural monopoly conditions, to protect possible competitive process new entrants from a dominant incumbent operator, and also to prevent opportunistic behavior by both the government and the operator.

Quite often, the required and necessary sectors' investments are of the "sunk" type and highly specific, that is, costs that cannot easily be recouped or salvaged if the economic atmosphere deteriorates or if the operator were to discontinue operations. This may tempt governments to behave opportunistically, taking regulatory actions that expropriate the available quasi-rents once costs are sunk. Typical scenarios are a government (or a mayor in the case of water concessions, since they usually have exclusive jurisdiction) during a re-election campaign deciding in a unilateral fashion to cut tariffs or not to honor agreed tariff increases to secure popular support. Another not uncommon scenario, is a new administration deciding not to honor the tariffs increase stated in the concession contract granted by the previous administrations. The knowledge of potential investors that this temptation exists may discourage investment in the first place, unless it is properly addressed, or it might require an additional premium (bigger tariffs, or smaller transfer price) to account for that risk. That possibility is the main source of regulatory risk, impacting costs of capital and needless to say tariff levels necessary to secure that higher cost of capital-the added regulatory risk component. The extent of that regulatory risk is not trivial. The estimates, depending clearly on country and sector range, from 2 to 6 percentage points to be added to the cost of capital (Guasch and Spiller (1999)). The impact is substantial. For example an increase of 5 percentage points in the cost of capital to account for the regulatory risk leads to a reduction of the offered transfer fee or sale price of about 35% or equivalently it requires a compensatory increase in tariffs of

about 20%. For example in the water concession in the city of Buenos Aires, the regulator granted an increase on tariffs of 3.5% for each percentage point increase on the cost of capital.

However, it is not only the government that may behave opportunistically. Once an enterprise has been granted a concession in an infrastructure sector -and the bidding competitors are gone- it may correspondingly be able to take actions that “hold up” the government, for example through insisting on renegotiating the regulatory contract *ex post*, or through regulatory capture. The extensive informational advantages that the enterprise possesses over the government (as well, likely, as over other potential operators), and its perceived leverage vis à vis the government in a bilateral negotiation is a powerful potential factor to seek renegotiation of the contract and secure a better deal than the bid one.

Finally, there are also “neutral” events, that is not induced by either the government or the operator, which can significantly affect the financial equilibrium of firms, and that can also be used as an opportunity to redistribute rents. Typical examples would be an internal or external macroeconomic shock, such as the devaluation in Argentina in 2001, or the one in Brazil in 1999. That possibility and the fact that not clear guidelines exist about how to adjust the concession contracts in such events adds again to the regulatory risk.

In all cases, the effectiveness of the regulatory framework in protecting operators from government intervention for political goals, government from firms’ opportunistic behavior, and in absorbing economic shocks, matters significantly in determining sector performance and the incidence of renegotiation.

Beginning in the late 1980s, developing countries, with Latin America and the Caribbean countries taking the lead, began a process of significant reforms.<sup>1</sup> A large component of those reforms was allowing private sector participation in the provision of infrastructure services transferring significant parts of the operation of utilities from government management and control to that of private enterprises. These private enterprises were either existing individual corporate entities, or conglomerations/consortia, foreign and domestic, that were formed to provide these services. There was a variety of forms and extent of private participation in the provision of infrastructure services. Each mode differs in terms of degree of government participation, risk allocation, investment responsibilities, operational requirements and in terms of the incentive structure for operators. The salient modes of private sector participation have been privatizations and concessions, and to a much lesser extent management contracts. The latter have not proven to be very effective and have only been occasionally used, at least in the Latin American and

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<sup>1</sup>See for example Sanchez and Corona (1993).

Caribbean countries. In sectors such as telecommunications, and to some extent in electricity generation and gas (the often pioneer sectors), private sector participation was accomplished by outright privatization-divestiture, accompanied by structural reforms of market structure and of the regulatory framework. In other cases or sectors, legal, political and constitutional restraints hindered or made very difficult the outright sale of public infrastructure utilities to private parties (who quite often were foreign companies, making the issue politically even more complicated). That context is quite often the case for the transport (ports, airports, roads and railroads) and water and sewage sectors, and some segments of the electricity sector. Also in some context and countries, where in principle there were no legal or constitutional impediments to full privatization, perceived concerns about the performance of privatized companies led to a revisiting of the mode of private sector participation so that the government would retain some control in the sector. Many countries, therefore, resorted to innovative strategies to introduce private sector participation in the provision of public infrastructure services in situations in which the state could not or did not want to transfer ownership of public assets to private agents. Amongst the alternatives to outright privatization, concessions to the private sector for the rights to operate the service for a limited length of time have emerged as the salient mode.

While private sector participation by concession has often produced significant improvements in infrastructure sector performance, a number of countries are raising some questions about the applicability of the model. Among them are frequent conflicts with operators in complying with contract clauses, tariffs perceived to be excessive, abandonment of the concession by the operator or the taking over of the concession by the government as a result of claimed bankruptcy of operator,<sup>2</sup> discontent with price levels and services, poor attention to users and, particularly, the perceived high incidence of renegotiation of contracts shortly after the award of the concession, often in detriment of consumer welfare.<sup>3</sup> In most cases (particularly in the water and transport sectors), contracts have been renegotiated, impacting sector performance and compromising the credibility of the country and sector involved. Excluding the telecommunications sector, over forty percent of concessions appear to be renegotiated, and sixty percent of those within three years of the award of the concession, when in principle the contract agreement was for a period of 15 to 30 years (see Guasch 2001). And this recorded high incidence of renegotiation

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<sup>2</sup>Examples are the highway concession program in Mexico in the early 1990s, the water concession in the provinces of Tucuman and Buenos Aires in Argentina, and in the city of Cochabamba in Bolivia, and a number of (build operate transfer) BOT concessions in the water sector in Mexico.

<sup>3</sup>The incidence of concessions abandoned and taken over by the government has been significant in other countries outside the Latin America and Caribbean region, such as in Indonesia, Thailand, China, in East Asia, and there have been a few cases in the Africa region, in Senegal, Nigeria, Kenya, Zimbabwe and Gambia. Most of those abandonments have been in the roads, water and sanitation and in the power sector.



is likely to be an underestimate, since the process is ongoing and additional concessions could be renegotiated in the coming years. While some renegotiation is desirable, appropriate and is to be expected, this high incidence appears to be beyond reasonable levels, and raises concerns about the validity of the model. It might indicate poor design or excessive opportunistic behavior by the new operators, or by the government, in detriment of the efficiency of the process and of overall welfare.

At the theoretical level, the procurement and regulation literature<sup>4</sup> has been written for developed countries in which the quality of institutions yields a level of enforcement of contracts so high that renegotiations can be considered as secondary at least as a first approximation. On the contrary, for LDCs it appears that renegotiation is an important phenomenon calling for both theoretical and empirical analysis.

Imperfect enforcement leading to renegotiations is a major characteristic of LDCs which must be understood to provide a useful theoretical framework for procurement policy and regulation. This has been emphasized by the 2001 World Development Report (World Bank, 2001), which stresses that “there is a growing consensus that regulation, particularly in poor countries, must be designed with an appreciation of both information asymmetries and difficulties of enforcement”.

The literature on regulation and procurement contracts has dealt with asymmetric information within the framework of mechanism design and complete contracts. Then, renegotiation never happens. If the regulator cannot commit not to renegotiate (Dewatripont (1986)) the optimal contract suffers from the ratchet effect, but is still renegotiation-proof (Hart and Tirole (1988), Laffont and Tirole (1990)). Indeed, optimal contracting commits to ex post inefficiencies to mitigate the costs of information rents. Any limitation of commitment yields potential renegotiation which can be anticipated in the initial contract; then, the anticipated outcome of renegotiation can be embedded in the initial contract which becomes renegotiation-proof, so that no renegotiation occurs along the equilibrium path. The analysis has been extended to cases where some contractual variables require costly auditing (Baron and Besanko (1984), Laffont and Tirole (1993), Khalil (1997)). Auditing of effort levels or states of nature is incorporated into the contracts but does not yield renegotiation.

When can we have actual renegotiations? One way is to postulate that initial contracts are incomplete (Hart and Moore (1988), Green and Laffont (1992), Aghion et alii (1994), Segal and Whinston (2002)). The reasons invoked for these contractual incompletenesses are contractual transaction costs difficult to pin down, bounded rationality of players which are rarely explicitly modeled or some imperfections of the judicial system, which are assumed in a rather ad hoc way. Modeling more precisely the imperfections of the

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<sup>4</sup>See Laffont and Tirole (1993) for a synthesis.

judicial system is likely to be the most promising path in our state of knowledge. One simple way is to observe that many contracts call for ex post penalties and to stress the imperfection of the enforcement of those penalties.<sup>5</sup>

Bondt (2002) constructs a moral hazard model with ex post penalties which may not be enforced because of side-contracting between judges and the contractual party which must be punished. Anderlini et alii (2000) instead consider incomplete contracts so that ex post judges who maximize social welfare may be willing to void some clauses, and this could lead to renegotiations.

Laffont (2000), Laffont and Meleu (2001) offer procurement and regulation models with adverse selection where imperfect enforcement of penalties can be affected by expenditures in enforcement very much in the black box tradition of the Chicago school. In Section 2 of this paper, we extend this theoretical framework to account for a maximal number of realistic characteristics of concession contracts and for exogenous shocks. We allow for the two main motivations of renegotiation, incompleteness of contracts calling for Pareto improving renegotiation and enforcement failures which yield rent shifting renegotiations. This will provide us with a whole set of predictions for the probabilities of renegotiation of concession contracts. The model we develop is a model of renegotiation initiated by firms. Renegotiations initiated by governments raise technical issues that we leave for another paper. In particular, in a world where firms have private information, the anticipation of opportunistic behavior by governments will lead to strategic behavior by firms which will want to hide their information to protect their future rents inducing a complex ratchet effect.

Then, Section 3 examines a data set of concessions awarded in Latin America and Caribbean countries from 1989 to 2000 covering the sectors of transport and water, and analyzes the renegotiation of these contracts. We perform a probit panel analysis which enables us to take full advantage of the information embedded in individual observations, such as the age of each specific contract or its power of incentives. The empirical analysis performed provides a broad support to the predictions derived from the theoretical model.

In the concluding section, we derive some policy implications of our theoretical and empirical work.

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<sup>5</sup>The importance of enforcement of laws was stressed by the Chicago school (see Becker (1968), Stigler (1970), Becker and Stigler (1974), Posner (1972) and Polinsky and Shavell (2000) for a recent synthesis), but has been little addressed by modern contract theory.

## 2 The Model

### 2.1 Optimal Regulation

Consider the concession of a natural monopoly which, in addition to a necessary sunk investment, or fixed cost,  $F$ , which is common knowledge, has a variable cost function:

$$C = (\beta - e)q. \quad (1)$$

where  $q$  is the production level,  $\beta$  is an adverse selection parameter in  $\{\underline{\beta}, \bar{\beta}\}$  with  $\nu = \Pr(\beta = \underline{\beta})$  and  $e$  is a moral hazard variable which decreases cost, but creates to the manager a disutility  $\Psi(e)$  with  $\Psi' > 0$ ,  $\Psi'' > 0$ ,  $\Psi''' \geq 0$ .

Consumers derive utility  $S(q)$ ,  $S' > 0$ ,  $S'' < 0$  from the consumption of the natural monopoly's good. Let  $p(\cdot)$  be the inverse demand function and  $\hat{t}$  the transfer from the regulator to the firm. The firm's net utility writes:

$$U = \hat{t} + p(q)q - (\beta - e)q - F - \Psi(e). \quad (2)$$

We assume that cost is ex post observable by the regulator as well as the price and the quantity. So we can make the accounting assumption that revenues and cost are incurred by the regulator, who pays a net transfer  $t = \hat{t} + p(q)q - (\beta - e)q - F$ . Accordingly, the participation constraint of the firm can be written:

$$U = t - \Psi(e) = t - \Psi(\beta - c) \geq 0, \quad (3)$$

where we make use of (1) to substitute  $e$  by  $\beta - c$ , with  $c = \frac{C}{q}$ .

To finance the transfer  $\hat{t}$ , the government must raise taxes with a price of public funds  $1 + \lambda$ ,  $\lambda > 0$ . Hence, consumers' net utility is:

$$V = S(q) - p(q)q - (1 + \lambda)\hat{t}. \quad (4)$$

Utilitarian social welfare is then given by the sum of consumers' surplus and the firm utility, here with equal weight of 1 for both:

$$\begin{aligned} \widehat{W} &= U + V \\ &= S(q) + \lambda p(q)q - (1 + \lambda)((\beta - e)q + F + \Psi(e)) - \lambda U. \end{aligned} \quad (5)$$

This implies that the government values the rent of the firm as much as consumers' utility, which may not be realistic when the awarded concessionaire is a foreign firm. The key feature, however, is that the regulator dislikes leaving a rent to the firm, which occurs

as long as the weight of its rent is lower than  $1 + \lambda$ . In subsequent sections, we analyze the effects of making this weight vary.

Under complete information, the maximization of social welfare would lead to<sup>6</sup>:

$$S'(q^*) + \lambda(p'(q^*)q^* + p(q^*)) = (1 + \lambda)(\beta - e^*) \quad (6)$$

$$\Psi'(e^*) = q^* \quad (7)$$

$$U = 0. \quad (8)$$

We denote  $\underline{q}^*, \underline{e}^*, \underline{U}^*$  and  $\bar{q}^*, \bar{e}^*, \bar{U}^*$  the complete information solutions corresponding to  $\underline{\beta}$  and  $\bar{\beta}$  respectively.

Since consumers equate their marginal utility to the price ( $S'(q) = p$ ), equation (6), which says that social marginal utility equals social marginal cost, can be rewritten as a Lerner index formula:

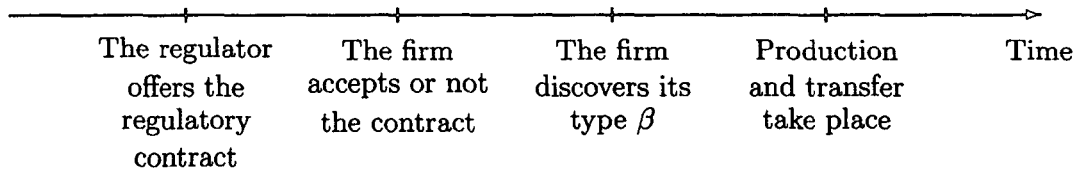
$$\frac{p - (\beta - e)}{p} = \frac{\lambda}{1 + \lambda} \frac{1}{\eta(p)},$$

where  $\eta(p)$  is the price elasticity of demand. The price is then between the marginal cost ( $\beta - e$ ) and the monopoly price  $p^M$  defined by  $\frac{p^M - (\beta - e)}{p^M} = \frac{1}{\eta(p)}$ .

The marginal disutility of effort  $\Psi'(e)$  is equated to its marginal social gain  $q$ , and no rent is given up to the firm because funds are socially costly ( $\lambda > 0$ ).

Suppose now that the regulator cannot observe the effort level  $e$  and does not know  $\beta$ . However, he can offer a contract to the firm before the latter discovers its type (see Figure 1 for the timing).

Figure 1: Timing



Equation (3) shows that the observability of cost reduces the problem to a simple adverse selection problem. From the Revelation Principle, there is no loss of generality in restricting the analysis to direct revelation mechanisms  $\{(\underline{t}, \underline{c}), (\bar{t}, \bar{c})\}$  which specify for each message  $\tilde{\beta} = \underline{\beta}$  or  $\tilde{\beta} = \bar{\beta}$  an average cost to achieve and a net transfer from the regulator. The regulatory contract also recommends a production level  $\underline{q}$  (or  $\bar{q}$ ) and a total cost  $\underline{C}$  (or  $\bar{C}$ ), compatible with  $\underline{c}$  (or  $\bar{c}$ ) (between which the firm is indifferent) which maximize expected social welfare.

<sup>6</sup>We make the appropriate assumptions on  $S(\cdot)$  so that  $W$  is strictly concave in  $(q, e)$ . For more details and motivations about the various assumptions, see Laffont and Tirole (1993).

However, the direct revelation mechanism must be truthful, i.e., must satisfy the incentive constraints

$$\underline{U} = \underline{t} - \Psi(\underline{\beta} - \underline{c}) \geq \bar{t} - \Psi(\underline{\beta} - \bar{c}) \quad (9)$$

$$\bar{U} = \bar{t} - \Psi(\bar{\beta} - \bar{c}) \geq \underline{t} - \Psi(\bar{\beta} - \underline{c}). \quad (10)$$

These constraints can be rewritten:

$$\underline{U} \geq \bar{U} + \Phi(\bar{e}) \quad (11)$$

$$\bar{U} \geq \underline{U} - \Phi(\underline{e} + \Delta\beta), \quad (12)$$

where  $\Phi(e) = \Psi(e) - \Psi(e - \Delta\beta)$ ,  $\Phi' > 0$ ,  $\Phi'' > 0$ .

Since the firm must accept or reject the contract before it knows its type, its participation constraint must be written ex ante:

$$\nu \underline{U} + (1 - \nu) \bar{U} \geq 0. \quad (13)$$

Finally, the regulator's maximization program becomes:

$$\begin{aligned} \max \nu [S(\underline{q}) + \lambda p(\underline{q}) \underline{q} - (1 + \lambda)(\underline{c}\underline{q} + F + \Psi(\underline{\beta} - \underline{c})) - \lambda \underline{U}] \\ + (1 - \nu) [S(\bar{q}) + \lambda p(\bar{q}) \bar{q} - (1 + \lambda)(\bar{c}\bar{q} + F + \Psi(\bar{\beta} - \bar{c})) - \lambda \bar{U}] \end{aligned}$$

s.t. (11) (12) (13).

It is more transparent to rewrite this program in terms of the variables  $(q, e, U)$  rather than  $(q, c, U)$ . Let us also denote  $W(q, e, \beta)$  the complete information ex post social welfare for a production level  $q$  and an effort level  $e$  when the efficiency parameter is  $\beta$ , i.e.:

$$W(q, e, \beta) = S(q) + \lambda p(q)q - (1 + \lambda)((\beta - e)q + F + \Psi(e)). \quad (14)$$

The regulator's program rewrites:

$$\max \nu [W(\underline{q}, \underline{e}, \underline{\beta}) - \lambda \underline{U}] + (1 - \nu) [W(\bar{q}, \bar{e}, \bar{\beta}) - \lambda \bar{U}]$$

s.t. (11) (12) (13).

The regulator makes the participation constraint binding and, substituting in the objective function, maximizes social welfare<sup>7</sup>. For each value of  $\beta$  he finds the complete information optimum. There are many pairs of transfers that structure the rents in such

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<sup>7</sup>See Laffont and Martimort (2002).

a way that the incentive constraints are satisfied. The main point to notice is that the inefficient type  $\bar{\beta}$ 's ex post utility is always negative.<sup>8</sup>

This negative ex post utility raises the issue of enforcement. Indeed, once it discovers its type  $\bar{\beta}$  the firm would like to renege on the regulatory contract. In a country with strong institutions, the contract is enforced in both states of nature  $\underline{\beta}$  and  $\bar{\beta}$ . As a consequence, asymmetric information does not create any transaction cost for society and the complete information optimal allocation is achieved despite the setting of incomplete information.

At the other extreme, suppose that the regulator anticipates that he will not be able to enforce a negative ex post utility level for the firm. Then, he will choose a regulatory contract which maximizes expected social welfare under the incentive constraints, but also the ex post participation constraints:<sup>9</sup>

$$\underline{U} \geq 0 \quad (15)$$

$$\bar{U} \geq 0. \quad (16)$$

The set of constraints is the same as if the contract was offered to the firm at the interim stage, i.e. once the firm knows its type. We know that in this case the efficient type's incentive constraint (11) and the inefficient type's participation constraint (24) will be the binding ones. Substituting into the objective function of the regulator and maximizing, we obtain:

$$\Psi'(\bar{e}^{SB}) = \bar{q}^{SB} - \frac{\lambda}{1+\lambda} \frac{\nu}{1-\nu} \Phi'(\bar{e}^{SB}) \quad (17)$$

$$\Psi'(\underline{e}^{SB}) = \underline{q}^{SB} = \underline{q}^* \quad (18)$$

$$\underline{U} = \Phi(\bar{e}^{SB}) > 0, \quad (19)$$

and the same pricing equations as under complete information<sup>10</sup>.

Now, the efficient type captures a positive rent, and to decrease somewhat this socially costly rent the regulator decreases the effort level in the case  $\beta = \bar{\beta}$ , while the efficient type's effort level is not distorted.

<sup>8</sup>This loss is minimized when (11) is binding.

<sup>9</sup>We assume here that production is so valuable that shut-down of the inefficient type is not an interesting option.

<sup>10</sup>This is due to the fact that the cost function satisfies the separability assumption  $C(q, h(\beta, e))$  which implies the dichotomy property, i.e. the absence of incentive correction in the pricing formula (see Laffont and Tirole, 1993).

## 2.2 Imperfect Enforcement

We want to model more precisely what happens when institutions ensure only an imperfect enforcement of regulatory contracts.

We will assume that when the firm obtains an ex post utility less than its status-quo payoff, it attempts to renegotiate its regulatory contract<sup>11</sup>. However, with a probability  $\pi(x)$ , the regulator is able nevertheless to impose the implementation of the agreed upon contract. This probability depends on the expenses  $x$  incurred to finance the functioning of an efficient enforcement mechanism. We assume that  $\pi(0) = 0$ ,  $\lim_{x \rightarrow \infty} \pi(x) = 1$ ,  $\pi_x > 0$ ,  $\pi_{xx} < 0$ .

With probability  $1 - \pi(x)$  the regulator is forced to accept a renegotiation. This is modeled using the Nash bargaining solution but assuming that renegotiation is costly (because it takes time say). The status quo payoffs which obtain if the negotiation fails are determined as follows: the firm loses its fixed cost and gets the utility level  $U_0 = -F$ . The regulator obtains a status quo payoff that we denote as  $-H$ .

We make appropriate assumptions so that the efficient type firm never wants to renege on its contract<sup>12</sup>. Therefore, costly bargaining takes place under complete information, only when  $\beta = \bar{\beta}$ . Its outcome solves:

$$\max_{\bar{q}, \bar{e}, \bar{U}^E} \left\{ \begin{array}{l} (\bar{U}^E - U_0) \left( \delta W(\bar{q}, \bar{e}, \bar{\beta}) - \lambda \bar{U}^E - W_0 \right) \\ = (\bar{U}^E + F) \left( \delta W(\bar{q}, \bar{e}, \bar{\beta}) - \lambda \bar{U}^E + H \right) \end{array} \right\}. \quad (20)$$

with  $\delta$  in  $(0, 1)$  to model the cost of renegotiation.

It yields the complete information production and effort level  $\bar{q}^*$ ,  $\bar{e}^*$  and the rent level

$$\bar{U}^E = \frac{\delta W(\bar{q}^*, \bar{e}^*, \bar{\beta}) + H}{2\lambda} - \frac{F}{2} \quad (21)$$

i.e. the firm and the regulator share equally the social surplus.

Anticipating the outcome of the renegotiation, the regulator modifies ex ante the contract it offers. From now on, we denote by  $\underline{U}_1$  and  $\bar{U}_1$  the modified rents once the possibility of renegotiation is taken into account by the regulator.

The sequence of events is now the following. If the firm discovers to be a bad type  $\bar{\beta}$ , with probability  $\pi(x)$  it faces tough enforcement and carries out the project despite a

<sup>11</sup>More precisely, we assume that a firm attempts to renegotiate when its ex post utility level after renegotiation is higher than the utility level specified in the contract. We are considering values of parameters where it is better for the regulator to accept the possibility of renegotiation than to give up such large rents in the initial contract so that no type of firm wants to renegotiate.

<sup>12</sup>See conditions below.

negative utility. With probability  $1 - \pi(x)$ , it succeeds in forcing a renegotiation. Moreover, when renegotiation happens, we assume that with some (small) positive probability  $P$  the parties fail to reach an agreement and the status quo payoffs are implemented.

The resulting probabilities are:

$$\begin{aligned}\Pr(U = \underline{U}_1) &= \nu \\ \Pr(U = \bar{U}_1) &= (1 - \nu)\pi(x) \\ \Pr(U = \bar{U}^E) &= (1 - \nu)(1 - \pi(x))(1 - P) \\ \Pr(U = -F) &= (1 - \nu)(1 - \pi(x))P.\end{aligned}$$

We still need the offer of contracts to be incentive compatible (conditions (11) and (12)) and the new ex ante participation constraint writes<sup>13</sup>:

$$\begin{aligned}\nu \underline{U}_1 + (1 - \nu)\pi(x)\bar{U}_1 + (1 - \nu)(1 - \pi(x))(1 - P)\bar{U}^E \\ - (1 - \nu)(1 - \pi(x))PF \geq 0.\end{aligned}\quad (22)$$

Substituting the outcome of renegotiation into the regulator's objective function, it becomes

$$\begin{aligned}\max \nu [W(\underline{q}, \underline{e}, \underline{\beta}) - \lambda \underline{U}_1] + (1 - \nu)\pi(x) [W(\bar{q}, \bar{e}, \bar{\beta}) - \lambda \bar{U}_1] \\ + (1 - \nu)(1 - \pi(x))(1 - P) [\delta W(\bar{q}^*, \bar{e}^*, \bar{\beta}) - \lambda \bar{U}^E] \\ + (1 - \nu)(1 - \pi(x))P [-H] - (1 + \lambda)x.\end{aligned}\quad (23)$$

Maximizing this objective function by making the participation constraint binding we obtain:

$$\underline{q}^E = \underline{q}^*; \underline{e}^E = \underline{e}^* \quad (24)$$

$$\bar{q}^E = \bar{q}^*; \bar{e}^E = \bar{e}^* \quad (25)$$

$$(1 - \nu)\pi'(x^E) = \frac{1 + \lambda}{(1 - \delta)W(\bar{q}^*, \bar{e}^*, \bar{\beta}) + P[\delta W(\bar{q}^*, \bar{e}^*, \bar{\beta}) + H + \lambda F]}. \quad (26)$$

The probability of renegotiation is given by:

$$\Pr(\text{renegotiation}) = (1 - \nu)(1 - \pi(x^E)) \quad (27)$$

where, in the right hand side, the second term, which can be labeled as the government's "tolerance for renegotiation", depends on  $x^E$ , the investment in enforcement.

<sup>13</sup>Note that the choice of the new levels of rent  $\underline{U}_1$  and  $\bar{U}_1$ , which is not unique, must be made in such a way that the efficient type does not want to mimic the bad type and then renegotiate, i.e. s.t.  $\underline{U}_1 \geq \pi(x) [\bar{U}_1 + \Phi(\bar{e})] + (1 - \pi(x))(1 - P) [\bar{U}^E + \Phi(\bar{e}^*)] + (1 - \pi(x))P[-F]$



What are the main features of the solution above? First, an enforcement mechanism is financed. It is valuable to build an enforcement institution only because the social welfare obtained by the initial contract for  $\beta = \bar{\beta}$  is higher than what would result from renegotiation ( $W(\bar{q}^*, \bar{e}^*, \bar{\beta}) > \delta W(\bar{q}^*, \bar{e}^*, \bar{\beta})$ ), or because renegotiation may fail. This enforcement mechanism is imperfect and its quality is determined by (26). The quality of enforcement decreases (and therefore the probability of renegotiation increases) with the efficiency of ex post bargaining  $\delta$ .

Note that an increase of the cost of public funds has a different effect on social welfare  $W(\bar{q}^*, \bar{e}^*, \bar{\beta})$  depending on the sign of revenue net of cost, i.e.,

$$p(q)q - ((\beta - e)q + F + \psi(e)).$$

It is increasing in  $\lambda$  if revenues exceed cost so that the industry is used as a source of public funds. It is decreasing in  $\lambda$  in the other case. So the net effect of an increase of  $\lambda$  is to decrease enforcement in the second case which holds in general for the water and transportation industries<sup>14</sup> that we are considering here.<sup>15</sup>

Second, the power of incentives is not intermediary between those which will be obtained with perfect enforcement (high powered) and self-enforcing contracts (low powered). This is because any rent resulting from ex post renegotiation is captured ex ante in the contract offered by the regulator.

## 2.3 Institutional constraints

Institutional constraints in host countries obviously affect the incidence of renegotiation in concession contracts. In what follows, we introduce in different ways these institutional dimensions in the regulatory contract, focusing specifically on politics, corruption and rule of law.

### 2.3.1 Politics and State Capture

A simple way to model the incidence of political considerations in the occurrence of renegotiations, is to assume that the government is more or less captured by the firm's stakeholders and overweights or underweights the firm's utility in social welfare<sup>16</sup>. Thus, the maximization program consists of a weighted sum of consumers' surplus and the utility

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<sup>14</sup>The effect through  $P\lambda F$  can be neglected for  $P$  small.

<sup>15</sup>In the absence of a proper measure of the cost of public funds, we can proxy it by the lack of institutional quality (associated with a more inefficient tax system).

<sup>16</sup>See Laffont (2000a)

of the firm:

$$W = V + \gamma U$$

where  $\gamma$  may actually be greater than 1. We simply need to assume, for an interior solution to hold, that  $\gamma < 1 + \lambda$ , so that the regulator always wants to minimize and not maximize the firm's rent. A value of  $\gamma$  higher than 1 is thus the sign that the interests of the firm and the government are more aligned, i.e. of a higher degree of state capture by the firm's stakeholders. A value of  $\gamma$  less than 1 is a sign that the government is partially captured by the non-stakeholders of the firm.

Solving the same maximization problem as before, we get a value of  $\bar{U}^E$  defined by equation (21), where at the denominator  $\lambda$  is replaced by  $1 + \lambda - \gamma$ . As for  $x^E$ , it is now given by

$$(1 - \nu)\pi'(x^E) = \frac{1 + \lambda}{(1 - \delta)W(\bar{q}^*, \bar{e}^*, \bar{\beta}) + P[\delta W(\bar{q}^*, \bar{e}^*, \bar{\beta}) + H + (1 + \lambda - \gamma)F]}. \quad (28)$$

What are the effects of an increase in  $\gamma$ , i.e. of a higher degree of state capture on the probability of renegotiation? From (28) it can be seen that it decreases the equilibrium level of enforcement, which implies more renegotiation. When  $\gamma$  increases, the cost of giving up a rent decreases. Suppose first that renegotiation never fails ( $P = 0$ ). Then this lower cost of the rent has no effect because ex ante contracting enables the regulator to capture this rent. However, if, as we have assumed, politicians do not incur losses when a renegotiation fails, the level of capture does not affect social welfare when renegotiation fails. As  $\gamma$  increases, the cost of the rent (when there is no renegotiation or when renegotiation succeeds) decreases. From the firm's participation constraint, it implies that the social cost of losing the sunk cost  $F$  when renegotiation fails decreases as well. It is relatively less costly to provoke renegotiation (because the regulator is relatively less concerned by failure of negotiation) and therefore the level of enforcement decreases. In a dynamic framework, changes of the majority may correspond to shifts in the value of  $\gamma$ . We can expect the probability of renegotiation to be affected by the results of recent elections.

### 2.3.2 Rule of Law or Corruption

We come back to the definition of the function  $\pi(x)$ , assuming now that it takes the form  $\theta\pi(x)$ , where the parameter  $\theta$  stands for the quality of the rule of law or for the level of non-corruption, i.e. of the existing "stock" of institutions. This parameter  $\theta$  may also represent a more direct channel of political capture when regulators or politicians can be bribed.

Coming back to the basic model, equation (26) can now be written:

$$(1 - \nu)\theta\pi'(x^E) = \frac{1 + \lambda}{(1 - \delta)W(\bar{q}^*, \bar{e}^*, \bar{\beta}) + P[\delta W(\bar{q}^*, \bar{e}^*, \bar{\beta}) + H + \lambda F]} \quad (29)$$

so that better rule of law or less corruption implies more investment in enforcement.

The direct effect of an increase in  $\theta$  is thus to decrease the probability of renegotiation, since it decreases the relative cost of enforcing the initial contract. Thus, we expect that in environments characterized by better rule of law or less corruption there will be less renegotiations.

## 2.4 Shocks

A simple way to introduce shocks in our framework is to suppose that the distribution of firm's types is subject to an unanticipated noise, so that upon a shock  $\varepsilon$ , the probabilities of the enterprise being good or bad become  $\{\nu + \varepsilon, 1 - \nu - \varepsilon\}$ . This can be thought of as a shortcut to model a shock affecting either cost or demand of a fraction of the firms and take into account Pareto improving renegotiations made possible by unanticipated events.

The probability of renegotiation then becomes:

$$\Pr(\text{renegotiation}) = (1 - \nu - \varepsilon)(1 - \pi(x^E))$$

which decreases as  $\varepsilon$  increases. This means that positive shocks, such as an increase in demand or a favorable shift in relative prices of inputs or outputs, reduces the probability of renegotiation, while negative shocks (decrease in demand, cost shock) increases the probability of renegotiation.<sup>17</sup>

## 2.5 Outside Financing and Limited Liability

Consider now the case where the firm is protected by limited liability. However, the firm owns assets which can be used as collateral if the firm incurs some debt. The sunk investment has to be made before producing, and financing may take two forms. First, the firm must rely on bank financing but should be guaranteed enough profit to pay back the loan.<sup>18</sup> Second, if private financing is insufficient, the government may finance it. Of course, any combination of these two cases is also possible. Let us introduce the following notation:

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<sup>17</sup>Admittedly, this is a very particular way of extending the model to account for renegotiations due to unexpected events.

<sup>18</sup>Here, we simplify the analysis by excluding renegotiations with the bank itself. It allows us to consider the bank's interest rate as exogenous.

$A$  denotes the firm's assets needed for the project.

$F$  is the necessary additional sunk investment.

$K$  is the amount financed by banks' loans ( $K \in [0, F]$ ), so that  $K = 0$  implies complete government financing, while  $K = F$  corresponds to totally private financing. The interest rate on this loan is  $r$ .

As the firm has to repay  $K$ , its utility level is now:

$$U = \hat{t} + p(q)q - (\beta - e)q - (1 + r)K - \Psi(e). \quad (30)$$

Moreover, since the bank must be repaid, the firm must have a non negative utility:<sup>19</sup>

$$U \geq 0.$$

This limited liability constraint ensures that the bank is always paid back. To simplify the analysis, we thus consider that the regulator takes this constraint into account in his program and does not include the bank's welfare in social welfare. A further justification is that the bank may be a foreign bank with respect to which default is not affordable.

Since the government finances only  $F - K$ , at the cost of public fund  $\lambda$ , the equivalent of (14) becomes:

$$W(q, e, \beta) = S(q) + \lambda p(q)q - (1 + \lambda)((\beta - e)q + F + rK + \Psi(e)). \quad (31)$$

Note that the level of  $K$  will affect the status quo payoff of the government in case of renegotiation. In what follows, we will assume that  $A < F$ , so that the firm is able to repay only a share of its debt in case of failure<sup>20</sup>. Two subcases arise. If  $K < A$ , the bank gets  $K$  and the government gets the remainder  $A - K$  that covers part of its investment  $F - K$ , leaving a net loss  $F - A$ . The status quo payoffs of the firm and the government are respectively:

$$(-A, -H - F + A).$$

If  $K > A$ , the bank gets only  $A$  while the government gets nothing, so it loses  $F - K$ . Payoffs are then:

$$(-A, -H - F + K).$$

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<sup>19</sup>We could specify this limited liability constraint on financial flows  $\hat{t} + p(q)q - (\beta - e)q - (1 + r)K \geq 0$ . This would introduce more regimes to consider in the program of the regulator below.

<sup>20</sup>Were we to consider the case  $A > F$ , the firm's assets would cover the total losses in case of renegotiation failure. The bank would get  $K$  and the government  $F - K$ , and the status quo payoffs would be  $(-F, -H)$ , thus being independent of financing.

These two cases can be summarized, by noting that the status quo payoffs are:

$$(-A, -H - F + \max(K, A)). \quad (32)$$

With the possibility of renegotiation and the disagreement point now given by (32), ex post bargaining yields:

$$\bar{U}^E = \frac{\delta W(\bar{q}^*, \bar{e}^*, \bar{\beta}) + H + F - \max(K, A) - \lambda A}{2\lambda}. \quad (33)$$

So, private financing costs more than public financing, but it increases the status quo payoff of the regulator and therefore its bargaining power in the renegotiation. Accordingly the outcome of renegotiation for the firm decreases with  $K$ . Similarly it decreases (resp. increases) with  $F$  if  $\delta(1 + \lambda) > 1$  (resp.  $\delta(1 + \lambda) < 1$ ). Note that the outcome of renegotiation for the regulator unambiguously decreases with  $F$ .

The program becomes then:

$$\begin{aligned} & \max \nu [W(q, \underline{e}, \underline{\beta}) - \lambda \underline{U}_1] + (1 - \nu)\pi(x) [W(\bar{q}, \bar{e}, \bar{\beta}) - \lambda \bar{U}_1] \\ & + (1 - \nu)(1 - \pi(x))(1 - P) [\delta W(\bar{q}^*, \bar{e}^*, \bar{\beta}) - \lambda \bar{U}^E] \\ & + (1 - \nu)(1 - \pi(x))P [-H - F + \max(K, A)] - (1 + \lambda)x \end{aligned} \quad (34)$$

s.t.

$$\begin{aligned} & \nu \underline{U}_1 + (1 - \nu)\pi(x)\bar{U}_1 \\ & + (1 - \nu)(1 - \pi(x))(1 - P)\bar{U}^E \\ & - (1 - \nu)(1 - \pi(x))PA \geq 0 \end{aligned} \quad (35)$$

$$\underline{U}_1 \geq \bar{U}_1 + \Phi(\bar{e}) \quad (36)$$

$$\bar{U}_1 \geq \underline{U}_1 - \Phi(\underline{e} - \Delta\beta) \quad (37)$$

$$\underline{U}_1 \geq 0 \quad (38)$$

$$\bar{U}_1 \geq 0. \quad (39)$$

The binding constraints are the limited liability constraint of the bad type (39) and either the incentive constraint of the good type (36) or the participation constraint (35). These two constraints can be summarized by writing (using the fact that  $\bar{U}_1 = 0$ ):

$$\underline{U}_1 \geq \max \left\{ \Phi(\bar{e}), \frac{(1 - \nu)(1 - \pi(x)) [PA - (1 - P)\bar{U}^E]}{\nu} \right\}$$

Noticing that now renegotiation happens only if  $\bar{U}^E \geq 0$ , and assuming that  $P$  is small, the second term in parenthesis is negative, so only the incentive constraint (36) is

binding ( $\underline{U}_1 = \Phi(\bar{e})$ ). Substituting the values of  $\underline{U}_1, \bar{U}_1$  and  $\bar{U}^E$ , the objective function becomes:

$$\begin{aligned} & \max \nu [W(\underline{q}, \underline{e}, \underline{\beta}) - \lambda \Phi(\bar{e})] + (1 - \nu) \pi(x) [W(\bar{q}, \bar{e}, \bar{\beta})] \\ & + (1 - \nu)(1 - \pi(x))(1 - P) \left[ \frac{\delta W(\bar{q}^*, \bar{e}^*, \bar{\beta}) - H - F + \max(K, A) + \lambda A}{2} \right] \\ & + (1 - \nu)(1 - \pi(x))P [-H - F + \max(K, A)] - (1 + \lambda)x. \end{aligned} \quad (40)$$

The effort and output levels of the bad type are now distorted because an expected rent is given up to the firm:

$$\Psi'(\bar{e}^L) = \bar{q}^L - \frac{\lambda}{1 + \lambda} \frac{\nu}{(1 - \nu) \pi(x^L)} \Phi'(\bar{e}^L). \quad (41)$$

The presence of the term  $\pi(x^L)$  at the denominator implies a stronger distortion than the second best ex post contracting level  $(\bar{q}^{SB}, \bar{e}^{SB})$ .

As for the level of enforcement, it is given by:

$$(1 - \nu) \pi'(x^L) = \frac{1 + \lambda}{[W(\bar{q}^L, \bar{e}^L, \bar{\beta}) - \delta(\frac{1-P}{2})W(\bar{q}^*, \bar{e}^*, \bar{\beta})] + (\frac{1+P}{2})[\delta W(\bar{q}^*, \bar{e}^*, \bar{\beta}) + H + F - \max(K, A)] - (1-P)\lambda A}. \quad (42)$$

What is the effect of variations in  $F$  and  $K$  on the probability of renegotiation? From the denominator of (42), and taking into account the presence of  $F$  and  $K$  in the expression of  $W(\bar{q}, \bar{e}, \bar{\beta})$  it comes that:

$$\frac{\partial x}{\partial K} < 0.$$

This first effect is due to the combined effect that an increase of  $K$  increases cost (and therefore decreases the gain from avoiding renegotiation) and improves the regulator's bargaining power<sup>21</sup> and therefore decreases the cost of renegotiation; and for  $P$  small enough,

$$\frac{\partial x}{\partial F} < 0.$$

This second effect is also due to the fact that an increase  $F$  increases cost.<sup>22</sup> Although it also decreases the bargaining power of the regulator, this cost effect dominates.<sup>23</sup>

<sup>21</sup>Note that if renegotiation was involving the bank it would remain true that an increase of  $K$  which weakens the bank's position should improve the bargaining power of the regulator.

<sup>22</sup>We have neglected the fact that  $x^L$  enters (41) so that there is a feedback effect as a decrease of  $x$  decreases  $W(\bar{q}^L, \bar{e}^L, \bar{\beta})$ . This reinforces the effect on  $x$ .

<sup>23</sup>This is true whenever  $-(1 + \lambda) [1 - (1 - P) \frac{\delta}{2}] + \frac{1+P}{2} (-\delta(1 + \lambda) + 1) < 0$ . This can be rewritten  $(1 + \lambda)(1 + \delta P) > \frac{1+P}{2}$ , which is always verified.

There is, however, an incentive effect of the limited liability constraint. Indeed, the expected utility of the firm is now strictly positive. Therefore, it has incentives to invest to increase its expected profit. Suppose that with expenses  $i(\nu)$  ( $i'(\nu) > 0, i''(\nu) \geq 0$ ) the firm increases the probability that  $\beta = \underline{\beta}$ . The firm chooses its investment level by solving:

$$\max_{\nu} \nu \Phi(\bar{e}) + (1 - \nu) (1 - \pi(x^L)) \left( (1 - P) \bar{U}^E - PA \right) - i(\nu).$$

Assuming for simplicity that it does not take into account the impact of its choice on the regulation, we get immediately that:

$$\text{sign} \frac{d\nu}{dX} = -\text{sign} \frac{d\bar{U}^E}{dX}.$$

This means that everything that decreases (resp. increases) the firm's bargaining power and therefore the utility from renegotiation increases (resp. decreases) its incentive for investment and therefore decreases (resp. increases) the probability of renegotiation.

From the expression of  $\bar{U}^E$  we see that, through this effect, if  $F$  increases, either the probability of renegotiation increases (case  $\delta(1 + \lambda) < 1$ ) which reinforces the direct effect, or it decreases (case  $\delta(1 + \lambda) > 1$ ). On the other hand, an increase in  $K$  decreases the probability of renegotiation.

Overall, more investment unambiguously increases the probability of renegotiation if  $\delta(1 + \lambda) < 1$ , and has an ambiguous effect otherwise. More private financing always has an ambiguous effect.

## 2.6 Regulation, Arbitration and other Contractual Clauses

Concessions contracts sometimes contain specific clauses meant to deal with the potential occurrence of renegotiations, as for example the existence of a formal set of arbitration rules in case of disputes, and minimum income guarantees.

Arbitration rules are processes which help settle disputes, thereby making renegotiation less costly, i.e. increase  $\delta$ . We have seen that a increase in  $\delta$  decreases  $x^E$  and increases the probability of renegotiation. In this case, we would thus expect the existence of formal arbitration rules (higher  $\delta$ ) to increase the probability of renegotiation. On the other hand, the existence of a regulatory body or more experience in concession contracting at the time of award will decrease the probability of renegotiation due to the more obvious effect of greater expertise in contracting.

A minimum income guarantee should decrease the desirability of renegotiation by firms but it also decreases the incentives for effort.

However, as discussed above, clauses of the concession affecting the outcome of a potential renegotiation should be treated as endogenous. This endogeneity has two dimensions. First there is a direct self-selection effect. For example, minimum income guarantee clauses are more likely to be introduced in more risky projects. Second, the inclusion of such clauses has a moral hazard effect, in that it may affect the incentive of the firm to behave efficiently as explained above. This implies a countervailing effect on the probability of renegotiation. Ultimately, determining the qualitative impact of such rules requires to take into account both effects, and is an empirical matter.

Also, the choice of a price cap regulation over a cost plus regulation is ambiguous because on the one hand it creates more risk to the firm and therefore more opportunities for renegotiation, but on the other hand more efficient firms select more easily price cap contracts.<sup>24</sup>

## 2.7 Impact on the Probability of Renegotiation

Table 1 summarizes the impact of key variables (institutional quality, i.e. rule of law/non-corruption,  $\theta$ ; shock  $\varepsilon$ ; degree of state capture  $\gamma$ ; efficiency of bargaining (arbitration)  $\delta$ ; minimum income guarantee; amount of investment required  $F$ ; share of private financing  $K$ ) on the probability of renegotiation, as well as the expected effects of some additional variables that we did not model explicitly (existence of a regulatory body which yields better contract and a stronger commitment of the government to not renegotiate and should obviously decrease the probability of renegotiation, price cap regulation which has an ambiguous effect as discussed above).

Table 1: Impact of key variables on the probability of renegotiation

Effect of an increase in:	Probability of renegotiation ( $1 - \nu - \varepsilon$ )( $1 - \pi(x^\varepsilon)$ )
Institutional quality $\theta$	-
Shock $\varepsilon$	-
Political capture $\gamma$	+
Arbitration	+
Cost of public funds $\lambda$	+
Investment $F$	+ / ambiguous
Private financing $K$	ambiguous
Minimum income guarantee	ambiguous
Existence of regulatory body	-
Previous experience	-
Price cap regulation	ambiguous

<sup>24</sup>See Jeon and Laffont (1999).



### 3 Empirical Analysis

#### 3.1 The Data

We use an original data set, developed by the World Bank, which describes the characteristics of nearly 1,000 infrastructure projects awarded in Latin American and Caribbean countries from 1989 to 2000, in the sectors of telecommunications, energy, transport and water. We restrict ourselves to the sectors of transport and water, both because renegotiations only occur in these sectors and because of their characteristics: first, transport and water projects are concessions *stricto sensu*, as opposed to telecommunications and energy projects which in some cases are closer to privatizations with transfer of assets; second, they both imply in general significant transfers from the state to the private operators<sup>25</sup>.

Considering only concessions for which we know whether they were renegotiated or not as of 2000, and at what date this renegotiation took place, and restricting to the 5 countries (Argentina, Brazil, Chile, Colombia and Mexico) where concessions were granted on a regular basis through the 1990s in these two sectors, we get a sample of 307 concessions. Table 2 shows the distribution by countries and sectors.

**Table 2:** Concessions by country and sector

	<i>Transport</i>	<i>Water</i>	<i>Total</i>
Argentina	38	5	43
Brazil	36	24	60
Chile	23	2	25
Colombia	41	7	48
Mexico	80	51	131
Total	218	89	307

The database contains detailed information about the characteristics of these concessions, including general details about the projects (sector, activity, year of award), the award criteria, size and duration of the concession, information with respect to the institutional context and degrees of freedom of the regulator, the type of regulatory framework put in place (price cap, rate of return, no regulation), and other details of the concession contract like arbitration clauses, nationality of operators, among others. Appendix 1 presents the full list and definitions of variables used in the analysis below. Table 3 summarizes the frequency of the concessions' key characteristics in our sample which are represented through dummy variables.

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<sup>25</sup>See Guasch (2001) for a detailed description of the data.

**Table 3: Characteristics of the concessions**

	Whole				Transport				Water			
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No		
Renegotiations	162	52,8%	145	47,2%	99	45,4%	119	54,6%	63	70,8%	26	29,2%
Renegotiations initiated by firms	53	17,3%	254	82,7%	49	22,5%	169	77,5%	4	4,5%	85	95,5%
Renegotiations initiated by Govt.	94	30,6%	213	69,4%	35	16,1%	183	83,9%	59	66,3%	30	33,7%
Renegotiations initiated by both	15	4,9%	292	95,1%	15	6,9%	203	93,1%	0	0,0%	89	100,0%
Existence of regulatory body	180	58,6%	127	41,4%	168	77,1%	50	22,9%	12	13,5%	77	86,5%
Bidding process	272	88,6%	35	11,4%	185	84,9%	33	15,1%	87	97,8%	2	2,2%
Investment requirements	235	76,5%	72	23,5%	198	90,8%	20	9,2%	37	41,6%	52	58,4%
Private financing only	160	52,1%	147	47,9%	139	63,8%	79	36,2%	21	23,6%	68	76,4%
Price cap regulation	283	92,2%	24	7,8%	199	91,3%	19	8,7%	84	94,4%	5	5,6%
Rate of return regulation	23	7,5%	284	92,5%	19	8,7%	199	91,3%	4	4,5%	85	95,5%
Arbitration process	179	58,3%	128	41,7%	172	78,9%	46	21,1%	7	7,9%	82	92,1%
Minimum income guarantee	63	20,5%	244	79,5%	62	28,4%	156	71,6%	1	1,1%	88	98,9%

The time structure of the sample is also important. Table 4 presents the number of outstanding concessions by country, from 1989 to 2000, and table 5 shows the occurrence of renegotiations in each country and year, giving first the number of renegotiations<sup>26</sup> initiated by firms, and second the total number of renegotiations regardless of their initiator. In total, 162 of the 307 concessions were renegotiated at some point during the time period under consideration, the bulk of renegotiations taking place in four countries: Argentina, Brazil, Colombia and Mexico. Moreover a look at table 5 reveals the apparent importance of economic fluctuations and political shocks in determining renegotiations. Indeed, the main peaks coincided with clearly identified events: in Argentina in 1990 (hyperinflation and recession) and, with a lag, after 1995 (aftermath of the 1995 Mexican crisis), in Brazil in 1999 (devaluation of the real), in Colombia in 2000 (recession) and in Mexico around 1995 (Mexican crisis). Although not all shocks have triggered waves of renegotiations, these facts suggest the consideration of economic and political fluctuations as potential determinants of renegotiations.

**Table 4: Outstanding concessions by country and by year**

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Argentina	1	15	4	16	29	40	52	51	50	42	41	41
Brazil	-	-	-	-	-	1	6	20	36	59	61	37
Chile	-	-	-	1	1	3	6	9	86	95	101	105
Colombia	-	-	-	1	6	18	22	29	37	42	45	43
Mexico	9	23	34	45	61	67	66	54	63	87	105	109

<sup>26</sup>A revision of the contract is classified as a renegotiation when it is a substantive revision and not a straightforward implementation or adaptation of the clauses in the original contract.

**Table 5: Renegotiations by country and by year**

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Argentina	0/0	12/12	2/2	1/1	0/0	0/0	1/1	3/3	10/11	3/3	0/0	0/0	32/33
Brazil	-	-	-	-	-	0/0	0/0	0/0	0/1	0/5	0/24	0/6	0/36
Chile	-	-	-	0/0	0/0	0/0	0/0	0/0	0/0	1/1	0/0	0/0	1/1
Colombia	-	-	-	0/0	0/0	0/0	0/1	0/1	0/0	0/0	1/3	14/14	15/19
Mexico	0/0	0/1	0/1	1/8	0/12	1/14	2/21	0/11	1/3	0/2	0/0	0/0	5/73
Total	0/0	12/13	2/3	2/9	0/12	1/14	3/23	3/15	11/15	4/11	1/27	14/20	53/162

Renegotiations led by firms / total of renegotiations

As for renegotiations initiated by firms, they amount to 53, of which 49 in the transport sector and only 4 in water. Moreover, they concentrate in Argentina and Colombia, while in Brazil and Mexico renegotiations were almost always initiated by the government or both. In this paper, we focus on these firm-led renegotiations, and as said in the introduction, we leave for another paper the analysis of government led renegotiations.

We build a panel sample by introducing in any given year macroeconomic variables (GDP growth and real exchange rate appreciation ) and a political dummy indicating the occurrence of national elections (presidential or legislative). Lastly, to capture the influence of the broad institutional context, we introduce indices of corruption, rule of law and bureaucratic quality. We get an unbalanced rotating panel of 1267 observations, covering 12 years and 307 concessions.

### 3.2 Probit Analysis

To take full advantage of the information included in each individual observation, we then run a probit model using the whole panel described above. This allows us to take into account the specific characteristics of each individual concession including, on top of general and regulatory details, particular aspects as the time elapsed since the initial award and the previous experience at the time of award. The output of these regressions is in tables 6 to 8.

Table 6 shows our basic specification, including the characteristics of the contracts, the regulatory and institutional environment, a sector dummy, political and economic shocks as well as the duration since award of the concession to account for the dynamics of the contract. The existence of a regulator has a significant and negative impact on the probability of renegotiation, as does better institutional quality, here represented by an index of bureaucratic quality. Concessions regulated by price caps prove more fragile, and so do older contracts. Both the existence of investment requirements and the exclusivity of private financing increase the occurrence of renegotiations. Finally, as for

shocks, fluctuations in the macroeconomic growth rate significantly affect the probability of renegotiations, i.e. recessions increase it while booms reduce it, and this probability also goes up in years following national elections, although this last effect is only weakly significant.

Table 6: Random effect probit panel  
Dependent variable: Dummy variable indicating the occurrence of renegotiation initiated by the firm

	(1)	(2)	(3)	(4)	(5)	(6)
Existence of regulatory body	-1.09* (-5.07)	-1.15* (-5.05)	-1.07* (-4.98)	-1.08* (-5.09)	-1.10* (-5.09)	-1.51* (-5.82)
Price cap	0.55*** (1.68)	0.63*** (1.88)	0.58*** (1.75)	0.60*** (1.85)	0.45 (1.25)	0.81** (2.46)
Duration since award	0.19* (3.97)	0.18* (3.58)	0.20* (4.07)	0.20* (4.03)	0.18* (3.53)	0.15* (2.72)
Investment requirements	0.78** (1.99)	0.74*** (1.87)	0.83** (2.09)	0.60 (1.57)	0.79** (1.99)	0.65*** (1.71)
Private financing	0.51** (1.90)	0.40 (1.38)	0.48*** (1.80)	-0.11 (-0.23)	0.55** (2.00)	0.15 (0.53)
Bureaucratic quality	-0.35** (-2.54)	-0.29*** (-1.82)	-0.36* (-2.60)	-0.39* (-2.76)	-0.32** (-2.19)	-0.21 (-1.47)
Bidding process		-0.27 (-0.91)				
Duration of contract			-0.01 (-1.00)			
Arbitration process				0.73 (1.32)		
Minimum income guarantee					0.16 (0.67)	
Corruption						-0.43* (-3.73)
Election-1	0.29 (1.53)	0.30 (1.59)	0.28 (1.50)	0.27 (1.44)	0.29 (1.55)	0.40*** (1.95)
GDP growth-1	-0.06* (-3.38)	-0.06* (-3.24)	-0.06* (-3.17)	-0.06* (-3.21)	-0.06* (-3.36)	-0.07* (-3.26)
GDP growth-2	-0.14* (-6.15)	-0.14* (-6.18)	-0.14* (-6.06)	-0.14* (-6.15)	-0.14* (-6.14)	-0.15* (-6.07)
Transport sector dummy	0.75** (2.21)	0.80** (2.32)	0.70** (2.03)	0.59 (1.53)	0.69*** (1.93)	1.05* (2.94)
Number of obs.	1132	1132	1128	1100	1127	1132
Log Likelihood	-132.49	-132.08	-131.95	-130.97	-132.26	-125.21

Coefficients significant at the 1% (\*), 5% (\*\*) and 10% (\*\*\*) level.

In columns 2 to 6, we add to this basic specification, a number of other variables. The existence of a bidding process to award the concession proves not significant in column 2. This probably reflect the fact that bidding induces several potentially opposed effects: on the one hand, the selection of a more efficient operator should make the concession more robust; on the other hand, however, by reducing its prospective profits by this ex ante competition, it could also make it more sensible to shocks. Finally, strategic bidding behavior can also generate an increase in further renegotiations. In columns 3, 4 and 5, the duration of the concession contract, the existence of an arbitration process, and of minimum income guarantee are also not significant. Finally, in column 6, an index of corruption shows that a more corrupt environment increases renegotiations.<sup>27</sup> Not surprisingly, in this case the bureaucratic quality index loses significance.

Several contract characteristics (duration of the contract, minimum income guarantee, arbitration process, price cap, regulation and the structure of financing) refer to clauses in the concession contract which are likely to be introduced or not according to the risk of renegotiation perceived ex ante and are thus endogenous to the type and the riskiness of the projects undertaken. This highlights the need to address the broader issue of contract endogeneity.

### 3.3 Addressing contract endogeneity

The endogeneity of contracts' clauses has two dimensions. First, there is an ex ante self-selection problem, in that the contracting parties would select specific clauses, type of regulation and financing according to their (sometimes unobservable) characteristics, or to the characteristics of the project. For example, the inclusion of specific arbitration rules could be induced by the government's anticipation of potential renegotiations and of the firm's perceived renegotiation skills. Conversely, minimum income guarantee would be included as a mean to make risky concessions attractive to private agents. A similar problem applies to the type of tariff regulation chosen. A self-selection effect would suggest that more efficient firms would prefer price cap regulation, which is more risky but would allow these firms to get higher rents, but may also lead to think that riskier projects would be regulated by lower-powered (cost plus) schemes. Finally, the type of financing which prevails cannot be considered as exogenous either, since private operators would be more willing to finance projects which appear as less risky and/or more profitable.

Second, there is an ex post moral hazard problem (the effect on the  $\nu$  variable in our model), due to the fact that once the contract has been signed, the firm and the government would act strategically given the nature of this contract. Facing shorter

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<sup>27</sup>This corresponds to a negative sign of the coefficient, due to the fact that a higher value of the index means less corruption (see Appendix 1).

contracts, firms might be induced to behave more efficiently to increase their chance to be awarded the contract again later on. Conversely, when protected by minimum income guarantee, they might make less efforts. Price caps or private financing can also be expected to have incentive effects on the behavior of firms.

The problem we intend to tackle is to disentangle these two dimensions, in order to assess the real incentive effect of each specific aspect of the contract. More precisely, we use a two stage process aimed at controlling the self-selection effect of each of the variables suspected to be endogenous.<sup>28</sup>

To do this, we need to find suitable instruments. We take as instruments: sectors, corruption, bureaucratic quality, rule of law, and existence of regulatory body, which are obviously exogenous in the sense that they are not determined by the risk of potential renegotiations. Nevertheless, finding instrumental variables that would not enter the equation explaining the probability of renegotiation appears very difficult:<sup>29</sup> virtually any contract characteristics and any aspects of the institutional and macroeconomic environment can be argued to have an impact on the probability of renegotiation. Appendix 2 presents the “reduced form” equation, including only truly exogenous variables.

The correct treatment of endogeneity in non linear probit models is still an open question (see Wooldridge, 2002). One of the available strategy is the following. We run probit estimates (OLS in the case of contracts’ duration) of the six variables we want to instrument, using the static sample of the 307 concessions. Note that these first stage regressions are fairly satisfactory (see Appendix 3). We then take the predicted values of each of these variables and reintroduce them in the probit panel. Finally, we estimate the equations with these instrumented variables. The results are in Table 7.

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<sup>28</sup>We test for endogeneity, by running regressions augmented with the residuals of the first stage regressions. Endogeneity is confirmed for the price cap, the arbitration and the minimum income variables.

<sup>29</sup>Although the existence of one of these variables not entering the equation explaining renegotiation is doubtful, identification is still ensured by the nonlinearities of the model.

Table 7: Random effect probit panel  
 Dependent variable: Dummy variable indicating the occurrence of  
 renegotiation initiated by the firm

	(1)	(2)	(3)	(4)	(5)
Existence of regulatory body	0.41 (1.00)	0.03 (0.05)	-1.20 (-1.40)	0.84*** (1.87)	1.91* (2.94)
Price cap (IV)	8.42* (3.97)	8.09* (3.65)	6.57* (2.90)	18.15* (4.49)	13.37* (4.77)
Duration since award	0.23* (4.12)	0.23* (4.19)	0.20* (3.45)	0.17* (2.93)	0.20* (3.41)
Investment requirements	0.86** (2.19)	0.79*** (1.96)	0.93** (2.36)	0.82** (2.06)	0.77** (1.97)
Private financing (IV)	4.56* (3.96)	1.48 (0.66)	2.89** (2.07)	3.87* (2.99)	4.28* (3.59)
Bureaucratic quality	-0.75* (-3.77)	-0.85* (-4.05)	-0.21 (-0.65)	-0.23 (-0.83)	-0.23 (-0.87)
Arbitration process (IV)		3.74 (1.61)			
Minimum income guarantee (IV)			7.98** (2.10)		
Bidding process (IV)				-3.48* (-3.25)	
Duration of contract (IV)					-0.13* (-3.15)
Election-1	0.21 (1.02)	0.23 (1.16)	0.30 (1.41)	0.23 (1.09)	0.21 (1.02)
GDP growth-1	-0.07* (-3.18)	-0.07* (-3.33)	-0.08* (-3.52)	-0.07* (-3.02)	-0.07* (-3.15)
GDP growth-2	-0.16* (-6.41)	-0.16* (-6.50)	-0.18* (-6.10)	-0.20* (-6.11)	-0.17* (-5.98)
Transport sector	-1.85** (-2.43)	-2.79* (-2.86)	-2.45* (-2.93)	-2.20* (-2.65)	-2.87* (-3.35)
Number of obs.	1132	1132	1132	1132	1132
Log Likelihood	-126.43	-125.08	-124.07	-119.60	-121.05

Note: IV in parenthesis denotes an instrumented variable.  
 Coefficients significant at the 1% (\*), 5% (\*\*) and 10% (\*\*\*) level.

The price cap variable remains positive and significant once instrumented. Thus, despite the potential self-selection effect, the higher riskiness of price caps still leads to more renegotiation of the concessions under this regulatory scheme.<sup>30</sup>

Concessions financed exclusively by the private sector are renegotiated more often and the effect remains after instrumenting it. Again, on top of the self-selection effect, the prevalence of private finance appears to be linked to more renegotiations.

<sup>30</sup>It must be noted however that since the instrumented variables are dummy variables varying in the range [0, 1] (except for the duration of contracts), their predicted values cover a reduced range. This induces a scale effect that explains the observed increases in the coefficients' sizes and does not allow for clear inferences on the magnitude of the effects. For example, the predicted value corresponding to the price cap variable has a mean very close to the actual variable (0.92 compared to 0.94), but varies only in the range [0.52, 1].

The instrumented minimum income guarantee variable is positive and significant at the 5% level. In this case, it seems that, even taking into account the self-selection effect of riskier concessions, this kind of clause fails to reduce renegotiation. This tends to confirm the inappropriateness of such provision (see for example Engel et alii, 2000). The instrumented arbitration process variable is positive but still not significant. The existence of a bidding process now is negative and significant, which support the idea that the first efficiency argument mentioned above dominates. Finally, longer contracts appear to be significantly more robust when this variable is instrumented.

One aspect worth noticing is that in 3 out of 5 cases in table 7, the effect of the existence of a regulator loses significance when some contract clauses are instrumented. Technically, this may be related to the fact that this variable is used both in the instrumental first-stage regressions and in the final specification. Intuitively, this could indicate that the influence of regulatory bodies precisely goes through their ability in selecting specific clauses adapted to the type and circumstances of the concessions.

Table 8 presents various robustness checks.

Since our model is one of renegotiations initiated by firms, we started by using firm-led renegotiations as our dependent variable. However, as discussed in Guasch (2001), the distinction according to the renegotiations' initiators is somewhat uncertain since a number of government-led renegotiations can be considered induced by the poor performance of the operator. This is why, in columns 1 and 2 we intend to see whether our results are robust when taking as dependent variable the dummy variable indicating whether or not there is a renegotiation, whatever the initiator. As can be seen, the main difference is the effect of the investment and financing variables. The existence of investment requirements loses significance, while the private financing variable has first a negative effect, which becomes positive but not significant when instrumented. This is not really surprising, since both variables have opposite effects on the bargaining powers of the firm and the government respectively, and so should affect their willingness to renegotiate in an opposite way. A more precise analysis of this issue is thus left for a future paper on government led renegotiations.

Relatedly, the fact that a renegotiation is profitable to the firm does not exclude that the government could gain too. This suggests using as dependent variable the sum of renegotiations initiated by firms and those initiated by both parties. The results, in columns 3 and 4, show very little variation with respect to the standard case of Tables 6 and 7. Although the price cap and private financing variables lose some significance when introduced directly, they are positive and very significant when instrumented. Other results remain unchanged, and the investment and election variables are even more significant than before.



In columns 5 and 6, we run the regressions excluding from the sample the two countries, Chile and Brazil, in which they were no or few firm-led renegotiations. The general results are again robust. Furthermore, a similar effect as in the previous two columns occurs with the financing variable and again it disappears when running two-stage regressions. Observing that Brazil has no firm-led but 36 government-led renegotiations, this result is probably linked to the bargaining power effect discussed before.

Table 8: Random effect probit panel

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sample	Basic	Basic	Basic	Basic	Basic without Brazil and Chile	Basic without Brazil and Chile	Basic	Basic	Basic	Basic
Dependent variable	All renegot.	All renegot.	Renegotiated by firms or by both	Renegotiated by firms or by both	Renegotiated by firms	Renegotiated by firms	Renegotiated by firms	Renegotiated by firms	Renegotiated by firms	Renegotiated by firms
Existence of regulatory body	-1.13* (-6.32)	0.12 (0.36)	-0.85* (-4.38)	0.55 (1.45)	-1.67* (-6.42)	-0.43 (-0.90)	-1.21* (-5.88)	0.34 (0.83)	-0.82** (-2.29)	-0.59 (-1.50)
Price cap	0.28 (1.18)		0.33 (1.24)		0.65*** (1.91)		0.54 (1.64)		0.61*** (1.80)	
Price cap (IV)		6.07* (4.29)		7.44* (4.16)		8.10* (3.51)		8.22* (3.84)		5.71*** (1.89)
Duration since award	0.23* (6.68)	0.24* (6.71)	0.15* (3.60)	0.17* (3.76)	0.27* (4.69)	0.33* (4.88)	0.20* (4.29)	0.23* (4.31)	0.23* (4.17)	0.31* (4.44)
Investment requirements	0.06 (0.33)	0.20 (1.18)	0.72** (1.99)	0.91** (2.45)	1.64* (3.44)	1.47* (3.18)	0.62*** (1.66)	0.60*** (1.68)	1.14* (2.69)	1.06** (2.41)
Private financing	-0.63* (-4.48)		-0.06 (-0.33)		-0.02 (-0.07)		0.68* (2.57)		-0.25 (-0.78)	
Private financing (IV)		1.36 (1.61)		3.43* (3.40)		2.43*** (1.83)		4.97* (4.61)		-1.48 (-1.31)
Bureaucratic quality	-0.44* (-4.62)	-0.44* (-2.96)	-0.39* (-3.20)	-0.71* (-4.00)	-0.34** (-2.33)	-0.44** (-2.06)	-0.70* (-5.00)	-1.12* (-6.02)		
Election-1	0.34* (2.85)	0.20*** (1.67)	0.46* (3.02)	0.41* (2.59)	0.38*** (1.83)	0.23 (1.07)	0.34** (1.97)	0.28 (1.54)	0.27 (1.21)	0.20 (0.88)
GDP growth-1	-0.06* (-4.56)	-0.08* (-5.32)	-0.04** (-1.99)	-0.03*** (-1.84)	-0.08* (-4.22)	-0.10* (-4.27)			-0.06* (-2.87)	-0.06* (-2.75)
GDP growth-2	-0.11* (-6.00)	-0.12* (-6.32)	-0.12* (-5.89)	-0.13* (-6.23)	-0.13* (-5.32)	-0.15* (-5.58)			-0.13* (-5.26)	-0.16* (-5.27)
Exchange rate -1							1.47** (2.27)	1.69** (2.52)		
Exchange rate -2							4.60* (5.08)	5.46* (5.41)		
Argentina dummy									7.25* (15.36)	7.50** (2.32)
Chile dummy									5.50 (-)	5.68*** (1.74)
Colombia dummy									6.73* (11.11)	7.34* (2.66)
Mexico dummy									5.72* (10.05)	5.85*** (1.91)
Transport sector dummy	0.38*** (1.79)	-1.37** (-2.40)	1.19* (3.88)	-1.13*** (-1.66)	0.27 (0.69)	-1.36*** (-1.66)	0.96* (2.86)	-1.76** (-2.42)	-0.18 (-0.43)	-0.07 (-0.09)
Number of obs.	1132	1132	1132	1132	908	908	1122	1122	1132	1132
Log Likelihood	-314.25	-313.08	-188.84	-181.05	-111.26	-106.61	-144.92	-139.13	-109.09	-104.05

Note: IV in parenthesis denotes an instrumented variable. Coefficients significant at the 1% (\*), 5% (\*\*) and 10% (\*\*\*) level.

Columns 7 and 8 present the basic specification, where growth shocks have been replaced by exchange rate movements. This kind of shock has also a clear effect, with lagged measures of exchange rate depreciation significantly increasing the probability of renegotiations by firms. The other results are unchanged with respect to Tables 6 and 7.

Finally, in columns 9 and 10, we exclude institutional variables and include instead a full set of country dummies. The main results remain unchanged, except for the private financing variable, which is now negative but not significant.

### 3.4 Relation to theoretical results

The empirical results presented above are broadly consistent with our theoretical model. We had first the prediction that better institutional quality (both through our  $\theta$  variable, representing rule of law, non-corruption, or the quality of the bureaucracy) should imply less renegotiations. This is indeed the case as the coefficients of the institutional variables are generally negative and significant.

Political cycles have a positive effect, in that post-election years witness more renegotiations. This result can be related to the effect of the degree of state capture  $\gamma$ . Under this approach, it means that, as governments closer to the firms access to power, they are likely to tolerate more renegotiations.

As anticipated, shocks have the expected effect and are significant determinants of the probability of renegotiation.

Relating the existence of arbitration rules to the cost of bargaining, the empirical results are consistent with our model, in that these rules increase the occurrence of renegotiation.

The prediction with respect to investment, which for some values of the parameters we expected to have a positive effect on the probability of renegotiation, is broadly confirmed by the probit analysis. For private financing, the model yielded ambiguous predictions due to the moral hazard effect through the impact on the relative bargaining power of the contracting parties. The empirical results show that the dominant effect is positive for firm-led renegotiations. As discussed above, the results on these two variables, and especially on the private financing one appear to be the main differences between firm- and government-led renegotiations. The effect of private financing is also relatively unstable when marginally modifying the sample or the dependent variable. We leave a more complete analysis of this issue for a future paper.

Finally, for the other variables not modeled explicitly, as anticipated, we get negative effects for the existence of a regulator, while income guarantees and price cap regulation have positive effects.

## 4 Conclusion: Policy Implications

We now discuss in some more details the principal results, in particular with regards to their practical policy implications.

### **Regulatory environment, experience and contracts' incompleteness.**

The first feature of the environment having an impact on the probability of renegotiation is the existence of a regulatory body at the time the concession was awarded. This aspect significantly reduces the occurrence of subsequent renegotiations, as can be seen from the random probit panel. The effect remains unaltered when controlling for the whole range of characteristics, shocks, as well as with sector and country dummies with some slight exceptions in Tables 7 and 8.

The pre-existence of a regulator in the field where a concession is awarded can first be related to the simple fact that a better designed regulation from the start will reduce the scope for obvious mistakes and lessen the need for later disruptive modifications. Instead, it can be expected that contingencies occurring during the life of the project could be dealt with through a normal revision process inside the existing regulatory framework. Furthermore the pre-existence of a regulator increases the quality of enforcement by better commitment.

Moreover, this aspect can be related to the deeper issue of contract incompleteness. It is sometimes argued that concession contracts should be made as complete as possible, i.e. trying to include every possible contingency to avoid leaving room for ex post renegotiations<sup>31</sup>. However, there are limits to this approach. First, in a very complex world describing infinite contingencies might prove impossible, and so contracts are bound to be incomplete. Second, imperfect enforcement limits the effectiveness of these contracts. Finally, complex contracts might be counter-productive if they lack transparency, contain contradictory requirements and lend themselves to opportunistic revision claims. These problems favor an alternative approach which relies on short concession-specific documents, while general rules regarding concessions would be found in laws and the relevant jurisprudence. With this type of contract, previous experience in dealing with the design of concessions should have an important role in limiting the risk of later renegotiations, and this is precisely what we should expect from a specialized and experienced regulator.

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<sup>31</sup>See the example of the Buenos Aires water concession, running hundreds of pages and several volumes, mentioned in Klein (1998).

## Type of regulation

The impact of the different regulatory schemes on the probability of renegotiation can be observed through the price cap variable, which shows up positive and significant in almost all the specifications tested. This effect remains when instrumenting this variable to try to take into account the self-selection problem. Thus, price cap schemes are conducive to more renegotiations and this effect is likely to be due to their greater riskiness and fragility to shocks. It could also be due to the difficulties of initiating price cap regulation.

This is important, since 75% of the concessions in Latin America are regulated by price caps, and the region is characterized by a rather volatile economic environment. This result is also important to point out the need to take into account this weakness of price cap regulation when dealing with developing countries. Moreover, remedies like minimum income guarantee clauses seem to be ineffective in taming the impact of risk.

## Shocks, investment, financing, and specific clauses.

If, on top of basic performance requirements (service and quality) and price regulation, concession contracts include investment requirements, they may end up being more sensitive to fluctuations in firm's productivity, shocks and overestimated demand forecasts<sup>32</sup>. The positive effect of the investment variable in table 6 to 8 is thus not a surprise. However, investment is generally not a choice variable, and, as discussed in the introduction, concessions are likely to be awarded precisely because the state is unable or unwilling to assume important infrastructure investments. This points out to the effect of related variables, which should compensate for this increased fragility: private financing and minimum income guarantee.

Exclusive private financing proves to increase significantly the occurrence of renegotiation. Our results, both from standard and two stage regressions, point out to a negative incentive effect of the financial structure on the behavior of concessions' holders.

Minimum income guarantees do in principle protect holders of concession contract against shocks and other unforeseen contingencies. However, the empirical analysis does not support this conclusion, and leads to think that such guarantees instead increase the probability of renegotiation by reducing incentives to behave efficiently and/or fostering strategic underbidding, as well as by making possible the realization of projects with negative social value.

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<sup>32</sup>In the transport sector, Engel et al. (2001) mention demand forecasts for the Washington D.C. Dulles Airport-Leesburg, Va. toll road, which were overestimated more than fourfold by two consulting companies. Argentine's freight railways concession included investment requirements that prove excessive in view of the ulterior market development (Klein, 1998). Chilean tolled roads experienced huge demand fluctuations during the 1986-1995 period (Engel et al., 2000).

## Politics

Political cycles are likely to have consequences on the occurrence of renegotiations. As our theoretical model suggests, the government's willingness to accept renegotiation of concessions contracts might depend crucially on the extent to which its interests are aligned with those of the firm. Our empirical analysis shows that in years following national elections, the probability of renegotiation increases significantly, even after controlling for the economic cycle. This is a first indication of the importance of political considerations.

A more detailed analysis of this aspect would need to consider the nature of political changes. In particular, asymmetries might appear depending on whether the previous government cares more or less for the rents of the firm than its successor<sup>33</sup>. Finally, interactions between the nature of government and institutional characteristics like corruption might also be relevant. However, we can expect the political cycle to be even more important when dealing with government led renegotiations.

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<sup>33</sup>See Aubert and Laffont (2002).

# Appendix 1

## List of variables.

For all dummy variables, 1=Yes, 0=No.

*Renegotiation (resp. initiated by the firm/by the Government)*: Dummy variable indicating whether there was or not a renegotiation of the concession contract.

*Existence of regulatory body*: Dummy variable indicating whether there was or not a regulatory body at the time of the concession first coming into operation.

*Price cap*: Dummy variable indicating whether the tariff regulation imposed by the regulator is a price cap.

*Investment requirements*: Dummy variable indicating whether there are or not investment requirements as part of the concession contract.

*Duration since award*: Indicates the number of year a concession has been in operation since its award.

*Private financing*: Dummy variable indicating whether the project is funded entirely through private funds (without any financial investment of the state, whether local or national) or not.

*Bidding process*: Dummy variable indicating whether there was or not a bidding process to award the concession.

*Minimum income guarantee*: Dummy variable indicating whether there is or not a government guarantee in term of minimum income promissories.

*Arbitration process*: Dummy variable indicating whether there is or not a formal set of arbitration processes stated in the contract providing for the settlement of a dispute between the concession holder and the government, should such a situation arise.

*Duration of contract*: Duration, in years, for which the concession is signed for.

*Corruption/Rule of law/Bureaucratic quality*: Indices from Political risk service, International Country Risk Guide; annual values from 1989 to 1995, and 1998 value after. Higher value means less corrupt/better rule of law/better bureaucratic quality.

*Growth*: Yearly growth rate of GDP in real terms. Source: World Bank and Inter-American Development Bank.

*Exchange rate*: Annual evolution of the real exchange rate (calculated as rate of year  $t$  - rate of year  $t-1$ /rate of year  $t$ ). A positive value indicates devaluation. Source: Inter-American Development Bank.

*Election*: Dummy variable indicating whether there were or not national elections (legislative or presidential) in any given year. Source: Political Database of the Americas. Georgetown University/Organization of American States. Center for Latin American Studies.

## Appendix 2

### Reduced form equation

Dependent variable	Renegotiations initiated by firms
Existence of regulatory body	-1.29* (-6.25)
Duration since award	0.20* (4.47)
Bureaucratic quality	-0.28** (-2.23)
Election - 1	0.30*** (1.67)
GDP growth - 1	- 0.07* (-3.55)
GDP growth - 2	- 0.14* (-6.17)
Transport sector dummy	1.25* (4.97)
Number of obs.	1267
Log likelihood	-143.59



## Appendix 3

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Price cap regulation	Private financing	Arbitration process	Minimum income guarantee	Bidding process	Duration of contract
Estimation method	Probit	Probit	Probit	Probit	Probit	OLS
Water sector	-0.58 (-1.29)	-2.34* (-7.23)	-3.58* (-8.43)	-1.43* (-3.35)	2.36* (2.93)	10.12* (7.19)
Existence of regulatory body	-0.48 (-0.94)	-1.68* (-5.06)	-1.01* (-2.98)	0.52*** (1.75)	2.90* (3.03)	13.10* (8.85)
Corruption	0.49* (2.66)	-0.52* (-2.94)	-0.47** (-2.37)	-0.09 (-0.60)	1.29* (5.11)	3.50* (4.21)
Bureaucracy quality	-1.07* (-4.16)	0.85* (4.88)	1.52* (5.37)	-0.22 (-1.39)	-1.73* (-4.80)	0.67 (0.83)
Rule of law	0.68* (3.84)	0.08 (0.71)	0.16 (1.12)	0.11 (1.05)	1.91* (5.87)	2.31* (4.20)
Number of obs.	307	262	296	305	307	303
Pseudo/Adj. R <sup>2</sup>	0.31	0.28	0.53	0.16	0.63	10.22

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