Lock-in, Reputation and Contractual Dynamics
The Case of Car Parking Services

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Abstract

This article deals with the effects of reputation in the contracting-out of public services. Using the framework of Tirole [2008], we consider that contractors are all the more willing to write incomplete contracts and support relational agreements than they trust their partner. In this context, we show that informal practices depend both on future transactions and past experiences. Then, reputation is built over time, which leads progressively to lower contracting costs and more contractual incompleteness. To benefit of these lower costs, parties tend to renew contracts with the same "trusted" partners that they identify through time. Our proposition is tested on an original database of management contracts of car parks. To our knowledge, this represents the first attempt of longitudinal study in public procurement sector to account for the evolution of contracts over time.

1 Introduction

Competitive pressure has been praised for long, and public services are not the exception that proves the rule. Indeed, benefits of competition for the market of public services have kept on being underlined since Demsetz [1968]. As a consequence, many legislations among the world have been modified to allow for better competition among private operators, when public authorities decide to contract out services. In Europe for instance, a series of communications in 1996, 2000 and 2001 aim to

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promote private participation in the management of public services, and the French Sapin law (1993) organizes competitive tendering to foster transparency in public contracting. In this case, public authorities can select their private operator among different candidates. The threat of a change at next contract renewal is supposed to prevent monopolistic behavior from private firms, and to encourage innovations and cooperative behaviors. As underlined by the European Commission, "by exposing public services to competition, PPPs [public-private partnerships] enable the cost of public services to be benchmarked against market standards to ensure that the very best value for money is being achieved (p. 15/16 European Commission [2003])." In the same way, a report from the world bank [2006] highlights the expected benefits of fair competition by stating that "Competition for the market consists of rebidding private sector contracts at regular intervals. Because the incumbent contractor risks losing the contract at the next bidding stage, regular rebidding is an efficient way of maintaining competitive pressure to deliver high-quality services at a reasonable price." However, a striking fact is that in many cases, public authorities do not change of economic partner, as if the contractual relationship was locked-in.[1]

In the economic literature, some contributions have suggested that corruption or collusive behavior among operators may be the source of such surprising statistics. Yet, in spite of some reports (Conseil de la Concurrence [2005]), few evidences are given to make this explanation conclusive (Cour de Cassation [2007]).[2] Transaction cost economics has given some other explanations, showing how asset specificity lead to "Fundamental Transformation" (Williamson [1975]): the initial winner of a bidding competition thereafter enjoys an advantage over rival suppliers because of its ownership of or control over transaction specific assets.

[1] A report by the French professional federation of water firms (des Entreprises de l'Eau [2008]) (p.28) states that "on average, competitive tendering for a water or a wastewater service resulted in a change of operator in from 8% to 10% of the contracts." Those statistics come from recent data from ENGREF, the French Institute of Forestry, Agricultural and Environmental Engineering. They are based on 2 569 procedures studied by ENGREF, which represent 63% of the total number of procedures during the period 1998-2004.

[2] The Cour de Cassation , that is the highest court in the French judicial system (excluding administrative justice), dropped the charge towards a French company, Lyonnaise des eaux, about lack of competitive behavior in Ile de France.

However, few attention has been paid up to now to the fears that public authorities regularly express about the idea to form a partnership with unknown partners. "The principle risks are that the private party proves insufficiently competent and/or is not able to deliver the services to the initial specifications (...)" (European Commission [2003](p.52)). As a consequence, public authorities have to balance the expected benefits of competition to the risks linked to the transfer of skills to a private operator, and the loss of management control. If the incumbent operator has proved to be trustworthy, then public authorities prefer to renew the contract rather than switching to another private operator. Thus, when differences on production costs are not large enough to discriminate among the candidates, public authorities can prefer to select the incumbent at the next bidding stage.

In this paper, we analyse the factors underlying this situation. We propose an explanation of the observed "lock-in", based on relational contracting and transaction costs, in a new original theoretical framework derived from Tirole [2008]. Under some conditions, we show why there can be some rationale for public authorities to choose a same private operator over time. Our goal is to demonstrate how contractual incompleteness and trustworthiness evolve over time. To reflect the emphasis given to trustworthiness in contract renewal, we model public-private agreements as incomplete contracts that may rely on informal commitments. This modelling strategy reflects some existing evidence on the nature of public-private agreements. Several case studies undertaken by the World Bank [2006] concerning Manilla and Gabon illustrate the role of informal dealings in public-private partnerships.[3] In the same way, the European Commission [2004] has also shown that informal relationships between public and private contractors may be helpful.[4] In the French case,

[3]In Manilla and Gabon, the World Bank reports some informal commitments over additional investments by the concessionaires over the contract's lifetime. Some more general considerations are also given about the role of informal dealings at an early stage of cooperation between public and private partners: "talking with potential bidders at an early stage about the structure and scope of a proposed project is a good idea. This type of informal market sounding, typically based on an initial project briefing, a consultation paper, or a prebid road show, is often undertaken before commencing the formal procurement process. Potential bidders generally welcome the opportunity to participate in informal market soundings. Early recognition of bidders' commercial concerns can greatly enhance bidder interest and increase the overall effectiveness of the formal procurement" (p.180).

[4]For instance, Case 17 of the Resource Book on PPP Case Studies accounts for the German

during the selection procedures, public authorities are allowed to introduce some negotiations with potential candidates in parallel to the objective selection criteria of the competitive tendering process (Auby [1997]).

Our approach also postulates contractual incompleteness and transaction costs of negotiating deals. Indeed, observations of contracts show that these agreements have various lengths, are more or less detailed about future contingencies, and are then more or less costly to elaborate. Moreover, renegotiations because of contractual blanks are regularly emphasized in the economic literature (Guasch, Laffont, and Straub [2003], Guasch [2004]). To account for negotiating costs and contractual incompleteness, the theoretical approach of Tirole [2008] brings together several strands of the contract literature, in order to narrow the gap between mainstream contract theory[5] and the bounded rationality approach (Simon [1961], Williamson [1975], Williamson [1985]).[6] To briefly introduce this framework, let us note that contrary to the "complete contracts" perspective, gathering and processing information is here supposed to be costly, mainly because of cognitive limitations. Yet, in such a context, "parties are aware that they are unaware" (Tirole [2008]), and make rational choices to manage these cognitive limitations. Then, parties to a contract avail themselves of to the best design under existing knowledge, but know that everything is not foreseen. Yet, even if not foreseen, contingencies are foreseeable: parties may exert some ex ante cognitive efforts to find out what may go wrong, and to draft the contract accordingly.[7] Then, parties have to decide the levels of ex-ante efforts to do before contracting. Why parties would choose incomplete contract by

experience (Mülheimer Entsorgungsgesellschaft mbH), and states that "to handle the complex multidimensional objectives and to protect their interests the parties had to agree on several informal and formalized agreements" (p.84).

[5]In mainstream contract theory, parties do not suffer from bounded rationality, and are able to design costless contracts that foresee any contingency.

[6]As noted by Bolton and Faure-Grimaud [2007], parties' bounded rationality has often been underlined to understand why contracts are incomplete: "In reality, a great deal of contractual incompleteness in undoubtedly linked to the inability of parties not only to contract very carefully about the future, but also to think carefully about the utility consequences of their actions. It would therefore be highly desirable to relax the assumption that parties are unboundedly rational." (Hart [1995], p.81)

[7]The example given by Tirole [2008] (p.1) may be helpful to understand this idea: the event that the oil price may increase, implying that the contract should be indexed on it, is perfectly foreseeable, but this does not imply that parties will think about this possibility and index the contract price accordingly.

voluntary making few cognitive efforts in order to guess about future contingencies? Our answer is consistent with MacNeil [1978] : because parties implicitly rely on their partner's willingness to respect the "spirit" of the contract, rather than its "letter". In such a perspective, an incomplete contract is then a contract that specifies an available design and is renegotiated whenever this design turns out not to be appropriate. A contract is all the more incomplete than few (cognitive) efforts have been made to foresee implications of future contingencies. In other words, those efforts are ex ante transaction costs that determine contractual completeness. Such an approach is close from "traditional" theories of the firm (Williamson [1975], Williamson [1985], Grossman and Hart [1986], Hart and Moore [1990]) to the extent that contractual choices will impact on ex-post hold-ups. Yet, those theories focus on post-contractual investments, while the emphasis is here laid on pre-contractual ones. Moreover, contrary to the Grossman-Hart-Moore approach that imposes contractual incompleteness from outside, parties themselves choose here to leave the contract more or less complete.[8]

To sum up, the originality of our work is to show how relational contracting builds over time and induces less and less costly and complete agreements. In that sense, our contribution also aims to make compatible the concepts of "reputation" and "reputational concern". The former relies on past experiences, while the second has to be interpreted according to the valorization of future. By combining past experiences and concerns for future business, our approach allows us to consider a unique and dynamic vision of reputation and its construction during (past and current) contractual relationships. With such a framework, results of our model show that the degree of contractual incompleteness depends on trust and mutual understandings built by partners over time. We also show that production costs cannot be the unique criteria

[8]Such an idea is also explored in a paper by Bolton and Faure-Grimaud [2007], where parties write satisfying contracts rather than optimal contracts: when they expect to receive a satisfactory payoff from a deal, they do not waste time writing a detailed contract and instead leave many decisions to be determined later. However, they do not deal with relational contracts, and rather focus on consequences of alignment of parties' objectives on contractual incompleteness. In the opposite, our approach both deals with relational agreements and ex ante efforts to make the contract more or less complete.

to select a private partner in a PPP scheme: public authorities evaluate the degree of trust of their partners, which may make the decision in some cases.

Some other recent contributions have focused on the role of reputation in contractual agreements. The seminal works of Baker, Gibbons, and Murphy [2002, 2004] (BGM hereafter) show that parties respect their informal commitments, whenever they obtain greater benefits by cooperating rather than by reneging on their promises. In that way, both of them use new information whenever it becomes available in order to adapt the relationship because they pay attention to their reputational concern. However, our approach departs from them because of cognitive limitations of contractors. In fact, we assume that parties have no perfectly rational anticipations of the gains of cooperation and deviation of parties ; they only try to guess the dominating strategy of their partner. This means that they elaborate some ex ante anticipations about the partner's ability to respect his informal commitment. As parties are bounded rational, they conjecture on their partner's behavior. In order to do that, they can try to learn about the partner's profile (i.e. whether he is patient or not and how he valorizes future) by observing past experiences. Then, while BGM associate informal agreements to concern for future business, we aim to show how trustworthiness is a dynamic process that depends both on future concern and past experiences.
Other works in the recent economic literature have explored connected themes: Bolton and Faure-Grimaud [2007] model costs of delays to acquire information before contracting to account for bounded rationality, but do not include informal agreements nor contractual dynamics. Barro [1986] and Mathis and Rochet [2008] highlight the role of dynamic reputation in different fields than ours, i.e. in monetary policy and financial market respectively.

The paper is organized as follows. Section 2 develops a model based on a simplified version of the framework of Tirole [2008] applied to contractual relationships between a public authority and a private manager. A public authority is supposed to support

some ex ante transaction costs to make the contract all the more complete. To reduce such costs, she may rely on some informal agreements. But the problem is that she is often unaware of the type of contractor, i.e. honoring contractor or not, she faces. She becomes all the more willing to leave room for informal contracting that she has had past successful experiences with the private firm. Then, the anticipated probability of trustworthiness is path dependent. In this way, our propositions show that past - and not only future - matters in relational contracting as it determines the degree of contractual (in)formalism. The direct consequence is that the change of partner leads to some additional cognitive costs compared to the situation where the previous contractor is renewed. Hence, there may be some rationale to choose the same candidate at contract renewal to economize on transaction costs. Section 3. proposes an empirical test of our propositions thanks to an international database made up of 669 contracts observed over several decades (to be completed).

2 The model

2.1 The framework

2.1.1 Agents

To study the issues at stake, we build a theoretical framework derived from Tirole [2008]. More specifically, let us consider two agents: a benevolent public authority representing national or local government (G, to whom we will refer to as "she") and a private manager (M, to whom we will refer to as "he").

2.1.2 Contract design

G and M contract on a design of a public service, denoted as design A. With probability $1 - \rho$, design A is the appropriate design and delivers utility B^+ for G and

costs the manager c to produce ($B^+ > c > 0$).

With probability ρ, A delivers only B^-, with $B^- = B^+ - \Delta$ where $\Delta > 0$, and some other, initially uncontractible, design A' delivers utility B^+ to G. Converting A into A' implies contract's modifications, that cost "a" to G, with a $\in [0; \Delta[$. This parameter "a" can be assimilated to some ex-post transaction costs supported by the public authority. Then, net gains from renegotiations are $\Delta - a$.[9]
By contrast, if design A' is identified before the contracting stage, parties can contract about it and there is no renegotiation nor adjustment cost to get B^+.

Let us note that we focus here on renegotiations that allow to increase the general surplus. Agents are assumed to be benevolent, and then do not engage in pure opportunistic renegotiations to impose a new sharing of the gains, once sunk investments have been made. Here, they renegotiate because of inappropriate contractual design, such as bad contractual specifications based on the means rather than on the outcomes, vague or inappropriate terms, environmental changes, implementations of (ex ante) non contractible innovations.[10]

2.1.3 Transaction Costs

Before contracting, we assume that G can incur thinking or cognitive costs $T_G(b)$.[11] Through cognitive attention, G may then become aware of implications of the current design, and of an alternative to it. As in Tirole [2008] (p.8), these cognitive costs "have a broad range of interpretations, including the managers' psychic cost of focusing on issues they are unfamiliar with, their opportunity cost of not devoting time to other important activities, or the fees paid to lawyers and consultants for

[9] We assume that trade is efficient, even in the absence of cognition, *i.e.* $B^+ - c - \rho a > 0$.

[10] The incomplete contract literature on PPPs explore those types of renegotiations, that are implemented to manage non-contractible innovations allowing to increase the global surplus (Hart, Shleifer, and Vishny [1997], Hart [2003], Bennett and Iossa [2006]).

[11] We assume that only G can learn about the appropriate design. It mainly comes from the fact that G has more incentives to avoid a potential hold-up by M.

advice on contracting.[12] The magnitude of cognitive costs is also revealed indirectly by the substantial incompleteness of many contracts and by the costs of this incompleteness."

In other words, the contract is said to be more incomplete if fewer resources are expended to identify the appropriate design, *i.e.* $T_G(.)$ is low. In such a situation, G knows little about implications of future contingencies, and the probability that the design specified in the contract needs to be altered ex post is all the higher. Let us note that transaction costs may be wastefully incurred,[13] as it is in the parties' individual interest to know whether they are vulnerable to renegotiation.

To go back to our model, we assume that if A is the appropriate design, G learns nothing from her investigation. If A' is the appropriate design, G learns A' with probability b, and learns nothing with probability $1-b$.

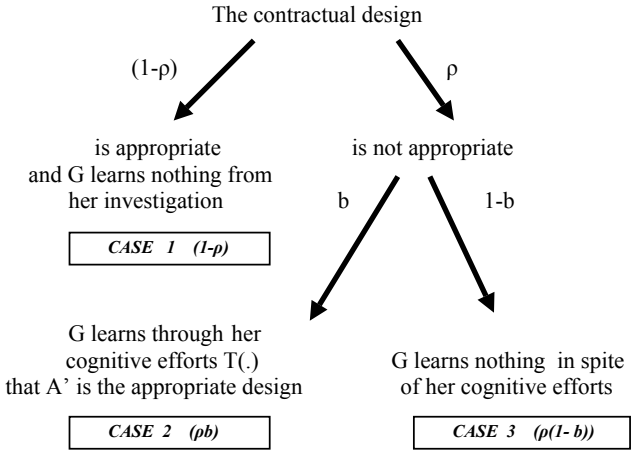
As a consequence, the correct contractual design is elaborated with a probability $(1-\rho)+\rho\times b$[14], while the contract is not appropriate with a probability $\rho(1-b)$, as shown in the scheme below:

[12] For example, a water concession contract may be a few thousand page long.

[13] In this case, contracts are considered as *too* complete.

[14] $(1-\rho)$ represents the probability that A is appropriate but G is unaware about it, as she learns nothing from her investigation; and $\rho\times b$ is the probability that A is not appropriate, but because of her ex ante cognitive efforts, G becomes aware of it and is able to propose A' before the contract is signed.

Figure 1: Contingencies



Let us add that the enunciation of A' by G fully reveals to M that the proper design is A'. The choice of b is rational, and not observed by M. The function T_G is smooth, increasing, and convex, so that $T_G(0) = 0$, $T'_G(0) = 0$, and $T'_G(1) = +\infty$.

2.1.4 Contract renewals

We suppose that contracts between G and M are periodically renewed. At each period, G may choose another private partner. We denote each contractual period t, t+1, t+2, ...

2.1.5 Hold-up and relational contracting

Up to now, the economic literature has shown how parties search for repeated relationships when contracts are (for an exogenous reason) incomplete (Bull [1987], Baker, Gibbons, and Murphy [2002], Baker, Gibbons, and Murphy [2004]). The main idea sustaining such contributions is that parties are willing to informally commit themselves on some actions, when the payoff stream from cooperation is

higher than the payoff stream from defection. Such "relational" contracts allow the parties to use their detailed knowledge of their specific situation to adapt to new information as it becomes available. Yet, as these agreements are tacit, they cannot be enforced by third parties and must become self-enforcing, hence the proposition that the value of the relationship must be sufficiently large that neither party wishes to renege. A consequence of informal dealings formulated by Macaulay [1963], is that they allow to economize on the cost of specifying the letter of the contract, as parties are supposed to abide by its spirit.

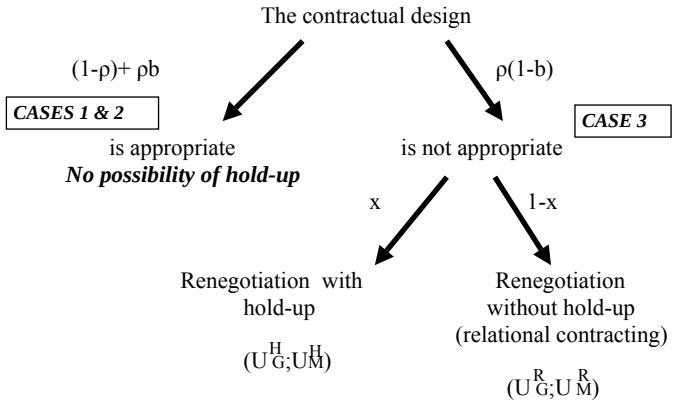
In our model, relational contracting may intervene when A is not appropriate, and G is unaware of it, in spite of her investigation cost b. In such a case, G asks for renegotiation to switch towards A', but during the renegotiation process, M may hold up G. We assume that hold up occurs with probability x. The manager asks for one part of the net gains, i.e. $h = \sigma(\Delta - a)$. In the other case $(1 - x)$, M adjusts "by the spirit of the law" and does not hold up G.

Let us note that we explore in this model one-sided opportunism : as the renegotiation may increase the utility of the public authority by allowing to reach B^+ rather than B^-, the fear of opportunism is that of the private manager, since he could ask for one part of the gains of the public authority. Symmetrically, we could explore governmental opportunism by assuming that a renegotiation could increase the surplus of the manager and the government could ask one part of the gains. Situations will be reversed, without changing the validity of our main propositions.[15]

Figure 2 allows to sum up the various situations:

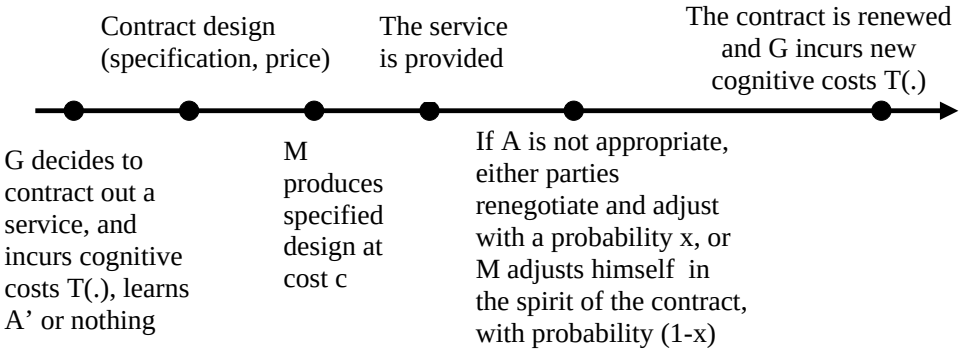
[15] Spiller[2008] shows that governmental opportunism is feared in developing countries, and Guasch [2004] shows that both types of opportunism can be observed. To model this situation in our framework, the gains Δ of renegotiations would be attributed to the manager, who bears the cost of ex post renegotiation a, and would fear an hold up of an amount h from the public authority. To avoid such a situation, the manager would have the possibility to support some ex ante cognitive costs. Finally, one could introduce the two types of opportunism in the model and allow both agents to support ex ante cognitive costs. This would make the demonstration more complex, without changing anything to our general proposition.

Figure 2: Evolution of contractual design and associated payoffs



The timing is summarized in figure 3.

Figure 3: Timing of a contractual period.



2.1.6 The ex ante bargained price

We assume that M has bargaining power $\sigma \in [0; 1]$, so that he can secure a proportion σ of the gains during a renegotiation. Symmetrically, the bargaining power of the government is $(1 - \sigma)$.[16]

[16]For simplicity's sake, we assume that ex post and ex ante bargaining powers are the same.

Let us first determine the ex-ante bargained price at which trade is contracted.
In a pure equilibrium strategy, we denote b^* the equilibrium probability that G discovers that A is not appropriate when it is indeed the case.

Suppose that G learns nothing, and decides to contract on design A. Two situations may occur: either A is the right design or is inappropriate, which leads to potential hold-up. The posterior probability that A is not appropriate conditional on cognitive efforts b and unawareness is[17]:

$$\hat{\rho}(b) = \frac{\rho(1-b)}{1-\rho b}$$

On the equilibrium path, $b = b^*$, and the expected hold-up is $\hat{\rho}(b)h$. As a consequence, the bargained ex-ante price $p(b^*)$ is such as the price shares the total expected surplus, i.e.:

$$\sigma(B^+ - c - \hat{\rho}(b)a) = p(b^*) - (c - \hat{\rho}(b)hx) \tag{1}$$

$$p(b^*) = c + \sigma(B^+ - c - \hat{\rho}(b^*)(a + \frac{hx}{\sigma}))$$

(1) represents the equalization of the manager's profit (on the left-hand side) and the share of the total surplus that he is able to bargain (on the right-hand side), according to his bargaining power σ.[18]

[17]The probability that A is not appropriate and G is unaware about it $\rho(1-b)$ (Case 3). The probability that G is unaware about the contractual design is (Case 1 and Case 3) is $(1-\rho+\rho(1-b)) = 1-\rho b$.

[18]Indeed, the manager's profit depends on his bargaining power σ to appropriate a share of the expected total surplus $(B^+ - c - \hat{\rho}(b)a)$. On the other hand, he receives the ex ante bargained price, supports cost c and benefits from the hold-up h with probability $\hat{\rho}(b)x$.

2.1.7 The payoffs of the agents

Let us now deduce the (gross) payoffs[19] of the agents in each situation depicted in figure 1:

- **First Case:** the contractual design A is appropriate $(1-\rho)$.
  In this case, G learns nothing from her investigation, then trade occurs at price $p(b^*)$, as previously defined. As the design is appropriate, no renegotiation takes place and G's payoff is then $U_G^A = B^+ - p(b^*)$, while the manager's payoff is $U_M^A = p(b^*) - c$.

- **Second Case:** The contractual design A is not appropriate (ρ) and G becomes aware that $A^{'}$ is the appropriate design (with a probability b) because of her investigation. She can ex ante contract on $A^{'}$, and does not renegotiate ex post. Since G becomes aware ex ante that A' is appropriate, and then that no renegotiation at cost "a" nor hold-up will occur, and the ex-ante bargained price does not take into account such a risk.
  (1) becomes $\sigma(B^+ - c) = p(b^+) - c$, i.e. $p(b^+) = c + \sigma(B^+ - c)$. Hence, the total surplus is shared according to the bargaining power of the parties: $U_G^{A'} = B^+ - p(b^*) = (1-\sigma)(B^+ - c)$, and $U_M^{A'} = \sigma(B^+ - c)$.

- **Third Case**: In case of inappropriate design, with a probability (1-b)), G does not find that the contractual design is inappropriate, and choose to trade at some price $p(b^*)$ as previously defined in equation (1). Yet, renegotiation occurs to reach B^+ and G supports adjustment costs a. Hold-up occurs with some probability x. Then $U_G^H = B^+ - a - xh - p(b^*)$ and $U_M^H = p(b^*) - c + xh$.

The various payoffs of the agents are summarized in the following table:

[19] Net payoffs of G are obtained by deducing ex ante transaction costs T_G.

Contingency	Awareness	Payoffs
A is appropriate $1-\rho$	G learns nothing from T_G	$U_G^A = B^+ - p(b^*)$ $U_M^A = p(b^*) - c$
A is inappropriate ρ	b G learns it	$U_G^{A'} = (1-\sigma)(B^+ - c)$ $U_M^{A'} = \sigma(B^+ - c)$
	1-b G does not learn it	$U_G^H = B^+ - a - xh - p(b^*)$ $U_M^H = p(b^*) - c + xh$

2.2 Optimal levels of cognitive efforts

2.2.1 Choice of cognitive efforts

Let us now determine the optimal level of G's cognitive efforts supported to foresee future contingencies, b. G maximizes her expected payoffs in each situation:

$$\max_b -T_G(b) + \rho(1-b)U_G^H + \rho b U_G^{A'} + (1-\rho)U_G^A$$

$\Leftrightarrow$

$$\max_b -T_G(b) + \rho(1-b)(B - a - xh - p(b^*)) + \rho b(1-\sigma)(B^+ - c) + (1-\rho)(B^+ - p(b^*)) \quad (2)$$

By replacing $p(b^*)$ by its value, (2) becomes:

$$\max_b \{-T_G(b) + \rho(1-b)(B - a - xh - (c + \sigma(B^+ - c - \rho\hat{(b)}(a + \frac{hx}{\sigma})))) + \rho b(1-\sigma)(B^+ - c)$$

$$+(1-\rho)(B^+ - (c + \sigma(B^+ - c - \rho\hat{(b)}(a + \frac{hx}{\sigma}))))\}$$

$\Leftrightarrow$

$$\max_b \{-T_G(b) + (B^+ - c)(1-\sigma) - \rho(1-b)(a + xh) + \rho(1-b)(\rho\hat{(b)}(a + \frac{hx}{\sigma})) + (1-\rho)(\rho\hat{(b)}(a + \frac{hx}{\sigma}))\}$$

$\Leftrightarrow$

$$\max_b\{-T_G(b) + (B^+ - c)(1-\sigma) - \rho(1-b)(a+xh) + (1-\rho b)(\rho\hat{(}b)(a+\frac{hx}{\sigma})\sigma)\} \quad (3)$$

Differentiating (3), we obtain:

$$T_G^{'}(b) = \rho[a + xh - \hat{\rho}(b^*)\sigma(a+\frac{hx}{\sigma})]$$

$$T_G^{'}(b) = \rho[a(1-\hat{\rho}(b)\sigma) + xh(1-\hat{\rho}(b))] \quad (4)$$

From (4), we can deduce some results about ex-ante transaction costs $T_G(b)$:

- $\frac{\delta T_G^{'}(b)}{\delta a} = \rho(1-\hat{\rho}(b)\sigma) \geq 0$, then the higher adjustment costs "a" are, the higher ex-ante transaction costs to learn about contingencies are.
- $\frac{\delta T_G^{'}(b)}{\delta x} = \rho h(1-\hat{\rho}(b)) \geq 0$ Ex-ante transaction costs increase with x, *i.e.* the higher the probability of hold-up in case of inappropriate design is, the higher transactions costs are to avoid such a situation. The corollary is that the lower the probability of hold-up (*i.e.* the more relational contracting is applied), the lower transaction costs are. G spends fewer resources on cognitive efforts, as she knows that M will apply the spirit of the contract, and will not take advantage of renegotiation to hold-up her. Given the previous definition of contractual incompleteness, then the more relational contracting is observed, the more incomplete contracts are. This result is consistent with Tirole [2008], and highlights that relational contracting is not only a response to, but generates contractual incompleteness.

- Static comparative on h gives $\frac{\delta T_G^{'}(b)}{\delta h} = \rho x(1-\hat{\rho}(b))$. As x and ρ are probabilities $\in [0;1]$, then this implies $\frac{\delta T_G^{'}(b)}{\delta h} \geq 0$. The higher the level of hold-up is, the higher ex ante transaction costs are.[20]

Let us note that these conclusions about ex ante transaction costs $T_G(b)$ remain valid for the total transaction costs (denoted GTC), as

$$GTC = \underbrace{T_G(b)}_{\text{Ex ante transaction costs}} + \underbrace{\rho(1-b)a}_{\text{Expected ex-post transaction costs}}$$

Hence the following proposition:

Proposition 1 *Transaction costs to learn about future contingencies increase with ex post adjustment costs (a), the level of potential hold-up (h) and with the probability of hold-up in case of inappropriate contractual design (x). The contracts are all the more incomplete than the manager proves to be ready to respect the spirit of the contract ($x \to 0$), and to adapt without hold-up of G.*

Such a proposition is consistent with Tirole [2008]. Contrary to propositions derived from Baker, Gibbons, and Murphy [2002, 2004], causality about relational contracting can run in both directions: relational contracts generate (and are not only a response to) contractual incompleteness. The degree of contractual completeness is no longer considered as an exogenous parameter, but as a choice made by contractors. If parties rely on their informal behaviors, they have no interest to support ex ante transaction costs to detail each type of future contingency in the formal contract.

From proposition 1, we can note that the probability x of hold-up determines to a large extent the level of ex ante transaction costs that makes the contract more or less complete. However, x is not an exogenous parameter. M decides to respect

[20] Such a result is consistent with the transaction cost framework. Assuming that hold-up is linked to asset's specificity, we note that transaction costs increase with it.

his informal dealing if such a strategy dominates that of deviation. Let us now determine in which case the probability x of hold-up is higher or lower, *i.e.* in which circumstances M abides by the spirit of the contract rather than decide to hold-up public authorities.

2.3 Conditions for sustainable relational contracts

When the agents are in a long term relationship and care about the future, some positive consequences on their incentives to invest can be generated (Baker, Gibbons, and Murphy [2002], Baker, Gibbons, and Murphy [2004]). The value of parties' future relationships determines whether they agree or refuse to respect their informal commitments. Here, we do not focus on the role of relational contracting on manager's incentives to invest, but rather on their ability not to hold-up their partner, as in Bull [1987] or Klein [1988], who suggest that reputation effects can limit hold-up problems. To model this informal agreement, we assume that G proposes to M an informal dealing, and asks him not to hold-up in case of contractual inappropriateness. If M does not respect his commitment, then G threatens to renew him with a lower probability in the future. For simplicity's sake, we assume that reputation is built in a bilateral relationship.[21]

We will use the trigger strategy framework, with Nash reversion to static equilibrium in case of deviation to account for such a situation. A period in our framework is considered as a contract's duration. As a consequence, at each period, the public authority can choose to pursuit or to stop the relationship. The discount factor is denoted $0 \leq \delta \leq 1$. We assume that M respects his informal dealing, whenever payoff stream from cooperation is higher than payoff stream from deviation.

At the beginning of the game, relational contracting induces a different bargain-

[21]The respect or deviation of M has some consequences on the probability to be renewed by G but not by other public authorities. Let us note that if we allow for some communications between several public authorities, the reneging of M from his informal commitment would increase the sanction, as more public entities will refuse to contract with him in the future. Then, this would strengthen our result. Yet, if we assume a perfect communication between all public authorities, that agree to apply the same sanction to a deviating partner, then this would prevent all kind of opportunism.

ing price, as parties do not expect hold-up. Then, the price becomes $p(b^{*,r}) = c + \sigma(B^{+} - c - \hat{\rho}(b^{*}))a$, since $h = 0$, and the level of cognitive effort $b^{*,r}$ changes (Proof in Appendix A).

Let us now detail the strategy of M:

- Either M decides to abide by the spirit of the contract and respects his informal commitment. He gains $p(b^{*,r}) - c$. Then, whenever the contractual design is inappropriate, he does not hold-up G. In exchange, he is renewed with probability p_c. His future expected payoff derived from relational contracting is denoted $E(U_M^R) = \rho[bU_M^{A',R} + (1-b)U_M^{H,R}] + (1-\rho)U_M^{A,R}$, where $U_M^{A',R}$ is the utility under relational contracting when the contractual design A' has been learnt, $U_M^{H,R}$ is the utility in case of inappropriate contractual design, and $U_M^{A,R}$ is the utility when the contractual design A is appropriate (See Appendix A for proof).

- Or M deviates and does not respect his informal commitment. He holds up G, whenever possible (in case 3 described above) and then, has a total gain of $p(b^{*,r}) - c + h$ when he deviates. Since M levies an amount h from G, then at next contract renewals, his probability to be chosen again is $p_h \in [0;1]$ with $p_h \leq p_c$.[22] In the subsequent periods, G does no longer trust him, and considers that hold-up will occur whenever possible. After having deviated, the expected payoff of M is denoted $E(U_M^D) = \rho[bU_M^{A',D} + (1-b)U_G^{H,D}] + (1-\rho)U_M^{A,D}$, where $U_M^{A',D}$ is the utility when the contractual design A' has been learnt, $U_M^{D,R}$ is the utility in case of inappropriate contractual design, and $U_M^{A,R}$ is the utility when the contractual design A is appropriate (See Appendix B for proof)

In other words, M does not hold up G in case of inappropriate design A whenever:

[22] p_h is not systematically equals to 0. For instance, we can suppose that the market is oligopolistic, and there is no other alternative than this private manager, or the costs to go back to the public provision are too high. Moreover, if is not selected at one contractual renewal, reputation effects are still persistent over time, as M will keep his "unfavorable" probability p_h to be selected again in the other future contractual renewals.

$$p(b^{*,r}) - c + \delta p_c E(U_M^R) + \delta^2 p_c E(U_M^R) + \delta^3 p_c E(U_M^R) + ... >$$

$$p(b^{*,r}) - c + h + \delta p_h E(U_M^D) + \delta^2 p_h E(U_M^D) + \delta^3 p_h E(U_M^D) + ...$$

$$p(b^{*,r}) - c + \frac{\delta p_c E((U_M^R))}{1-\delta} > p(b^{*,r}) - c + h + \frac{\delta p_h E(U_M^D)}{1-\delta}$$

$$\frac{\delta(p_c E(U_M^R) - p_h E(U_M^D))}{1-\delta} > h$$

Let us denote $V = (p_c E(U_M^R) - p_h E(U_M^D))$. We can deduce that relational contracting is sustainable for relatively "low" amount of potential hold-up, inferior to $\tilde{h}$, so that:

$$\tilde{h} = \frac{\delta V}{1-\delta} > h \tag{5}$$

From (5), we can deduce that M accepts to cooperate and not to hold up G, if the level of hold-up (h) is low enough (inferior to $\tilde{h}$) .

Two factors determine $\tilde{h}$:

- **the level of discount factor** δ

  If $\delta \to 0$, then $\tilde{h} \to 0$ and relational contracting is not sustainable (the hold up h cannot be negative). This situation also means that M is not patient and he attributes a low value to future gains.

  If $\delta \to 1$, then $\tilde{h} \to \infty$. This means that even for high levels of hold-up, the relational contract is sustainable. M is very patient and attributes as much importance to present as to future.

- **Value of future business** related to the probability to be chosen again when cooperating rather than deviating (V).

  The higher such a value is, *i.e.* $V \to \infty$, the higher $\tilde{h}$ becomes, and the more sustainable relational contracts become. Future business represents a too strong opportunity to deviate.

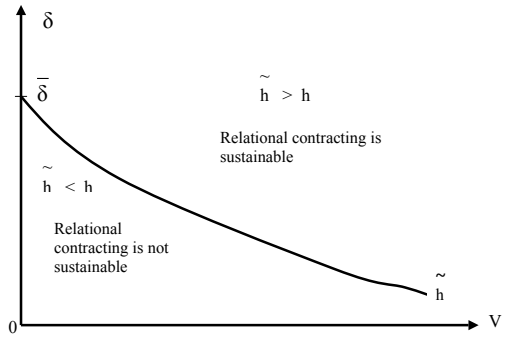
  The lower this value is, *i.e.* $V \to 0$, the less sustainable relational contracting is.[23] Indeed, the amount h of hold-up has to become lower and lower to be smaller than $\tilde{h}$. Perspective of future business with G are not strong enough.

As a consequence, the following proposition can be established:

Proposition 2 *Both discount factor δ and relative value of future business determine the probability that private managers do not hold-up public authorities in case of inappropriate contractual design, so that $x = x(\delta, V)$.*

Such a result may be graphically represented as follows:

Figure 4: Sustainable relational contracting as function of δ and V.



[23]Theoretically, V could even take negative values, which does not change the results: if V is negative, then relational contracting is not sustainable.

- There exists a level $\bar{\delta}$ so that beyond such a level, M proves to be very patient, and relational contracting is sustainable, whatever the value V is.
- Under $\bar{\delta}$, the cooperation depends on the value of V. The higher V, the more sustainable relational contracts are. The value of future business becomes so high that M has better not to hold-up to benefit from the more favorable probability p_c to be chosen again in future.

Let us note that V depends on the value of future business, but also on competitive pressure. For instance, assume that $p_c = 1$, which means that whenever relational contracting is respected, the manager is certain to be chosen again at next contract renewal. In such a configuration, p_h is a measure of competitive pressure: the higher p_h is, the less competitive pressure is observed, since the public authority has a high probability to choose the same operator even if he cheats. To the contrary, when $p_h \to 0$, the private operator is unlikely to be renewed, which means that it is rather easy for G to turn to another provider. The competitive pressure is high when $p_h \to 0$. As a consequence, we observe that V grows up when p_h tends to be lower. In other words, the higher competitive pressure, the higher V, and the more easily relational contracts are enforced.

Proposition 3 *The higher competitive pressure is, the more sustainable relational contracts become.*

However, because of cognitive limitations, she is unaware of the values of δ and V. She may guess V but δ is much more difficult to determine. For instance, if G represents a small market share of M's activities, the value V is all the more likely to be low for M, while if M has difficulties to sign new contracts with other public authorities, he will be all the more attentive to keep the relationship with G. In the same way, a small local entrepreneur will be all the more attentive to the business with G, as it is probably much more difficult for him to diversify his activity, than

for a big multi-national firm. Yet, δ represents the degree to which M prefer present gains to future ones, and is not easily foreseeable.
Before signing a contract, G has to anticipate M's behavior, *i.e.* M's values of δ and V. The following subsection proposes to detail such a mechanism.

2.4 Role of past experiences between contractors

Before signing an agreement with a private manager, G tries to form some conjectures as to the probability of hold-up. To this end, she has to guess how "patient" M is (δ), and how M considers value of future business (V).

Let us now introduce two types of private operators:

- **Type 1**: Private managers of type 1 are very patient and attribute strong value to future, *i.e.* have a high δ, so that $\delta > \bar{\delta}$. Then whatever the value of V, we suppose that they are able of credible commitments and bind themselves to respect the spirit of the contract.
- **Type 2**: Private managers of type 2 are much more impatient, i.e. have a lower δ. Then, their willingness to cooperate depends on the value of V.

Let $\alpha_t \in [0;1]$ be G's subjective probability at the start of period t that the private operator is of type 1, i.e. the probability that the private manager is very patient. As a consequence, at each period t, there is a probability $(1-\alpha_t)$ that the private manager is of type 2, and may choose not to respect his informal agreement, according to the value of V. Whenever a new contractual relationship begins with a new private operator, for period 0 of the relationship, α_0 is a given value and is common knowledge.[24]

We assume that $z \in [0;1]$ is the proportion of type 2-managers that attribute a

[24] α_0 is the expected fraction of type 1- private managers among the population.

high value to V.[25] For instance, they may have few business or some other future contracts, whose attribution is connected to reputation on the contract with G. Or they believe that communication between different public authorities is good enough to prevent other contracts to be signed with others public authorities in case of hold-up, so that they refuse to do so, because p_h will tend towards zero for many other contracts.

Table 1: Summary of anticipations formulated about M by G

Subjective probability of G	Type of M		Value of future business	
α_t	T_1	$(\delta > \overline{\delta})$		
$1-\alpha_t$	T_2	$(\delta < \overline{\delta})$	z	V is strong enough
			$(1-z)$	V is too low

The probability α_t formulated by G about M's type is revised at each period t, by taking into account "good" (h=0) or "bad" behavior from M ($h \neq 0$) in the previous period, that is whether he has reneged or not in case of inappropriate contractual design.

If the contractual design was appropriate at period t, then $\alpha_{t+1} = \alpha_t$, because G has no additional information to revise her subjective probability. Yet, if the contractual design was inappropriate, then G revises upward the probability that M is of type 1.[26]

The adaptation formula follows from Bayes' law as :

$$\alpha_{t+1} = Prob(Type1/h_t, h_{t-1}, ... = 0) \tag{6}$$

[25] For simplicity's shake, z is common-knowledge: once G knows that M is of type 2, he knows that z% of type 2- managers have a high value of V. For instance, G knows that her contract represents an important market share for M, so that V is high for M. As a consequence, uncertainty is mainly about how patient M is (α_t).

[26] This demonstration is similar to the way adaptative anticipations are modeled in macroeconomic models, as that of Barro [1986] that study reputation in a model of monetary policy with incomplete information.

$$= \frac{Prob(Type1/h_{t-1}, ... = 0) \times Prob(h_t = 0/type1)}{Prob(h_t = 0/h_{t-1} = 0, ...)}$$

$$\alpha_{t+1} = \frac{\alpha_t \times 1}{\alpha_t + (1 - \alpha_t)z}$$

As $0 \leq \alpha_t \leq 1$, and $0 \leq z \leq 1$, then $\alpha_{t+1} \geq \alpha_t$. In other words, the observation of $h_t = 0$ raises the probability that M respects his informal dealings.

To sum up,

- If the contractual design A is appropriate (with probability $(1-\rho)$, then $\alpha_{t+1} = \alpha_t$. G has no information to revise her subjective probability upwards or downwards.
- If the contractual design is inappropriate (with probability ρ), and that M does not hold up G (with probability $(1 - x)$, then $\alpha_{t+1} \geq \alpha_t$.
- If the contractual design is inappropriate (with probability ρ), and that M holds up G (with probability x), then $\alpha_{t+1} = \alpha_{t+2} = ... = 0$. G knows that M is untrustworthy, and selects him at next contract renewal with probability $p_h \leq p_c$.

2.4.1 Consequences for transaction costs

Remember that from (4):

$$T'_G(b) = \rho[a(1 - \hat{\rho}(b)\sigma) + xh(1 - \hat{\rho}(b))]$$

x represents the probability that M holds-up G, when the contractual design is inappropriate. Therefore, x is the probability that M is of type 2 and attributes a low value to V, *i.e.* $x_t = (1 - \alpha_t)(1 - z)$.

If we denote $T'_{G,t}(b)$ the level of transaction costs supported by G before each contractual period t, then :

$$T'_{G,t}(b) = \rho[a(1 - \hat{\rho}(b)\sigma) + (1 - \alpha_t)(1 - z)h(1 - \hat{\rho}(b))]$$

and

$$T'_{G,(t+1)}(b) = \rho[a(1 - \hat{\rho}(b)\sigma) + (1 - \alpha_{t+1})(1 - z)h(1 - \hat{\rho}(b))]$$

Since $\alpha_{t+1} \geq \alpha_t$, then $(1 - \alpha_{t+1}) \leq (1 - \alpha_t)$ and

$$T'_{G,(t+1)}(b) \leq T'_{G,t}(b) \tag{7}$$

By recurrence:

$$T'_{G,(t+n)}(b) \leq ... \leq T'_{G,(t+1)}(b) \leq T'_{G,t}(b) \tag{8}$$

This leads to the following proposition:

Proposition 4.a *Suppose that G chooses the same private operator during several contractual periods, and that M has not held up her. The level of ex ante transaction costs supported to anticipate future contingencies decreases with time. As a consequence, contracts between the same partners tend to become more and more relational over time.*

2.4.2 Consequence for contract renewal

Let us now focus on contract renewals. We denote $t = 0$ the first contractual period with a new private manager. Then, if M is honest, (8) gives:

$$T'_{G,(t+n)}(b) \leq ... \leq T'_{G,(t+1)}(b) \leq T'_{G,t}(b) \leq ... \leq T'_{G,0}(b)$$

Because of increasing-convexity of function T, then

$$T_{G,(t+n)}(b) \leq ... \leq T_{G,(t+1)}(b) \leq T_{G,t}(b) \leq ... \leq T_{G,0}(b)$$

For each new potential operator, $T_{G,0}(b)$ is the same at period 0 of the relationship, as α_0 represents the probability of type1-managers in the population. Then if the private operator that is chosen at period $t = 0$ is honest, at each next contract period, he is all the more likely to be chosen again, as transaction costs supported by G are lower than those that would be supported in case of partner's change. For instance, at period t, if G decides to choose another private firm to perform the service, she bears $T_{G,0}(b)$, while if she continues the contractual relationship with the previous private firm, she supports $T_{G,t}(b) \leq T_{G,0}(b)$. Such a result shows that there may be some rationale to select the same candidate over time, if the production costs proposed by the candidates are similar. Lock-in may thus be justified.

Proposition 4.b *If a private operator has proved to be honest on relational contracting in past experiences, then he is more likely to be selected again than similar competitors (ceteris paribus), because public authorities will support fewer ex ante transaction costs.*

3 An empirical analysis of relational contractual practices

3.1 Putting the model to the test

Matching our theory to the data requires us to focus on a public service that can be contracted out by public authorities and in which reputation matters. That's why, we focus on the car parking sector. Parking enforcement is generally a local authority responsibility, but few of them have the internal resources to manage this function. Then, they often decide to contract these services out to benefit from technical, operational and professional expertise.

Then, to put our model to the test, we collect these data from an international private operator, specialized in the development and management of car parking solutions. This firm ranks among the best suppliers of parking infrastructure and management systems for the local authority, transport, health, retail and property sectors. It is also known as the world's largest car park operator, providing parking services in 15 countries.
As a consequence, this operator benefits from a large experience and benefit from an unrivalled access to the best technology, research and development services, expertise and financial support. This private operator is part of a global group created in the 19^{th} century, that is today considered as a world leader in the construction, management and operations of all aspects of transport infrastructures. For all these reasons, we believe that reputation has some true significance for this operator that regularly communicate on its quality experience.

This operator has a relative high market share in the car parking service sector, but the sector remains still competitive. As an illustration, for the last five years (2003-2008), the operator under study won 67 out of the 203 recorded car parking contracts under franchise-bidding, i.e. 33% of the market share. Table 2 summarizes

Table 2: Shares of contracts by operator (2008-2013)

	Number of successful bids	Percentage
Our operator	67	33%
Rival 1	20	9,85%
Rival 2	14	6,9 %
Rival 3	11	5,42%
Rival 4	8	3,94%
Others	37	18,23%
Semi-public companies	46	22,66%
Total	203	100

The "Others" category represents small firms operating at a local level. They represent small shares: Each of them has at most 4 contracts.

the allocation of contracts (under franchise bidding in France between 2003 and 2008) among the private firms operating in this service.

As an illustration, we can note that it won 67 of the 203 recorded car parking contracts up for bid this last five years (2003 - 2008). Its main competitors respectively won 20, 14, 11 and 8 of those up for bid contracts. Considering market share based on winning bids, our operator won 33 percent of awarded contracts. Its main rival won only 9,8 percent of contracts. The distribution of contracts allocation is presented in table 1.

3.2 Database

To empirically evaluate our proposition, we have developed a unique dataset by combining data from an international operator and data from a survey carried out by the French National Institute of statistics and economic studies.

In this database, we can observe several types of contracts: Some are Design, Build, Finance and Operate (DBFO), and others are lease or service contracts (LSC). Moreover, our database is made up of contracts that have been signed by this company

Table 3: Distribution of contracts in function of their number of renewals

	Expired relationships	On-going relationships	Total
1^{st} contract	223	246	469
1^{st} contract renewal	62	73	135
2^{nd} contract renewal	16	36	52
3^{rd} contract renewal	5	3	8
4^{th} contract renewal	1	4	5
Total	307	362	669

since the 1960s (the older contract of the database was signed in 1963), which allow us to do some longitudinal studies, as we can observe repeated observations of a same transaction over several periods of time. To our knowledge, this represents the first longitudinal studies in the public procurement sector. This allows us to test the evolution of contractual incompleteness over time, and the effects of reputation of a private firm in the selection process.

Our database also allows us to show that 200 public authorities have been engaged in relationship with our operator. Among those public authorities, we observe the story of 669 contracts. Some of them were renewed (135 contracts were renewed at least once) and some of them are today expired (223 contracts). As we show in table 3, contracts renewals allow us to work on a database compelling 669 contracts.

To sum up, the originality of our database is to allow us to:

- observe the contracting-out of a public service
- observe contract renewals between the same partners
- observe evolution of contractual (in)completeness over time
- observe reputational effects over time
- propose a longitudinal study in procurement sector

What we are interested in is the evolution of contractual incompleteness over time and the role of past experiences in the selection of operators. To reach this goal, we intend to complete our database with several interviews of executive managers of the car parking company that have played a role to negotiate contracts. This allows us to better appreciate the role of reputation, formal and informal aspects during such negotiations.

We still work to complete our database. The following subsections propose to expose our preliminary (and still incomplete!) results, as well as the methodology we plan to use.

3.3 Our variables

The following table provides the description of the variables we use in the empirical model with some descriptive statistics.

What we are interested in, is to see whether contractual renewals allow to avoid renegotiations between partners. As a consequence, we expect that amendments (i.e. renegotiations between contractual partners) will be lower if parties have contracted on several times during the past.

Consequently, our regression will have the number of contractual adjustments as explained variable, and explanatory variables will be parameters about contractual specifications, technical characteristics of the service, and the number of contractual renewals.

Let us now precise the role of these variables.

Contractual design. As we argue in the model, the likelihood of ex post contractual adjustment is more important if fewer resources are ex ante expended to identify the appropriate contractual design. The variable "number of contractual adjustments" (presented in table 4) is used to approximate those renegotiations. In fact, we are able to determine whether the partners altered their relationships by looking whether relevant contractual renegotiations occur. By relevant, we mean that we only consider situation where those adjustments are about the following issues: duration of the contract, extension of the due date (in case of buildings and/or renovation workings), price list for consumers, operator earnings, additional investments, amount of the ground-rent distributed to the operator by the public authority, financial balance and quality. De facto, we voluntary exclude amendments which do not clearly modify the execution conditions of the contract such as a denomination change or address change.

Asset specificity. Considering that asset specificity increases hold-up risk (Klein, Crawford and Alchian,1978) and impacts on contract duration (Joskow, 1987), we have to take into account this dimension. It appears all the more relevant since assets are necessarily specific in the case of car parking contracts. In fact, DGBO contracts foresee the construction or the renovation of the park. So we have to control our

Table 4: Description of our variables

The Nature of the contract	New: 1=470 / 0=229 Renewed: 1= 229 / 0 =470
Expiration	Expired: 1 = 307 / 0 = 362
Contractual type	DBFO: 1=379 / 0=291 LSC: 1=291 / 0 = 379
The duration	Mean: 14,44 years (DBFO: 23,37 / LSC:2,72) SE: 0,57 (DBFO: 0,71 / LSC: 0,24)
The date of signature	Mean: 1996 Median: 1985 Older contract: 1963 Younger Contract: 2008
The number of car parking	Mean: 1,31 (DBFO: 1,64 / LSC: 0,87) SE:0,64 (DBFO: 0,09 / LSC: 0,08)
The number of public roads parking	Mean: 0,38 (DBFO:0,24 / LSC: 0,57) SE: 0,02 (DBFO:0,02 / LSC: 0,03)
Building Investments	1=123 / 0=546 DBFO: 1=121 /0=257 LSC: 1=0 / 0= 289
Workings	1=109 / 0= 560 DBFO: 1= 98 / 0=281 LSC: 1=0 / 0=289
Asset Specificity	1= 167 / 0=495 DBFO: 1= 155 / 0 = 281 LSC: 1=11 / 0= 278
The number of contractual amendments	Mean: 1,84 (DBFO: 1= 2,73 / LSC: 0,069) SE: 0,12 (DBFO: 0,19 / LSC: 0,08)

regressions by the potential buildings of the parks or renovation workings by using the variable "asset specificity" (also presented in table 4).

Firm size and possibility of informal dealings. As first discussions with head managers of the operator raise it, the possibility to develop informal dealings widely varies among public authorities. One of the key variables is the number of intermediary on the decision process. The less there are intermediaries between the operator and the final decision-maker of the public authorities, the more it is possible to develop close ties and informal understandings. According to such an idea, the size of the city, besides its role of simple control variable, could also be used as way to measure this possibility.

Prior interactions. This variable draws our main attention. For each contract, it is possible to track the renewal during time. As we previously mentioned it, 134 of the 469 studied contracts have been renewed at least once. Furthermore, we also are able to know if the private operator has signed other contracts with the same public authorities. According to such a fact, it is possible for us to take into account the duration of the relationships, and not only the duration life of the contracts. In order to catch this effect, we use the variable "age of the relationship at the signature date" (see table 4). Those points are crucial because the stock of prior interactions may affect contracting choice. In fact partners who have had prior relationships are thought to implement character-based trust and, given a lower threat of opportunism, they are able to rely on less complex governance arrangements to achieve their objectives (Williamson, 1979). As various contributions also argue, prior ties can also promote the development of relational capabilities (Dyer and Singh, 1998 ; Baker, Gibbons and Murphy, 2001 ; Poppo and Zenger, 2002).

What we expect is that prior interactions will have a negative and significative impact on the number of renegotiations.

3.4 Empirical Methodology

In this section, we describe the approach we will take to investigate the dynamics of contractual design and the effect of this dynamics on the probability of contract renewal. For those reasons and for the moment, we propose basic structures of model testing antecedents of contract contractual renegotiation. The model specification is the following:

Contractual renegotiation = β_1 contract duration + β_2 renewed contract + β_3 contractual renegotiation in previous contract + β_4 age of the relationship at the signature date + β_5 asset specificity + ε [1]

The baseline of contract theory leads us to expect a positive impact of the initial duration ($\beta_1 > 0$), long term contract tend to be incomplete and, de facto, suppose adjustment. Similarly, the expected sign associated with asset specificity must be positive (β_5). According to our testable implications regarding the dynamics of contracts, we should expect that contractual renegotiation of the current contract is lowered by the fact is the renewed one ($\beta_2 < 0$) as well as by the number of adjustment in the previous contract ($\beta_3 < 0$). Finally, mutual trust and understandings deriving from prior interactions is likely to lower the necessity of contractual adjustment ($\beta_4 < 0$).

3.5 Estimation Results

Table 5 presents correlation matrix for variables appearing in the contractual renegotiation model. In table 6, we present estimates of [1] using a measure of contractual renegotiation previously mentioned. In column 1 (model 1) , we find significant validation of our prediction. Only for one of our key variable : the number of contractual renegotiation of the previous contract. That is why we decide, in column 2 (model 2), to more precisely detail the nature of those contractual renegotiations (CR here-

after). As we can see, we find positive effect for CR about contract duration and delays for workings. At contrary, negative effect appear for CR about prices, operator earnings, additional investments and volume of workings. Such results lead us to believe that the nature of contractual renegotiation and the behavior of partners during those adjustments is crucial for a better understatement of contracts dynamics. Efforts to deeply analyze contractual renegotiation will be the future challenge to improve the empirical examination of our propositions.

Table 5: Correlation matrix

	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)
(1)Contractual Renegotiations	2,2	0,13	1.0000					
(2)Contract Duration	14,24	0,57	0.000 0.4184 0.0000	1.0000 0.0000				
(3)Contract renewals	0,3	0,02	−0.3128 0.0000	−0.4480 0.0000	1.0000 0.0000			
(4)Contractual renegotiations of previous contract	0,54	0,06	−0.0900 0,0210	−0.1841 0.0000	0,4669 0.0000	1.0000 0.000		
(5)Prior Interactions	10,6	0,47	−0.2591 0.0000 0.0000	−0.0452 0.2447 0.2447	0,1819 0.0000 0.0000	0,1050 0.0068 0.0068	1.0000 0.0000 0.0000	
(6)Asset Specificity	0,16	0,01	0.2131 0.0000	0.2990 0.0000	−0.1301 0.0008	−0.0633 0.1032	0.0056 0.8864	1.0000 0.0000

Table 6: Results of our regressions

	Model 1	Model 2
Contract duration	0.072***	0.072***
	(0.009)	(0.009)
Contract renewal	−0.988***	−0.913***
	(0,17)	(0.168)
Contractual renegotiation of previous contract	0,130*	$0,138^{+}$
	(0.06)	(0.081)
Age of the relationship at the signature date	$-0,061$***	$-0,062$***
	(0.00)	(0.008)
Asset specificity	0,896*	0,935*
CR about duration		0,148
		(0,144)
CR about delays		1.137***
		(0,287)
CR about prices		$-0,483$*
		(0,196)
CR about operator earnings		0,344
		(0.354)
CR about additional investments		0.253*
		(0,114)
CR about workings		0.859**
		(0.203)
Constant	1.902***	1.910***
	(0,184)	(0,186)
R-squared	0.2551	0.2651
N	655	655

Independent variable: number of contractual renegotiation of the current contract

We would like to add another control variable in our regression to account for geographical proximity. As our model supposes that reputation will be a relevant criterion of partner selection and contractual choices, we have to assess such effect. Geographical proximity could appear as a way to measure the reputation effect. In fact, greater information is available about close partners and reputational consequences of opportunism are more severe in this kind of setting (Gulati, 1995). For each date of signature, we are able to observe the number of contracts (on-going, renewed and expired) according to two levels of geographic settings corresponding to the delimitation of France territory: the "département" and the "région".

We also would like to add more control variables, deal with eventual endogeneity and fixed effects associated with public authorities.

Moreover, our project also entails a better appreciation of qualitative variables and role of informal dealings.

To reach this goal, we complete our database with several interviews of executive managers of the car parking company that have played a role to negotiate contracts. This allows us to better appreciate the role of reputation, formal and informal aspects during such negotiations.

Some propositions we want to test require qualitative variables. So we have to approximate some aspects of the regressions; which cannot be done through contract reading. In that perspective, we built a questionnaire to address to the regional managers. Each managers is submitted a series of questions so that all contracts are covered by interviews. The variables we want to approximate are the following:

- What was the main criterion which motivates the selection by the public authorities?
- What was the role of prior ties in case of contract renewal?

- What was the initial spirit of the contract? As precise as possible in order to foresee all contingencies or, by contrary, enough flexible in order to easily adapt
- What was the "degree of fierceness" during the contractual adjustment?
- What were the main reasons of the contractual adjustment?

4 Conclusion

We build a model to show how past transactions matter to understand contractual design, and more precisely contractual incompleteness. Our theoretical model shows that the degree of contractual incompleteness is likely to decrease as times goes by. Relational contracts (i.e. tacit dealings between parties) become all the more implementable, because partners become more trustworthy through a learning experience. This should lead to fewer formal renegotiations due to inappropriate contractual design.

This proposition is not rejected by our data on the car parking sector in France according to our preliminary results. Further works on our empirical analysis should help us to present more accurate results.

Appendix A

In case of relational contracting, M informally commit not to hold-up G in case of inappropriate design (Situation 3). In exchange, G promise to select M at next contract renewal with probability p_c. In such a case, the ex-ante bargained price changed as well as the optimal level of cognitive effort $b^{*,r}$.

The ex ante bargained price in case of relational contract

As previously mentioned, we assume that M has bargaining power $\sigma \in [0; 1]$, and the posterior probability that A is not appropriate conditional on cognitive efforts b and unawareness is:

$$\hat{\rho}(b) = \frac{\rho(1-b)}{1-\rho b}$$

As under the informal dealing between parties, there is no hold-up, and renegotiation occurs at cost a, equation (1) defining bargaining on ex-ante price becomes:$\sigma(B^+ - c - \hat{\rho}(b)a) = p(b^*) - c$ which leads to $p(b^{*,r}) = c + \sigma(B^+ - c - \hat{\rho}(b)a)$.

The payoffs of the agents

Let us now deduce the (gross) payoffs of the agents under relational contracting, in each situation depicted in figure 1:

- **First Case:** the contractual design A is appropriate $(1 - \rho)$:
  In this case, G learns nothing from her investigation, then trade occurs at price $p(b^{*,r})$, as previously defined. As the design is appropriate, no renegotiation takes place and G's payoff is then $U_G^{A,r} = B^+ - p(b^{*,r})$, while the manager's payoff is $U_M^{A,r} = p(b^{*,r}) - c$.

- **Second Case:** There is no need of relational contracting and payoffs remain as in the initial case: $U_M^{A',r} = U_M^{A'} = \sigma(B^+ - c)$.

- **Third Case**: In case of inappropriate design, with a probability (1-b)), G does not find that the contractual design is inappropriate, and choose to trade at some price $p(b^{*,r})$, with the hope that no hold-up will occur. Hence, renegotiation occurs to reach B^+ and G supports adjustment costs a. Payoffs become $U_G^{H,r} = B^+ - a - p(b^{*,r})$ and $U_M^{H,r} = p(b^{*,r}) - c$.
  There is no hold-up.

As a consequence, in case of relational contracting, the expected payoff of M when he decides to respect his informal dealing is:

$$E(U_M^r) = \rho[bU_M^{A',r} + (1-b)U_G^{H,r}] + (1-\rho)U_M^{A,r}$$

Optimal cognitive efforts

Let us now determine the optimal level of G's cognitive efforts supported to foresee future contingencies, b^r, in case of relational contracting. G maximizes her expected payoffs in each situation:

$$\max_b -T_G(b^r) + \rho(1-b^r)(U_G^{H,r}) + \rho b^r(U_G^{A',r}) + (1-\rho)U_G^{A,r}$$

$$\max_b -T_G(b^r) + \rho(1-b^r)(B - a - p(b^{*,r})) + \rho b^r(1-\sigma)(B^+ - c) + (1-\rho)(B^+ - p(b^{*,r}))$$

By replacing $p(b^{*,r})$ by its value:

$$\max_b -T_G(b^r) + \rho(1-b^r)(B-a-(c+\sigma(B^+-c-\hat{\rho}(b^r)a))) + \rho b^r(1-\sigma)(B^+-c)$$

$$+(1-\rho)(B^+-(c+\sigma(B^+-c-\hat{\rho}(b^r))a))$$

$\Leftrightarrow$

$$\max_b\{-T_G(b^r) + (B^+-c)(1-\sigma) - \rho(1-b^r)a + \rho(1-b^r)(\hat{\rho}(b^r))a + (1-\rho)((\hat{\rho}(b^r)a))\}$$

$\Leftrightarrow$

$$\max_b\{-T_G(b^r) + (B^+-c)(1-\sigma) - \rho(1-b^r)a + (1-\rho b^r)(\hat{\rho}(b^r))a\} \tag{9}$$

$$\max_b\{-T_G(b^r) + (B^+-c)(1-\sigma) + \rho a[-1+b^r(1-\hat{\rho}(b^r)a)]\} \tag{10}$$

Differentiating (10), we obtain the equation defining $b^{*,r}$:

$$T_G^{'}(b^{*,r}) = \rho a(1-\hat{\rho}(b^{*,r})) \tag{11}$$

Let us note that this level of transaction cost is lower than that in the absence of relational contract (equation (4)). This is quite intuitive, as it implies that the public authority is less willing to support cognitive costs to avoid inappropriate contractual design, because in this case, there is no hold-up as the contract is expected to be relational.

Appendix B

Suppose that a relational contract has been concluded at price $p(b^{*,r})$. Then, when M deviates from his informal commitment, then G does no longer trust him. If he is still chosen at next contract renewal, then the ex-ante bargained price in next periods takes into account the hold-up action of the manager in the future. In other words, $x = 1$ in (1) that becomes:

$$p(b^{*,d}) = c + \sigma(B - c - \rho(b^*)(a + \frac{h}{\sigma}))$$

$$p(b^{*,d}) = c + \sigma(B - c - \rho(b^*)\Delta)$$

since $h = \sigma(\Delta - a)$, i.e. $\Delta = (\frac{h}{\sigma} + a)$.

- **First Case:** the contractual design A is appropriate $(1 - \rho)$.
  In this case, G learns nothing from her investigation, then trade occurs at price $p(b^{*,d})$. As the design is appropriate, no renegotiation takes place and G's payoff is then $U_G^{A,D} = B^+ - p(b^{*,d})$, while the manager's payoff is $U_M^{A,D} = p(b^{*,d}) - c$.

- **Second Case:** As shown in appendix A, there is no opportunity of hold-up, *i.e.* $U_M^{A'} = U_M^{A',D} = \sigma(B^+ - c)$.

- **Third Case**: In case of inappropriate design, with a probability (1-b)), G does not find that the contractual design is inappropriate. Hence, renegotiation occurs to reach B^+ and G supports adjustment costs a. Hold-up occurs as there is no more relational contract once the manager has cheated.[27] Payoffs become $U_G^{H,D} = B^+ - a - h - p(b^{*,d})$ and $U_M^{H,D} = p(b^{*,d}) - c + h$.

As a consequence, in case of relational contracting, the expected payoff of M is:

[27] We assume that once a manager has cheated, he always hold-up as he is no longer trusted.

$$E(U_M^D) = \rho[b^d U_M^{A',D} + (1-b^d)U_G^{H,D}] + (1-\rho)U_M^{A,D}$$

Optimal cognitive efforts

Let us now determine the optimal level of G's cognitive efforts supported to foresee future contingencies, b^d, in case of relational contracting:

$$\max_b -T_G(b^d) + \rho(1-b^d)U_G^{H,D} + \rho b^d U_G^{A',D} + (1-\rho)U_G^{A,D}$$

$\Leftrightarrow$

$$\max_b -T_G(b^d)) + \rho(1-b^d)(B-a-h-p(b^{*,d})) + \rho b^d(1-\sigma)(B^+-c) + (1-\rho)(B^+-p(b^{*,d})) \quad (12)$$

By replacing $p(b^{*,d})$ by its value, the previous inequality becomes:

$$\max_b \{-T_G(b^d) + \rho(1-b^d)(B-a-(c+\sigma(B^+-c-\hat{\rho}(b^d)a))) + \rho b^d(1-\sigma)(B^+-c)$$

$$+(1-\rho)(B^+-(c+\sigma(B^+-c-\rho(\hat{b}^d)\Delta)))\}$$

$\Leftrightarrow$

$$\max_b \{-T_G(b^d) + (B^+-c)(1-\sigma) - \rho(1-b^d)(a+h) + \rho(1-b^d)(\hat{\rho}(b)\Delta\sigma) + (1-\rho)(\hat{\rho}(b^d)\Delta\sigma)\}$$

$\Leftrightarrow$

$$\max_b \{-T_G(b^d) + (B^+-c)(1-\sigma) - \rho(1-b^d)(a+h) + (1-\rho b^D)(\hat{\rho}(b^D))\Delta\sigma\} \quad (13)$$

$$T_G'(b^{*,d}) = \rho(a+h-\hat{\rho}(b^{*,d})\sigma\Delta) \quad (14)$$

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