Université de Paris-Sud 11
École Doctorale “Sciences juridiques, économiques et de gestion” - ED 263
Équipe de Recherche ADIS

Reputation, Informal Dealings and Contractual Dynamics

Four Essays on Contract Economics

Thèse présentée et soutenue publiquement le

8 novembre 2011

en vue de l’obtention du

Doctorat en Sciences Économiques

par

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Acknowledgements

The preparation of a Ph.D. dissertation is an arduous task. Without the help and encouragement of numerous people around me, it would have been impossible for me to accomplish this work. To express my utmost gratitude to all of them is an arduous task as well.

First and foremost, I am tremendously indebted to my supervisor, Professor Stéphane Saussier. I thank him for putting his trust in me. Without his patience, guidance and support, none of this would have been possible. His careful and valuable readings, discussions, criticisms and encouragements have been most precious in widening my perspective, and have contributed substantially to the work done in this dissertation. He has also greatly helped me by being my co-author in two papers that have served as a basis for my discussion in this dissertation. I am fortunate to have a supervisor such as him.

The second person I am tremendously indebted to is Claudine Desrieux. She greatly helped me by being my co-author in two papers but I cannot limit her role to those two joint works. Indeed, she played the role of a second PhD advisor. I learn a lot by working with her and I really hope that our collaboration will be fruitful in the future.

I also would like to thank my last co-author, Julie de Brux. More than a co-author, she was also my PhD-mate. We shared doubts and joys along our years of PhD students. I thank her for her presence and her support; and also for the good ideas she surprisingly had sometimes!

I also feel really grateful to people I randomly met during academic conferences, seminars and summer schools. I specifically think about Giorgio Zanarone, from the Colegio Universitario de Estudios Financieros in Madrid; Ricard Gil, from University of California at Santa Cruz and Brian Silverman, from the Rotman School of Management in Toronto. They accepted to give me some of their precious time and very helpful advices as well. Interacting with them has been priceless. I also think to the persons that have accepted to read the preliminary versions of some of the papers presented in this dissertation. Thus, I would like to thank Jean Tirole, Carine Staropoli and Anne Yvrande-Billon.

I am also very grateful to Professor Pierre Garrouste, Professor Claude Menard, Professor Thierry Penard, Yannick Perez, Emmanuel Raynaud, Professor Steven Tadelis, David Masclet and Professor Eric Avenel for generously sharing valuable comments, knowledge and experience with me. Other colleagues and fellow students at the Chaire EPPP have also offered many enlightening thoughts and discussions that have proved to be highly useful to my work. They include Aude Le Lannier, Miguel Amaral, Laure Athias, Lisa Chever, Simon Porcher, Jean-Michel Oudot, John Moore (the youngest one), Tra Phoung Tran, Heidi Weichtler, Paula Berdugo and Michael Klien. I would like to thank them for their time and effort, and for the moral support that they have provided to me throughout the years. It has been a great pleasure to work with them.

I also would like to thank Eshien Chong, Professor Philippe Gagnepain, Stéphane Robin, Professor Patrick Schmitz and Professor Brian Silverman for accepting to be the members of the jury.

Obviously, as the preparation of a Ph.D. dissertation is a full-time job, I also have to thank my friends that encourage me by accepting my mood swings and my discontinuous presence. They include Martin Koning, Baptiste Françon, Simon Dubecq, Mathilde Guerguoat, Matthieu Couttenier, Maïkel Marcos Vega, Jean-Pierre Ané, Fabrice Rusig, Adeline Khov Cao, Xavier Prevost, Marguerite Lavedan, Pierre et Julien Collot, Lionel Paolella, Benjamin Pruniaux, Gaetan Rivaud, Mathieu Grichois, Franck Honoré, Xavier Berre, Pierre De Brux, Vincent Mansuy, Diego Castillo, Irwin Marc, Jérome Héricourt, Marie-Sophie Hyernard, Natacha Daubord, Kevin Sheehan, Madeleine Portmann, François Cao and many others...

Before the start of the Ph.D. dissertation, several professors have played an important role, by making me love the economy and making me gain confidence in my ability to undertake such work. In this regard, I would especially like to thank Jean-Louis Rivaud.

I would like to thank my godfather Olivier Chérain and my godmother Odile Fréquelin. I would have liked Luis Benito and my grandfather Gérard Oudin to attend the Ph.D. defense. I also would like to thank Claire Fourton for her support. She makes easier my life in Paris during my years as a PhD student.
Obviously, I also want to express all my gratitude to my family. I want to thank my family in Troyes and Pau: Marianne, Caroline, Fabienne and David Pourille ; and my grandfather Jean Beuve and all my aunts, uncle and cousins : Brigitte, Muriel and Philippe Beuve and Laurence, Edouard and Alix Favier. I also want to thank my parents, Denis and Sylvie Beuve, who supported me unconditionally and did not hesitate to show their pride and to help me all along my scholarship. I also thank my grandmother Emilienne Oudin for always having faith in me (nevertheless, she is still waiting for me to find a real job!). Finally, it is impossible for me to not mention my sister Julie Ferrère, my brother Antoine Beuve, my sister-in-law Marion Brégeon, my brother-in-law Dominique Ferrère and my niece Jeanne Ferrère. I am lucky to have a family such as them. This work is dedicated to them.

Last, but not least, I would like to thank Hélène-Charlotte Pisarska that shared my life during my years as a PhD student. Her daily kind gestures and her unconditional support were precious sources of motivation. I thank her for her love and patience. This work is also dedicated to her.

Without all these people, this work would not have been possible.

Foreword

This Ph.D. dissertation, entitled "Reputation, Informal Dealings and Contractual Dynamics", brings together four essays in the field of contract economics. Each essay corresponds to one chapter. The links between those different chapters and the underlying logic of the whole dissertation is explained in the General Introduction in which we also provide a review of the related literature and we define the questions of research we address. Nevertheless, since each chapter corresponds to an independent essay, chapters can be read separately. This implies the presence of redundant information across chapters.

Abstract

This Ph.D. dissertation seeks to investigate the existing links between cooperative behavior and formal contracts. First, because formal agreements are supposed to facilitate smooth collaboration and avoid costly misunderstandings, we are interested in how formal contracts impact on the ability of parties to cooperate. Following the same intuition, we also analyze cooperation through the lens of renegotiations in order to investigate how contracts adapt themselves through time in a changing environment. Second, we also study the impact of the existence of informal dealings, alternatively considered in previous literature as substitute or complement to formal contracting. More precisely, we aim to investigate how the existence of relational mechanisms may impact on contractual choices. Our goal is thus to improve the understandings of the role played by formal contract and informal cooperation in relationships and to enrich the theory of the determinants of incomplete contract. Our results suggest that the role of formal contract in relationships strongly depends on the context and the identity of parties. Our results also identify the ability of the parties to sustain a relational agreement as a new source of endogenous contractual incompleteness. Finally, we also find that adaptations through contractual renegotiations are not necessarily harmful for the contracting parties. We believe that this Ph.D. dissertation contributes to the lit-

erature on the debate of complementarity and/or the substitutability of formal and informal governance and to the literature on the link between relational contract and endogenous contractual completeness. In the end, the overall implication is the necessity for parties to carefully think about the initial contract they draft. Because it has an impact on their ability to cooperate *ex post* and also because contracts can be over-complete compared to the efficient (i.e. socially optimal) level of completeness.

Keywords: Cooperation, Formal Contract, Relational Contract, Reputation, Contractual Incompleteness, Repeated Games, Experiment, Renegotiations, Inter-firm Relationships, Public Private Partnerships, Transaction Costs.

Résumé

Cette thèse cherche à étudier les liens existants entre les contrats formels et les comportements coopératifs. Les contrats formels étant censés faciliter la collaboration et éviter des incompréhensions coûteuses entre les parties, nous nous intéressons dans un premier temps à la manière dont le contrat formel impacte sur la capacité des parties à coopérer. Nous analysons ensuite, dans un même ordre d'idée, la coopération à travers le prisme des renégociations contractuelles. L'objectif est alors d'étudier la façon dont les contrats s'adaptent à un environnement changeant à travers le temps. Enfin, l'étude se porte sur l'impact de l'existence de rapports informels, considérés par la littérature antérieure comme, de manière alternative, substitut ou complément aux contrats formels. Plus précisément, nous étudions comment l'existence de mécanismes relationnels influe sur les choix contractuels. Ainsi, l'objectif est d'améliorer la compréhension du rôle joué par les contrats formels et la coopération informelle dans les relations et d'enrichir la théorie sur les déterminants de l'incomplétude contractuelle. Nos résultats suggèrent que le rôle du contrat formel dans les relations dépend fortement du contexte et de l'identité des parties concernées. Nos résultats permettent également d'identifier la capacité des parties à soutenir un accord relationnel comme une nouvelle source endogène d'incomplétude contractuelle. Enfin, nous obtenons également que les adaptations

contractuelles, par le biais des renégociations, ne sont pas nécessairement nocives pour les parties. Au final, nous pensons que cette thèse contribue à la littérature sur le débat entre complémentarité et / ou substituabilité des modes de gouvernance formels et informels ainsi qu'à la littérature sur le lien entre contrat relationnel et l'incomplétude contractuelle endogène. Par conséquent, l'implication majeure de ce travail de thèse est illustrée par la nécessité pour les parties de réfléchir attentivement au contrat initial et aux efforts consentis pour sa rédaction. En premier lieu car le contrat formel impacte sur leur capacité à coopérer *ex post* et, en second lieu, car le contrat formel peut se révéler être trop complet par rapport au niveau de complétude optimal.

Mots clés: Coopération, Contrat Formel, Contrat Relationnel, Réputation, Incomplétude Contractuelle, Jeux Répétés, Economie Expérimentale, Renégociations, Relations Inter-Firmes, Prtenariats Public Privé , Coûts de transaction.

Contents

General Introduction

Most relationships include different forms of formal contract. To an economist, a contract is an agreement under which two parties make reciprocal commitments in terms of their behavior - a *bilateral coordination arrangement*. Over the last decades, the development of various theoretical approaches of contract economics and the boom in empirical studies have illustrated the huge and growing interest of economists for contract analysis. The reasons of such an interest have to be found in the key role played by contracts in a world of decentralized markets in which agents deal bilaterally (Akerlof [1970]). Considered as an essential feature for relationships stability and success, contracts are viewed as a mean to address coordination difficulties inherent to economic exchanges characterized by uncertainty. If contracts are not well designed and not well managed, the relationship might suffer from failures. For instance, it is likely that decisions are not taken at the right time or not taken at all, parties may fail to understand their obligations and responsibilities, misunderstandings may occur, intended profits may be not realized and opportunities to improve performance may be missed. Following this idea, the classical example of General Motors - Fisher Body case is telling. As described by Klein [2007], Fisher took advantage of the long term, cost-plus exclusive dealings contract designed by the parties to encourage Fisher to make

specific investment dedicated to its relationship with General Motors. Actually, the long term contract used to protect Fisher creates a contractual specificity that also locked General Motors into Fisher. In the end, Fisher took advantage of this long-term commitment by refusing to locate a new plant next to General Motors and by producing very costly (but highly profitable) automobile bodies that General Motors was compelled to buy. This example allows to highlight an other key determinant of successful relationship, namely the cooperation between parties. While coordination and maladaptation costs resulting from complexity and uncertainty are a source of relationships failure, a second main source comes from the existence of opportunistic behavior between parties. As emphasized by scholars and consulting firms, one of the major reasons for alliance dissolutions has been the opportunistic behavior of partners.[1] Opportunistic behavior correspond to the conventional assumption that economic agents are guided by considerations of self-interest. As pointed out by Williamson [1975], "opportunism refers to a lack of candor or honesty in transactions, to include self-interest seeking with guile." Such opportunistic behavior, often called "relational risk", may include shirking, delivering unsatisfactory products and services, appropriating the partner's resources and distorting information. Because these activities seriously jeopardize the viability and the success of relationships, a major goal for parties is to find way to deter opportunism, that is to say, to promote cooperative behavior. In practice, this can be achieved thanks to two different instruments. First, the formal governance can, through contractual safeguards, anticipate and dictate *ex ante* a framework for cooperation. However, it is impossible to *ex ante* determine first best response to all future contingencies. As we will see, contracts are incomplete for at least two reasons: because it is prohibitively costly to foresee all relevant contingencies at the time the contract is signed (Williamson [1985]); and because verifiability of contractual provisions, a requirement for *ex post* enforceability, is

[1]Major consulting firms have estimated failure rates from 50 (McKinsey and Company) to 64% (Pricewaterhouse Coopers) for US ventures, and as high as 70% (Boston Consulting Group) for international alliances with failure often attributed to opportunistic behavior by one or both partners (Parkhe [1993], Zeng and Chen [1986]).

often, not to say always, impossible to achieve.[2] Second, cooperation can also be managed *ex post* through informal agreements. Those latter are defined as mutual promises and understandings that are not provided in the formal contract and rely on trust and relational contracting. A broad literature now insists on the fact that relational contracting has long played a role in vertical and horizontal economic relationships. However, Telser [1980], Bull [1987], Klein [1996] and Baker et al. [2002] note that a relational contract cannot be enforced by a third party and must therefore be self-enforcing. Because of the close relationships that firms have with their partners, so-called implicit contracts might be implemented. Partners' attribute dispositions to each other-reliable, dependable, committed to providing expected rewards, and so on. Once trust has grown, there is an increasing willingness for a party to expose itself to risk, rely on a partner's promises, and to sacrifice present for future gains (Rempel et al. [1985], Parkhe [1993]). Through repeated interactions, contracting parties can make it costly for each other to breach the contract (*i.e.*, loss of future trade value). However, the self-enforcing range of such implicit agreements is limited (Klein [2007]), mainly by the level of trust parties have for each other.

In the end, the existence of two ways to foster cooperation naturally leads to a trade-off between formal and relational contracting, depending on their relative efficiency. This trade-off is the starting point of this dissertation. Our aim is to investigate the roles of formal contract and informal cooperation and the links between them. We want to understand how parties design and manage their contracts and how formal and informal agreements influence each other.
However, the need for formal agreements to sustain exchanges between parties, the role ascribed to contracts and the importance of informal cooperation is viewed differently, depending on the theoretical lens and their respective assumptions. A necessary pre-requisite, hence, is to review those different theoretical approaches in the field of contract economics.

[2]Those two approaches of contractual incompleteness (and their differences) will be described below in this general introduction.

The Agency Theory assumes that agents are endowed with substantial rationality, parties' information is complete and asymmetric and external institutions (court, "judge",...) are perfectly able to guarantee the performance of commitments. Under those assumptions, agents are able to frame a complete contract and the primary motives for contracting parties are risk transfer and incentive alignment (Hart and Holmstrom [2002]). The Incomplete Contract Theory also assumes that parties are perfectly rational but differs from Agency Theory since external institutions are endowed with bounded rationality. Hence, parties' information is complete but third parties are unable to observe (verify) relevant variable that is observable by the parties and, *de facto*, have a limited enforcement capacity. Consequently, some dimensions of the relationships are non-contractible and the main focus remains on the *ex ante* allocation of suitable decision rights and residual surplus to remedy contractual incompleteness, *i.e.* to motivate those non-contractible investments (Grossman and Hart [1986]). The difference between Agency Theory and Incomplete Contract Theory is that the enforcement environment is imperfect in the latter, reducing the ability of agents to implement the first best response to all future contingencies (Brousseau [2008]). However, a common point of those two strands of the theoretical literature is that informal cooperation is not a central issue. Indeed, both theories assume that contractors may make accurate anticipations about the future problems to be solved. Hence, parties are able to align incentives *ex ante* so as to define efficient way to adapt *ex post*, *i.e.* to define costless adaptations that enable to reach higher payoffs. All *ex post* cheating possibilities are anticipated, breach is never appealing and there is no need to informally adapt. Thus, in spite of some recent developments (Hart and Moore [2008], Schmitz [2006], Hoppe and Schmitz [2011]), the Incomplete Contract Theory exclusively focused on *ex ante* incentives.

Transaction Cost Theory distinguishes itself from Agency Theory and Incomplete Contract Theory because agents, as well as external institutions, are endowed with bounded rationality. The immediate consequence of this bounded rationality

is that parties' information is incomplete and asymmetric and external institutions are imperfect. Contracts, hence, are necessarily incomplete and imperfect. Even for simple economic transaction, it is practically impossible to list the entire range of outcomes and contingencies that might affect contractual performance (Williamson [1975]). The real-world complexity prevents contracts from providing an exhaustive description of the rights and obligation of the contracting parties in every possible contingency (Al Najjar [1995]). Indeed, contracts are costly to design and manage and these costs prevent contracts to solve *ex ante* all dimensions of coordination problems, hence calling for *ex post* adjustment. Nevertheless, such *ex post* adjustment opens the door for opportunistic behavior. Those *ex post* adjustments include bargaining and hold-up activities in transactions supported by relationship-specific investments (Williamson [1975], Klein et al. [1978]).[3] As a consequence, the level of contractual completeness is the result of a trade-off between *ex ante* costs of crafting more complete agreement and *ex post* inefficiencies associated with less exhaustive agreements (Crocker and Reynolds [1993]). Given that contracts are incomplete, the viability of the relationships also depends on the parties' ability to cooperate in case of contingencies that are not foreseen by the formal contract. The main purpose of contracting boils down to generating adequate *ex ante* incentives to invest by securing the parties, and adequate incentives to adapt to unanticipated *ex post* events and to constrain wasteful efforts to influence the distribution of gains from trade (Masten and Saussier [2002]). In other words, contracts have to formally protect the parties all by allowing them to informally adapt and learn. To sum up, if contracts are necessary to organize the frame of future coordination, they are not sufficient in guaranteeing its efficiency. A lot depends upon the mutual behavior of parties and upon the dynamics of their relationships. Such cooperative behavior can be sustained by contractual safeguards as well as informal mechanisms such as the reputation of the parties. According to Williamson [1983], reputation of the parties can act as hostages by

[3]Asset specificity is the main issue underpinning organizational relationship. Indeed, as soon as an asset is especially dedicated to a relationship, it becomes less valuable outside of this relationship and the generated quasi-rent can be the source of confrontational interest between parties.

securing the relationship. Other authors extend this argument by considering reputation as a substitute for costly formal mechanisms that verify the intentions and monitor the actions of business partners (Kogut [1989]).

Relational Contract Theory share with Transaction Cost Theory the idea that formal contract is costly and not the only solution to the coordination difficulties. However, the starting point of this theory is closest to the Incomplete Contract Theory. Indeed, Relational Contract Theory assumes that parties are perfectly rational, information is complete and symmetric and external institutions are unable to verify some variables. As a consequence, contracts are incomplete in the same sense, *i.e.* they contain "third party unenforceable" elements (*i.e.* elements that cannot be enforced by a court). Nevertheless, other means apart from formal contract exist to curtail opportunistic behavior and promote cooperation between partners. Departing from Incomplete Contract Theory, Relational Contract Theory considers the existence of repeated interactions and mainly insists on their disciplinary power. As soon as parties expect to interact repeatedly, relational mechanisms may achieve similar results than formal contract to address the moral hazard problem by achieving incentive alignment (Telser [1980], Bull [1987]). Perspectives of future business thus allow to overcome the adaptive limits of formal contract by solving asymmetry problems that formal contract, for whatever reasons, are not able to address (moral hazard, hold-up). By using the terminology of MacNeil [1978], parties are encouraged to respect the *spirit* of the contract rather than to exploit its *letter*. As pointed out by Gil and Marion [2009], "it may be prohibitively expensive to completely specify in advance all relevant contingencies and product attributes to the transaction at hand. It is in these cases that relational contracting proves most useful since it helps a firm and its supplier to respond to unforeseen circumstances when needed or induces the supplier to provide the informally agreed optimal product quality when the attributes of the supplied product are not verifiable to a third party."
When contracting parties are engaged in repeated exchanges, reputational con-

cerns encourage them to cooperate by utilizing their detailed knowledge of their specific situation and by adapting to new information as it becomes available (Gibbons [2005]). The idea is that both parties have an incentive to cooperate given that "reneging would bias future trade terms or even end the relationship" (Levin [2003]) and also that any transactor who reneges would suffer a loss of reputation which undermine his ability to start new relationships. Such a link between future relationships and cooperative behavior is also emphasized by sociologists. For instance, Granovetter [1985] argues that "individuals with whom one has a continuing relation have an economic motivation to be trustworthy, so as not to discourage future transactions; and departing from pure economic motives, continuing economic relations often become overlaid with social content that carries strong expectations of trust and abstention from opportunism." The consequence is that informal agreements of cooperation becomes self-enforced, and it does not matter if the formal contract is not complete. Nowadays, this idea of future interactions sustaining informal agreements is applied in the studies of topics as varied as subjective pay performance (Baker et al. [1994]), quality provision (Klein [1981]), the boundaries of the firm (Baker et al. [2002]) and procurement contracting (Calzolari and Spagnolo [2009]). On the empirical side, the existence and the impact of relational contracting was put to the test in industries as diverse as telecommunication and microelectronics (Ryall and Sampson [2009]), dry cleaning (Gil and Hartmann [2011]), highway procurement (Gil and Marion [2009]) and movies (Gil [2011]).

However, the ability of firms to implement self-enforced informal agreements does not depend on future businesses but rather on the *valuation* of those future businesses. Indeed, relational contract is only possible to the extent that contracting parties value more the gains from future trades than the potential gains coming from short term deviation. Here again, the previously cited example of Fisher Body - General Motors speaks for itself. Both contracting parties recognized that the original contract signed in 1919 was imperfect and incomplete. But although

Fisher always had the ability to exploit the imperfect supply contract, the contract functioned extremely well for more than five years. Like Klein [2007] emphasizes it, "Fisher had more to lose from General Motors' non-renewal of the agreement than it had to gain. It was only in 1925, when General Motors' demand for Fisher bodies increased dramatically (along with new large required Fisher specific investments) that Fisher began to take advantage of the contract." In other words, because of the modification of the contractual environment, Fisher Body found it profitable to exploit the *letter* of the contract rather to respect it *spirit* and the relationship gets outside the self-enforcing range. This example clearly highlights that contractual incompleteness is not an issue *per se*. It becomes a source of *ex post* difficulties as soon as the valuation of future business does not provide enough incentives for parties to cooperate. Thus, there exist a link between valuation of future business, the sustainability of relational contract and the parties' willingness to commit on incomplete contract. Nevertheless, those links are still, up to now, an under-investigated topic that we aim to investigate in this dissertation.

Through this short review of the literature, we can also notice that Transaction Cost Theory and Relational Contract Theory both take reputation into account in their analytical framework and highlight its important role in sustaining cooperation. Nevertheless, there is a difference in their interpretation and in the role assigned to reputation mechanism. According to transaction cost economists and sociologists, reputation refers to past experiences. They emphasize the development of trust or embeddedness from prior interactions that facilitates smoother collaboration in the future (Ryall and Sampson [2009]). As pointed out by Parkhe [1993], "one way for a firm to deal with potentially opportunistic partner is to take their cumulative past behavior as a guide to their future behavior, or - when such information is unavailable - to use reputation as a proxy for knowledge of opportunistic attention." Hence, reputation works as a screening device that parties use to determine (even imperfectly) the true type of their partners when moral hazard or adverse selection exist. On the other hand, defendants of the Rela-

tional Contract Theory are rather interested in reputational concerns. Instead of focusing on the *shadow of the past*, they consider that the *shadow of the future* (*i.e.* anticipation of valuable future interactions) acts as an incentive for parties to behave cooperatively, *i.e.* to create and maintain a reputation of reliability. In this dissertation, reputation and reputational concerns, considered as informal contracting aspects, are central issue of investigation.

This Ph.D. dissertation first seeks to study the role played by formal contract. To the extent that formal agreements are supposed to facilitate smooth collaboration and avoid costly misunderstandings, we are interested in how firms perceive formal contracts. Are they the cornerstone of the relationship or simple "blueprints" for exchanges relegated to a position of second importance in the daily life of the relationship? Contractual relationships evolve and must respond to changes in the business environment. It follows that formal contracts must also be capable of evolving efficiently in response, through formal change and by mutual consent. Thus we want to understand the impact of contractual renegotiations in the dynamics of relationships. In particular, whether renegotiations are considered as positive or negative in terms of contractual surplus. As previously said, the existence of relational mechanisms may impact on contractual choices of parties, notably in terms of contractual completeness. We also investigated this issue.

The dissertation is divided into two parts. In the first part, contractual incompleteness is taken as granted, i.e. contracts are incomplete for exogenous reasons. Hence we are interested in *the way parties deal with this situation by considering the impact of the formal contract on informal cooperation and by investigating the issue of renegotiation.* Our second part proposes an analysis of *the link between endogenous contractual incompleteness and sustainable relational contract.* We investigate this question theoretically then we test empirically the causality between the existence of relational contract and the voluntary commitment to incomplete contract.

We now discuss in greater detail how each part of our dissertation is organized in the following.

The first part studies the role of the formal contract in allowing parties to achieve cooperation in their relationships. As previously emphasized in this general introduction, there exists a trade-off between *ex ante* costs to draft the contract and the *ex post* inefficiencies associated with less exhaustive arrangements. Hence the question is to determine whether the formal contract improve or undermine the ability of parties to cooperate *ex post*. Such a question is relevant since it determines the necessity and the relevance to *ex ante* incur costs and efforts to craft the formal contract. This research question is close to the on-going debate about the substitutability and/or the complementarity of formal and informal governance. Previous studies consider that relational governance and formal contracts are substitutes. In fact, many scholars consider that the presence of either device makes the presence of the other useless. For instance, Dore [1983], Gulati [1995], Powell [1990] and Uzzi [1996] argue that informal institutions are able to enhance cooperative behavior without the costs and complexity associated with formal agreements and, *de facto*, act as a functional substitute for formal contracting. From a starker perspective, other authors consider that the existence of a formal contract will undermine the possibility of implementing relational exchange, suggesting a pernicious effect of formal controls on cooperation. By its simple existence, a formal contract sows the seeds of mutual suspicion, causing a decline in mutual trust and making the development of cooperative behavior impossible (Macaulay [1963]). However, more recent studies argue that formal and informal dimensions of the relationship can complement one another and, when combined, can improve the overall performance of relationships (Ryall and Sampson [2009]). Rather than hindering or replacing relational governance, contracts may promote the formation of long-term, trusting exchange relations (Poppo and Zenger [2002]). From this perspective, a formal contract secures an agreement, increases transparency in the partnership, facilitates learning processes about each partner's conduct, and

helps to promote cooperation. In the first part of this dissertation, we seek to understand how the formal contract influences cooperation in interfirm relationships. Then, we turn to consider the context of public-private arrangements and investigate how cooperation through adjustments of the formal contract impacts on the continuation of the relationship. Naturally, this part is divided into the two following chapters.

In the first chapter, we examine empirically how firms achieve cooperation to create value in their relationships, using an original database constructed by the French National Institute of Statistics to characterize inter-firm contractual agreements. The literature mainly stresses the complementarity/substitutability of formal and relational governance (Poppo and Zenger [2002], Lazzarini and Zenger [2002]) or the link between past interactions, trust, and the way contracting partners draft contracts (Crocker and Reynolds [1993], Corts and Singh [2004], Gulati and Nickerson [2008]). In contrast to this literature, we do not focus primarily on the formal-relational dimensions of contractual agreements. Taking for granted that a relationship is efficient and creates value only to the extent that it fits its environment and adapts through time without any conflict dissipating the surplus, we study the conditions under which such cooperation is achieved. Our contribution to the literature is then to analyze the conditions under which *ex post* cooperation is more likely to develop, depending on the characteristics of the contracting parties and transactions, as well as *ex ante* contractual choices.
We find that *ex post* cooperation can be achieved without any *ex ante* effort to frame a formal contract encompassing the dimensions of their future relationship. Nevertheless, we do not find any evidence that formal contracts undermine trust or encourage the opportunistic behavior they are designed to prevent. More precisely, our results show that formal contracting increases the probability of *ex post* cooperation between the contracting parties when hazards become severe. This suggests that *ex ante* formal contracting efforts are not always destructive but can actually encourage partners to cooperate *ex post* and to rely on relational

agreements, leaving room to adapt cooperatively to unanticipated changes in the environment. Our results also reinforce the idea that contracts and cooperation have to be assessed conjointly for a more subtle explanation of the interaction between *ex ante* governance mechanisms and subsequent adaptations. Finally, this chapter makes us believe that the answer to the on-going debate about the substitutability or the complementarity of formal and informal governance has to be found empirically. In accordance to Corts and Singh [2004], we argue that the real question is not to determine *whether* formal and informal governance mechanisms are complement or substitute but rather *when* they are.

Chapter 2 studies the issue of cooperation through renegotiations. Our focus on contractual renegotiations in this chapter is driven by the data we explore. In fact, it is highly complicated to empirically observe the entire range of history of a relationship and scholars mostly use to rely on questionnaire and survey to investigate relationships. This leads to unavoidable imperfect information. We choose to study public-private arrangements since the regulation imposes that each adaptation during the lifespan of the relationships should be translated in the written formal contract. This need is due to the characteristics of goods and services that are provided through this particular kinds of arrangements. Because they deal with services of general interest, public-private contracts are especially under the scrutiny of regulation bodies. Here, we collected all the contracts signed between 1963 and 2008 between the leading company of the French car park sector and 135 different public authorities; and we codified their initial characteristics and all the subsequent contractual renegotiations they are concerned with. Hence, we built a completely new and original data-set of 252 expired public-private contracts. We consider that a contract is renegotiated when a revision, not envisioned in the original contract, occurs. For instance, changes in tariffs, duration, additional investments or conditions of the financial equilibrium are coded as contract renegotiations.

Our goal in this chapter is to assess the impact of renegotiations on the contractual relationship. More precisely, we investigate the link between renegotiations and contract renewals. Hence, our starting point is to consider that if renegotiations led to surplus decrease, then parties would not be prone to contract again together. This way, we aim to fill a gap identified by Oxley and Silverman [2008] when they call for studies that enable to determine whether renegotiation represents a jointly beneficial move toward greater efficiency or whether it represents an opportunistic behavior by one of the partners. According to the authors, this question might be informed by "explicitly connecting renegotiation to (actual or perceived) performance effects, and to unpacking more disaggregated detail about which types of provisions are renegotiated in the presence of which triggering factor".

The first originality of this study is that we overcome the usual limits of the literature on contractual renegotiation. Indeed, not only do we consider whether renegotiations have occurred but also do we endeavor to characterize their nature by taking into account their timing, their frequency and their types. The second originality of this chapter is that we study the link between those renegotiations and contract renewal in order to determine how they impact on the relationship. Our findings reveal that some renegotiation types, their frequency and their scope clearly impact on the probability to see a contract renewed as soon as public authorities have discretionary power on the decision to renew a contract with the same private partner. Hence, our results suggest a positive, negative or neutral impact on the contractual surplus, depending on the kind of renegotiation and the kind of contract that is considered. In order to better ensure the relevance of this chapter in the dissertation, we also take into account relational dimensions of the relationships by introducing variables about the past history and the perspective of future business between the private operator and the different public authorities. The results we obtain are consistent with previous literature on this topic.

The second part of our dissertation intends to study the causality between sustainable relational contract and endogenous contractual incompleteness. Compared to the first part, we do not still wonder to investigate the impact of the formal contract on cooperation but we aim to investigate the causality between informal cooperation and the level of contractual incompleteness. Indeed, much more needs to be known of the way contract are designed by agents and we need a better understanding of the relationship between contracting arrangements and patterns of behavior. As pointed out by Scott [2000], reciprocal behavior could explain endogenous contractual incompleteness and would change, to a large extent, our current understanding of contract. Moreover, this part of the dissertation is also motivated by the observation that there might exist a strong heterogeneity of formal contract in a same sector, even for highly similar relationships. For instance, in their study of 42 technology alliances contract in the telecommunications equipment manufacturing and microelectronics industries, Ryall and Sampson [2009] observe very formal documents with highly detailed clauses and lengths over one hundred pages along side with fairly simple five pages document containing very general terms. Thus, the resulting question is to determine whether there are conditions under which contracting parties might choose incomplete contracts, even though more detailed contract could have been easily draft? To address this question, we start from the trade-off between *ex ante* costs of crafting more complete contract and the gains to avoid contractual incompleteness and potential *ex post* opportunism; then we look what happens to this trade-off when parties trade repeatedly. Thus, we build a model of relational contracting where contractual incompleteness is determined by the level of *ex ante* efforts made by parties to foresee future contingencies and we investigate how this incompleteness evolves over time. This part is divided into the two following chapters.

Chapter 3 examines why relational contracts are not only a response but also a determinant of contractual incompleteness. Following an intuition raised by Tirole [2009], we theoretically show that when parties know that a relational contract is

sustainable, they become more willing to sign *ex ante* formal agreements that are left intentionally incomplete, because the relational contract allows to deal with *ex post* unforeseen events. Then, the ability of a co-contractor to sustain a relational contract determines the *ex ante* efforts made to learn about future contingencies and make as complete a formal contract as possible. This ability mainly depends on the discount rates of the parties, which determines the value of future business. The contribution of this chapter is twofold. First, we depart from usual model of relational contracting by considering that parties do not share a same discount rate and that the information about private discount rate is asymmetric. Second, we use this asymmetric information model to show how the degree of contractual incompleteness evolves over time in a dynamic setting. Our results show that transactions with a same degree of complexity can be managed through formal contracts that are more or less (in)complete according to the identity of the co-contractors. Moreover, we formally provide a dynamic model which allow to confirm the suggestion of Tirole [2009] saying that relational contract can be an explaining factor of voluntary incomplete contract. To our knowledge, our model is the first contribution showing that contractual incompleteness is determined by the sustainability of relational contracts. Only Bernheim and Whinston [1998] have explored the link between incomplete contracts and relational contracts. They view contractual incompleteness as a cause and not a consequence of relational contracts, since punishment strategies allowing a relational contract to be sustainable can be more easily elaborated when contracts are incomplete. Our contribution is to formally show the reverse causality: incomplete contracts are not a cause but a consequence of relational contracts.

Finally, chapter 4 puts to the test the propositions derived from chapter 3. We use experimental methodology and we empirically investigates the interaction between relational contracting and endogenous contractual incompleteness. In order to account for contractual relationships with perspective of future interactions, we build an original experimental design of infinitely repeated games between identifi-

able players. In our experiment, the level of contractual completeness is decided by participants at each period. This possibility for players to endogenously determine the level of completeness they want is compared between treatments in which vary two determinants of relational contract: the probability of continuation and the level of shared information. In accordance with the propositions of the chapter 3, our results show that past interactions are a stronger determinant of the level of investment in contractual completeness than the perspective of future business. More precisely, we find that sustainable relational contract allow to decrease the level of completeness over time through a learning process between players about their more or less strong willingness to cooperate. The experimental methodology allow us to overcome major limits of empirical studies of relational contracting. Actually, most of the studies use prior deals to measure the presence of relational mechanisms. Unfortunately, this kind of measures is inappropriate for two reasons. First, it fails to really capture the expectation of future dealings. Second, it is also an imperfect measure for past interactions since it captures all prior deals whether positive or not. To our knowledge, however, there is only one empirical paper, Gil [2011], that has succeeded to jointly analyze relational mechanisms and contractual completeness. In his study of the Spanish movie industry, he reaches a conclusion very closed to ours, *i.e.* contractual incompleteness emerges when firms can use *ex post* renegotiation and the value of their relational contracts to use new relevant information about the transaction to their benefit.

We believe that our dissertation contributes to several strands of the literature. Concerning the literature about the complementarity and/or the substitutability of formal and informal governance, we argue that the answer of such a question is mainly empirical and we suggest that informal cooperation depends on the characteristics of the relationship and *ex ante* contractual choices. We also contribute to the literature on contractual renegotiations. Actually, we go beyond existing studies on this issue by taking into account much more dimensions of renegotiations and by looking to their impact on contract renewals (which can be seen as a proxy

for perceived performance). Finally, we also provide contributions to the literature on relational contract and endogenous contractual completeness by showing theoretically and, afterward, by proving empirically that the causality between relational contract and incomplete contract can be reversed. As a consequence, informal cooperation is not only a complement of necessary incomplete contract but expectations of future cooperation (sustained by relational mechanisms) can explained why contracts are voluntarily incomplete. We thus emphasize the relational dimensions of relationships and the crucial importance that has to be attached to parties identity and history (*i.e.* reputation). In the end, the overall implication is the necessity for parties to carefully think about the initial contract they draft for two reasons. First because it has an impact on their ability to cooperate *ex post* and, second, because contracts can be over-complete compared to the efficient (i.e. socially optimal) level of completeness. Obviously, the works presented in this dissertation need further investigations that fit into our research agenda. The limits and the perspectives of future researches are discussed within the chapter and within the general conclusion.

Tables 1 and 2 provide a summary of the research questions, the used methodology and the main results of each of the four chapters of this dissertation. A general conclusion resumes our work and discusses some limits and possible extensions for future research.

Table 1: Summary of Part I (*Research questions, methodology and main results*)

Chapter	Methodology (and Data)	Main results
• **Chapter 1.** Interfirm Cooperation and The Role of Formal Contract. • **Research Questions.** How parties achieve cooperation in their relationships? What are the role played by reputation and formal contracts?	• Econometric analysis (probit estimations). • Questionnaire send to firms having a main industrial activities in various sector (2003). Firms have to describe their three most important relationships. • Focus on complex relationships (excluding all simple spot agreements with any kind of specific investments). • 1 101 firms & 3 359 complex interfirm relationships. • ***Source:*** INSEE.	• The use of detailed formal contract undermine the ability of firms to cooperate *ex post* in their relationships. → Support for the *Strong Substitution View* between formal and informal governance (the use of the former limits the possibility to use the latter). • The use of detailed formal contract improve the ability of firms to cooperate *ex post* when their relationships entail important contractual hazards (*Strategic Importance*). → Support for the *Complementarity View* between formal and informal governance (the use of the former strengthen the possibility to use the latter). • The choice of a reputed (*i.e.* reliable) partner improve the ability of firms to cooperate *ex post*, especially when their relationships entail important contractual hazards (*Strategic Importance*).
• **Chapter 2.** Renegotiations and Contract Renewals in PPPs. • **Research Question.** What is the impact of renegotiations on the contractual relationships?	• Econometric analysis (probit estimations). • Public Private Partnership contracts (delegated management and public procurement). • Data coming from the market leader of the French car park sector. • 666 contracts and all their respective renegotiations. • ***Source:*** original database gathered and constructed by the authors.	• To renegotiate fast after the date of signature reduces the probability of contract renewal (aggressive bidding or winner's curse effect). • Depending on the dimensions they are concerned with, renegotiations have a differentiated impact on contract renewal (positive, neutral or negative). • Existence of a non-linear effect concerning the frequency of renegotiations during the lifespan of the contract.

Table 2: Summary of Part II (*Research questions, methodology and main results*)

Chapter	Methodology (and Data)	Main results
• **Chapter 3.** Reputation and the Dynamics of Contractual Incompleteness. • **Research Questions.** Does repeated contracting diminish the fears of hold up in renegotiations, making a less complete (and a less costly) agreement more attractive? How does relational contract impact on contractual incompleteness over time?	• Theoretical model of open-ended repeated interactions. • Buyer-Seller relationship with asymmetric information about the discount rate.	• In one-shot game, there is an over-investment in contractual completeness (Nash Equilibrium, NE). • In repeated games with symmetric information, sustainable relational contract leads to the optimal level of *ex ante* efforts (First Best, FB) and, under certain conditions, a sustainable second-best relational contract allow to minimize *ex ante* efforts (>FB but <NE). • In repeated games with asymmetric information, first period is characterized by over-investment in contractual completeness (contract pooling equilibrium), then contractual completeness decreases *over time* thanks to a mechanism of revelation through default (*i.e.* non cooperative behavior).
• **Chapter 4.** Relational Contract and Endogenous Contractual Incompleteness. Experimental Evidence. • **Research Question.** Empirical test of the propositions derived from Chapter 3 through laboratory experiment.	• Experimental methodology • Experimental design: infinitely repeated games between identifiable players and endogenous contractual incompleteness. • Treatments variables (the determinants of relational contracting): duration (short run *vs* long run) and information (public *vs* private)	• Public information and a long duration of the game increase informal cooperation. • Incompleteness is more determined by past behavior than by future interactions (players adapt their investment in contractual completeness according to what they learned in previous periods and they decide themselves to incur lower costs in contractual safeguard mechanisms only when they really observe cooperative behavior).

Part I

Formal Contract, Cooperation and Renegotiation

Chapter 1

Interfirm Cooperation and The Role of Formal Contract*

1.1 Introduction

Value creation in strategic relationships is only possible to the extent that contracting parties adapt to their environment during the lifespan of their contractual relationship. Like Parkhe [1993] describes, strategic relationships are "often characterized by inherent instability arising from uncertainty regarding a partner's future behavior and the absence of higher authority to enforce agreements". Opportunities may arise and require rapid responses. In the face of this necessity for adaptation, firms have to structure their relationships to promote cooperative behavior. As underlined by Arend [2009], major consulting firms attribute the failure of alliances to opportunistic - that is, non-cooperative - behavior by one or both partners. Given the necessity to adapt, and the likelihood of failure due

*This chapter is based on a joint work with Stéphane Saussier. This paper is accepted for publication and forthcoming in *Industrial and Corporate Change* (Beuve and Saussier [2011]). This paper have greatly benefited from comments and suggestion by Brian Silverman, two anonymous referees and participants at 2010 International Industrial Organization Conference in Vancouver, the 2008 International School of New Institutional Economics Conference held in Toronto and the 2008 Congrès de l'Association Française de Sciences Economiques. We gratefully acknowledge their help.

to opportunism, determining the way firms can implement cooperation in their strategic relationships is an important topic in organizational research. Mutual cooperation is not automatic, since it is not in the players' interest to behave cooperatively if there are no guarantees that each player will reciprocate Gibbons [1992]. Hence, contractual parties have to find efficient ways to enhance those cooperative behavior. In practice, this can be anticipated and dictated *ex ante* through formal contractual arrangements that provide a framework for cooperation. However, the contracting parties are often uncertain of the enforceability of the real intent of the contract by a court or third party. As Grossman and Hart [1986] point out, verifiability of contractual provisions, a requirement for *ex post* enforceability, makes formal contracting costly if not impossible, leading to incomplete contracting. Furthermore, it is impossible to foresee all future relevant contingencies at the time the contract is signed (Williamson [1985]).

Adaptation and cooperation can also be managed *ex post* through informal agreements dependent on trust and relational contracting. A broad literature now insists on the fact that relational contracting has long played a role in vertical and horizontal inter-firm relationships. However, Telser [1980], Bull [1987], and Klein [1996] note that a relational contract cannot be enforced by a third party and must therefore be self-enforcing. Because of the close relationships that firms have with their partners, implicit contracts might be implemented. Partners' attribute dispositions to each other-reliable, dependable, committed to providing expected rewards, and so on. Once trust has grown, there is an increasing willingness to expose oneself to risk, rely on a partner's promises, and to sacrifice present for future gains (Rempel et al. [1985], Parkhe [1993]). Through repeated interactions, contracting parties can make it costly for each other to breach the contract (*i.e.*, loss of future trade value). However, the self-enforcing range of such implicit agreements is limited (Klein [2007]), mainly by the level of trust parties have for each other.

The fact that there are two ways to foster cooperation naturally leads to a trade-off between formal and relational contracting, depending on their relative efficiency.

The previous literature usually studies the emergence of informal contracting when formal contracting may yield suboptimal outcomes (Klein [1981], Bull [1987], Baker et al. [1994], Klein [1996], and more recently Lafontaine and Raynaud [2002], Kvaloy and Olsen [2009], Board [2010] and Halac [2011a]). Informal agreements will only emerge when they improve on the result of formal agreements. Fewer studies suggest that formal contracting might go hand-in-hand with implicit contracting and indeed improve the enforcement of relational contracts (Poppo and Zenger [2002]; Iossa and Spagnolo [2007]).

In this paper we examine empirically how firms achieve cooperation to create value in their relationships, using an original database constructed by the French National Institute of Statistics to characterize inter-firm contractual agreements. The previous empirical literature mainly stresses the complementarity/substitutability of formal and relational contractual dimensions (Poppo and Zenger [2002], Lazzarini and Zenger [2002]) or the link between past interactions, trust, and the way contracting partners draft contracts (Crocker and Reynolds [1993], Reuer and Arino [2007], Corts and Singh [2004], Gulati and Nickerson [2008] and Vanneste and Puranam [2009]) or bid (Gil and Marion [2009]). In contrast to this literature, we do not focus primarily on the formal-relational dimensions of contractual agreements. Taking for granted that a relationship is efficient and creates value only to the extent that it fits its environment and adapts through time without any conflict dissipating the surplus, we study the conditions under which such adaptation is achieved. Our contribution to the literature is to analyze the conditions under which *ex post* cooperation is more likely to develop, depending on the characteristics of the contracting parties and transactions, as well as *ex ante* contractual choices.

Interestingly, we find that *ex post* cooperation can be achieved without any *ex ante* effort to frame a formal contract encompassing the dimensions of their future relationship. We do not find any evidence that formal contracts undermine trust or encourage the opportunistic behavior they are designed to prevent. In accordance with Luo [2002], we find that contracts could serve as "a framework guiding

the course of cooperation, while cooperation overcomes the adaptive limits of contracts". More precisely, our results show that formal contracting increases the probability of *ex post* cooperation between the contracting parties when hazards become severe. This suggests that *ex ante* formal contracting efforts are not always destructive but can actually encourage partners to cooperate *ex post* and to rely on relational agreements, leaving room to adapt cooperatively to unanticipated changes in the environment. Our results also reinforce the idea that contracts and cooperation have to be assessed conjointly for a more subtle explanation of the interaction between *ex ante* governance mechanisms and subsequent adaptations. The paper is organized as follows. In the next section we present our theoretical framework and hypotheses. In section 3 we describe data, measures, and the empirical strategy. Section 4 presents results and robustness checks. Finally, in section 5 we discuss our results and explore a future research agenda.

1.2 Theory

1.2.1 Cooperation and Formal Agreements

It is well known that cooperation between partners creates value, enhancing learning and knowledge (Dyer and Singh [1998]) and enabling efficient adaptation in the face of unanticipated events (Gibbons [2005]). As Poppo and Zenger [2002] remark, cooperation is an important safety mechanism, mitigating external and internal hazards. Surprisingly, while cooperation is often presented as a way to cope with the limitations of a contract, one of the common features of every firm relationship is that a contract is signed. As a consequence, the role assigned to the contract is questionable. Does it help to achieve *ex post* cooperation? Does it help to secure the agreement *ex ante*? Do *ex ante* contractual safeguards enhance or reduce *ex post* cooperation?

The need for formal agreements to sustain exchanges between contracting parties is

viewed differently, depending which theoretical lens is turned on the role ascribed to contracts. In the agency literature, the primary motives for contracting are risk transfer (insurance) and incentive alignment (see Hart and Holmstrom [2002]).
Transaction cost economists take contracts as devices for structuring *ex post* adjustments and for constraining wasteful (rent-dissipating) efforts to influence the distribution of gains from trade (Masten and Saussier [2002]). Those *ex post* adjustments especially include bargaining and hold-up activities in transactions supported by relationship-specific investments (Williamson [1975], Klein et al. [1978]). In this case, the main purpose of contracting boils down to generating (1) adequate *ex ante* incentives to invest (Grossman and Hart 1986) by securing the parties and (2) adequate incentives to adapt to unanticipated *ex post* events and to avoid hold-up. Those two objectives are often seen as antagonistic. As pointed out by Williamson [1985] and highlighted in empirical studies (Crocker and Masten [1991], Crocker and Reynolds [1993], Saussier [2000]), contracting partners might want to shape a complete contract *ex ante* in order to avoid *ex post* adaptation because such adaptation might be costly without any cooperation (*i.e.* with opportunistic behavior). From this perspective, the contract may be analyzed as a tool to generate trust, with contracting parties investing *ex ante* at the cost of less *ex post* potential cooperative adaptation.
Other commentators (Kogut and Zander [1996], Conner and Prahalad [1996]) argue that formal governance devices hinder the development of cooperative behavior, limiting the contracting parties to the contractual terms rather than encouraging the exploration of new solutions (Macaulay [1963], Sorensen and Sorenson [1992]). A pernicious effect of formal institutions and formal controls on cooperation thus appears, meaning that the intensive use of contractual control mechanisms tends to destroy trust between partners (see for instance Ghoshal and Moran [1996]). These various theoretical perspectives conclude that detailed formal contracts have a negative effect on *ex post* cooperation. This leads us to our first hypothesis:

Hypothesis 1. *The use of detailed formal contracts restrains the ability of the parties to adapt ex post through cooperative agreements.*

1.2.2 Cooperation, Formal Contract and Equilibration of Hazards

Recent theoretical developments (Hart and Moore [2008]) and recent experimental studies suggest that cooperation depends on both parties sense of fairness in their on-going relationship (Fehr et al. [2010]). These results confirm older economic (transaction cost) studies, showing that parties greatly disadvantaged by the terms of a contract are more likely to evade or renegotiate a previous deal. Imbalanced situations often induce fear of opportunistic behavior and may lead to diminished performance levels (Williamson [1985]). White and Siu-Yun [2005] reach the same conclusion, pointing out that"as the perception of inequity increases, in either absolute terms or relative to a partner or other referent, a firm will be less willing to undertake an alliance or continue a particular alliance in the same form". In other words, partners' assessment and reaction to perceived inequity in the partnership will influence alliance outcomes (Kumar and Nti [1998]). As a consequence, a way for contracting parties to enhance cooperative behavior and achieve *ex post* adaptation is to attempt to design their governance structure so that *ex post* rents are divided "equitably", keeping the relationship within the "self-enforcing range" (Telser [1980], Klein [1996]). Even if the marginal costs of specifying an additional step of completion is likely to be higher under conditions of greater complexity, this complexity also imply a higher marginal benefit to specify an additional step because firms may have more project-critical contingencies to consider (Ryall and Sampson [2009]).

One important issue is that contracts can be used as an instrument to achieve Williamson's "hazard equilibration"[4] (Fehr et al. [2010], Iossa and Spagnolo [2007]). According to this view, the contract is pushed to the background in the daily relationship between firms and is considered only as a reference point in case of

[4]Williamson, O.E. 1985. *The Economic Institutions of Capitalism.* Page 34.

conflict. Fehr et al. [2010] maintain that one drawback of flexible agreements with a low level of contractual details is that they cause a significant amount of shading on *ex post* performance, because the contracting parties perceive them as unfair as soon as events occur. Nevertheless, over time a relationship can evolve from formal to informal types of contract in which rules and regulations are no longer needed (Ring and Van de Ven [1992, 1994]). A detailed contract would then help to generate trust *ex ante* and give incentives to invest, leading to *ex post* cooperation.

This is particularly true in transactions for which *ex ante* hazards are important, making a case for a detailed contract to secure *ex ante* parties. The strategic dimension of the partnership for one of the parties is clearly one element that generates important *ex ante* hazards. The similarity between strategic interfirms' relationships is that each party needs the other to foster its individual interest. But, as noted by Parkhe [1993], these "needs intersect with behavioral uncertainty to create vulnerability to opportunism". In fact, as said before, strategic relationships are often characterized by inherent instability arising from uncertainty regarding a partner's future behavior. As a result, in case of conflicts, the party for which the partnership is strategic anticipates a huge impact on his revenues stressing the need for probity of its partner (this point is also stressed by Williamson [1999] considering the role of public bureaus for public services). This probity concern is crucial in agreements for which damage payments should a firm not perform, are likely to be far outweighed by the costs of drafting a detailed contract. This is typically the case where one is considering strategic agreements. As pointed out by Ryall and Sampson [2003], "firms entering into strategic alliances face considerable moral hazard problems, since partner behavior is often unobservable and the costs of opportunism are potentially high. Firms anticipate such difficulties, though, and often craft formal governance to address these issues." Thus, in such relationships, the contract can act as prerequisite insurance, equilibrating hazards and, finally, allowing parties to implement cooperative behavior *ex post*. A same argument is provided by Zanarone and Lo [2011]. In their theoretical paper, the

authors show that when the parties bring valuable pre-existing capabilities to the relationship that are vulnerable to post-contractual expropriation, safeguard can be achieved through a specific contract. Most of the time, relationships of high strategic dimension entail those kinds of pre-existing capabilities. We thus have the following hypothesis:

Hypothesis 2 *Detailed formal contracts help to balance the strategic relationships, enhancing ex post cooperation*

1.2.3 Cooperation and reputation

If contractual devices impact on *ex post* cooperation, the identity of partners can also play a role. As Parkhe [1993] and many others suggest, one way for a firm to deal with potentially opportunistic partners is to take their cumulative past behavior as a guide to their future behavior, or-when such information is unavailable-to use reputation as a proxy for knowledge of opportunistic intentions. Reputation is often considered a means to increase alliance cooperation (Houston [2003]) because it can be a substitute for costly mechanisms that verify the intentions and monitor the actions of business partners (Kogut [1989]). Some authors extend this argument by saying that reputation effects can sometimes be more efficient than the threat of legal sanctions in assuring cooperation in strategic relationships (Dore [1983], Wright and Lockett [2003]). As Dellarocas [2001] argues, reputation networks are a solution to the problem of trust-building, since their objective is to enable efficient transactions in social interactions where cooperation is compromised by post-contractual opportunism (moral hazard) or information asymmetries (adverse selection). Those mechanisms act as sanctioning devices in the former instance and as signaling devices in the latter. As a consequence, firms have an incentive to foster and maintain a good reputation (*i.e.* a reputation for high reliability) to valorize their on-going relationships and to increase the possibility of

developing new ones. In practice, each partner's reputation can act as a hostage by securing the on-going relationship (Williamson [1983]), avoiding mutual distrust prompted by fears of opportunistic intentions, especially in very sensible relationships, like strategic ones, where opportunistic behavior would have huge impact as discussed previously. Moreover, as Holmström and Tirole [1989] emphasize, "the more faith the firm's trading partners have in the firm's ability and willingness to fill in contractual voids in a reasonable (efficient) manner, the lower the cost of contracting". As a result, reputation appears as an intangible asset (Hall [1992]) that can be an important factor in competitive advantage (Hall [1993]), can attract partners (Dollinger et al. [1997]) and contributes to relationship success (Saxton [1997]). As long as a good reputation enhances and a questionable reputation hampers the emergence and maintenance of cooperative interfirm relationships, reputation is likely to be important where there are pervasive hazard problems. This leads us to the following hypothesis:

Hypothesis 3. *The reputation of contracting parties helps to sustain ex post cooperation, especially when strategic relationships are concerned.*

1.3 Data and Method

1.3.1 Data

To test our hypotheses, we used an original data set, developed by the French National Institute of Statistics and Economic Studies (INSEE hereafter), which described relationships between industrial firms in France in 2003. For its different surveys, the INSEE disposes of a sample of 22 000 firms with more than 20 employees and/or more than 5 million Euros of sales and with an industrial main activity. A compulsory questionnaire was sent to 5 220 companies corresponding to a representative sub-sample. The sampling strata were obtained by crossing

size, sales and business sectors. Inside those strata, firms were randomly selected. The survey lasts four months and leads to a satisfying rate of response, varying between 63% and 83% depending on sectors. Afterwards, the statisticians of the INSEE carried out a two steps procedure of "non-response weighting" in order to limit non-response bias. First they define a logistic model to identify homogenous groups of non-respondent firms. Then they calculated weights to adjust the sample of respondent firms to the overall population (the post-stratification is based on size, sales and sectors). This leads to the survey we are using in our paper, composed by 3 904 responses.

This survey gives a global picture of the relationships between firms and allows cross-sectional comparisons. An important feature of our data is that the questionnaire asked firms to focus on their on-going "complex" relationships, excluding all simple spot agreements without any kind of specific investment (simple purchases and/or sales relationships, strictly financial relationships, or relationships with a temping agency). The final sample is composed by 1 101 of the 3 904 respondent firms, *i.e.* those that declared having effectively complex relationships with other firms. The others 2 803 firms declared no such relationships.

This database has three major advantages for our study. First, the questionnaire has an approach by sector (transport, storage and services, research, design activities) and function (production, supply, distribution and research and development), permitting cross-sectional comparisons. Second, the focus on complex relationships allows us to avoid a classic drawback of firm surveys that is the description of only a "representative" relationship. Here, we elicit descriptions of (at most) three different relationships by function. Third, the data develop a set of indicators that captures firms' perceptions of their relationships, instead of only external indicators. Such indicators are rare and important because, as pointed out by some recent studies (Fehr et al. [2010]), the way economic actors perceive their relationships is crucial to explain the willingness to cooperate and hence the efficiency of the relationship.

To sum up, our final sample accounts for 1 104 firms involved in 3 359 inter-

firm relationships and gives us a global picture of the relationships between firms, encompassing many functions and sectors. At the same time, it is restricted to complex relationships for which *ex post* cooperation is likely to be crucial.

1.3.2 Dependant Variable

Cooperation

We are interested in the way firms generate and sustain informal cooperation. The level of cooperation characterizing one contractual relationship is not easy to measure. In our study, instead of developing indirect measures, we used the variable *Cooperation* to assess the firm's perception of its on-going relationships. This is a dummy variable that takes value 1 when firms declare that its relationship is characterized by a high level of cooperation and zero otherwise. Because our data concern on-going relationships we capture with this variable the *ex post* cooperation level actually at stake in each of our relationship. In our sample, more than 57% of the firms consider that cooperation is a crucial feature of their relationship. This suggests that a large proportion of relationships lack *ex post* cooperation.

1.3.3 Independent Variable

Formal agreements

Our hypotheses suggest that the degree of formalism in relationships, as it is depicted in the *ex ante* contract, might interfere positively or negatively on the effective *ex post* cooperation between contracting parties. Contracts may be considered either as the cornerstone of the governance structure or as a simple reference point, allowing discussion and adaptation within the relationship. To take care of the formal dimension of contractual agreements we created the variable *Contract*, which is equal to 1 if the formal contract is perceived by firms as a central element of their relationship and zero otherwise. This gives us a clear idea of how much effort

contracting parties put in the writing of the contract *ex ante* and measure the freedom perceived by contracting parties toward what is written in the contract. More than 24% of our firm sample considers the contract a central coordinating device. This suggests that there may be no direct connection between signing a formal contract that is central for coordination and the development of *ex post* cooperation.

Strategic agreements

Even if we focus only on relationships that involve specific investments, it is clear that not all relationships have the same importance for firms. Some of them are more strategic than others and may impact on the firm's development and in the case of failure, compromise its future. To capture this in the survey, firms can pinpoint whether the relationship described is particularly strategic, in the sense that its aim is to strengthen firm development. Thus we define a variable *Strategic Importance* taking the value 1 if the firm pays great attention to a particular relationship and zero otherwise. This is the case in 37% of the relationships we study in our sample.

Reputation

Reputation, as we have discussed, can generate trust and ease cooperation *ex post*. Indeed, contracting parties might screen potential partners on the basis of their reputation. Even if we have no information about prior ties between partners that would give us an indication of their mutual trust, we nonetheless know whether or not the partner is selected for its reputation. We take this possibility into account with our variable *Reputation* taking the value 1 if the firm selects its partner according to its reputation for reliability and zero otherwise. This is the case in 13% of our relationships.

1.3.4 Control Variables

A large part of the observed variance in the way interfirm agreements are shaped can be explained by differences in firm and sector characteristics, as well as differences in other relationship characteristics. To control for these potential differences, we introduce control variables such as the foreseeable duration of the relationship at the beginning (*Duration*), its type (*Type*), the motivation of its setup (*Economic Logic*), and the criteria used to select the partner (Partner Selection). For each respondent firm, we add control variables about size (*Size*), sales value due to its relationships (*Sales*), experience (*Number of Relationships*), age (*Age*), and geographical distance from its partner (*Distance*). Finally, to factor for the potential influence of functions and sectors in which relationships take place, we introduce dummy variables for each (*Function* and *Sector*). Table 1.2 shows the variables used in the empirical analysis and their descriptive statistics.

1.3.5 Empirical Strategy

Our goal is to explore the impact of different variables on the cooperation level observed in on-going firms relationships. We are thus interested in the following model:

$$C_i = a_1.FormalContract_i + a_2.Reputation_i + a_3.StrategicImportance_i + a_4.Z_i + e_i$$

Where C_i is the level of cooperation observed in relationship i, that is a latent variable that we cannot observe. What we can observe is the fact that firms declare that a high level of cooperation characterizes a relationship (our variable *Cooperation*). We only have access to their perception of cooperation level. We consider this perception as an indicator for whether our latent variable C_i is positive:

$$Cooperation_i = \mathbf{1}_{\{C_i>0\}} \Leftrightarrow \begin{cases} 1 \texttt{ if } C_i > 0 \\ 0 \text{ otherwise} \end{cases}$$

Hence our problem boils down to a probit estimation of the following model:

$$Cooperation_i = \alpha_1.FormalContract_i + \alpha_2.Reputation_i + \alpha_3.StrategicImportance_i + \alpha_4.Z_i + \epsilon_i$$

Where $Cooperation_i$ is the binary variable indicating whether relationship i is governed through cooperation or not depending on the perception of the actors; ϵ is the error term and $(\alpha_1, \ldots, \alpha_3)$ are the parameters corresponding to our key variables. Z is a vector of additional control variables about firms (number of ongoing relationships, age, level of sales due to their relationships) and relationships (reasons to select a particular partner, economic logic, type, duration, geographical proximity of the partner, functions and sectors affected by relationships) to take into account the specific characteristics of each individual relationship as well as aspects of the environment in which they arise.

The baseline model only includes the variables corresponding to the hypotheses we want to test: the selection of a partner (*Reputation*), the importance of the formal contract (*FormalContract*) and the strategic importance of the relationship (*StrategicImportance*). We also added cross variables to disentangle direct and indirect effects of formal contracting and reputation on the level of cooperation observed in our agreements, as our theoretical discussion suggested.

Finally, we try as far as possible to take care of possible fixed effects coming from functions, sectors, and firms affected by the agreement (our c_j, d_k, f_l variables):

$$Cooperation_i = \beta_1.FormalContract_i + \beta_2.Reputation_i + \beta_3.StrategicImportance_i + \beta_4.FormalContract * StrategicImportance_i + \beta_5.Reputation * StrategicImportance_i + \beta_6.Z_i + c_j + d_k + f_l + \epsilon_i$$

Hence, we expect a negative impact from the existence of a formal contract on observed *ex post* cooperation (H_1: $\beta_1<0$); but we also expect an indirect positive

impact of higher magnitude when the relationship is strategic (H_2: $\beta_4 > 0$ and $|\beta_4| > |\beta_1|$). Additionally, we expect a positive impact of the selection of a reputed partner on *ex post* cooperation, and we also expect an indirect positive impact when the relationship is strategic (H_3: $\beta_2 > 0$ and $\beta_5 > 0$). Pairwise correlations of variables used in our analysis are presented in Table 1.3.

1.4 Results

1.4.1 Main Results

Table 1.1 reports results from probit regression models for *Cooperation*. The first column (Model 1) reports our basic specification. Results provide good support for the hypotheses of our theoretical discussion. Consistent with our hypothesis 1, the coefficient for *Formal Contract* is significant ($p < 0.01$) and negative, indicating that the probability of *ex post* cooperation decreases with the degree of formalism in the relationship. In other words, as soon as a detailed formal contract is considered the central element of a relationship, the ability of parties to adapt through cooperation *ex post* is reduced. This result argue in favor of the *Strong Substitution View* between formal and informal governance. The importance attached to the formal contract restrain the parties' ability to adapt *ex post* through cooperative agreements. Nevertheless, as soon as we cross the variable *Formal Contract* with variable *Strategic Importance* to disentangle direct and indirect effects of formal contracting on the level of cooperation we find that the use of detailed formal contracts can help to balance the relationship and enhance *ex post* cooperation. As expected, we observe a significant and positive effect of our interaction terms (Model 2). This indirect positive impact is of higher magnitude compared to the direct effect (See Figure 1.1). In other words, having a formal contract helps to increase cooperation as soon as the relationship is a particularly strategic one (hypothesis 2). This effect is observable through the coefficients of

probit estimations provided in Table 1.1 as well as through the marginal effects provided in the Figure 1.1. This second main result provide empirical support for the *Complementarity View* between formal and informal governance. Hence, the use of the detailed formal contract allow parties to cooperate *ex post* but, in the particular context of strategic relationships. The intrinsic hazards associated with such relationships appeal for the securization of parties' interests, making the use of detailed formal contract necessary and, *de facto*, compatible with *ex post* cooperation.

Turning now to the impact of the selection of a reputed partner, we do not find direct effect on the *ex post* level of cooperation. However, a positive effect exists as soon as we consider strategic relationships (hypothesis 3). This third and last main result indicates that the selection of a reputed partner is particularly relevant when parties face moral hazards problems. If parties are vulnerable to opportunistic behaviors, as in the case of strategic relationships, these hazards need to be overcame by credible commitment of parties. In our data, reputation acts as a hostage in the sense of the Transaction Cost Theory, i.e. it provides a mean to retaliate in case of opportunistic behavior. Finally, the fact that our variable *Reputation* is significant in Model 1 but it is not in the following models (Model 2 to 6) seems to indicate that the reputation of the partner is neutral when we consider relationships that are not strategic.

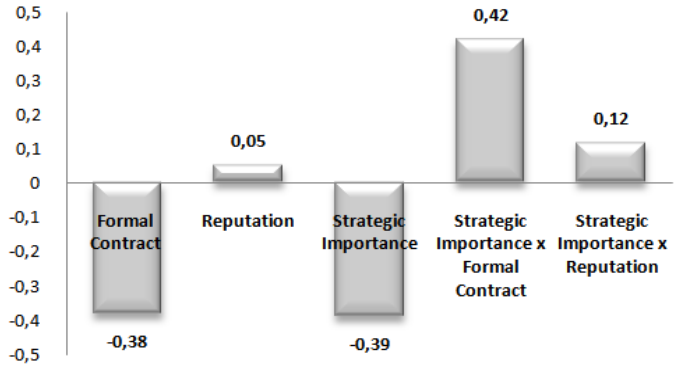
In the end, the results from baseline estimations (Models 1 and 2) provide strong support for our hypotheses. They are not affected when considering other specifications, as we will discuss below.

Table 1.1: Probit estimations for *Cooperation*

	1 Probit	2 Probit	3 Probit	4 Probit	5 Probit	6 Probit
Dependant Variables						
Formal Contract	-0.645***	-1.140***	-1.094***	-1.115***	-1.106***	-1.710***
	(0.055)	(0.065)	(0.066)	(0.067)	(0.067)	(0.133)
Reputation	0.265***	0.074	0.068	0.135	0.134	0.131
	(0.071)	(0.095)	(0.095)	(0.098)	(0.099)	(0.184)
Strategic Importance	-0.727***	-1.104***	-1.126***	-1.151***	-1.166***	-2.029***
	(0.048)	(0.057)	(0.058)	(0.059)	(0.059)	(0.120)
Strategic Importance x *Formal Contract*		1.403***	1.409***	1.410***	1.405***	2.167***
		(0.109)	(0.110)	(0.111)	(0.111)	(0.213)
Strategic Importance x *Reputation*		0.293**	0.315**	0.323**	0.344**	0.872***
		(0.139)	(0.139)	(0.139)	(0.140)	(0.248)
Control Variables						
Duration			0.254***	0.257***	0.268***	0.639***
			(0.040)	(0.042)	(0.043)	(0.098)
Distance			-0.015	-0.009	-0.003	-0.017
			(0.022)	(0.022)	(0.022)	(0.048)
Age			-0.026**	-0.024**	-0.022*	0.021
			(0.011)	(0.012)	(0.012)	(0.119)
Size			-0.048	-0.064	-0.071+	0.325
			(0.044)	(0.045)	(0.046)	(0.327)
Sales			-0.002	-0.002	-0.002	-0.029***
			(0.002)	(0.002)	(0.002)	(0.004)
Number of Relationships			-0.014	-0.019*	-0.018*	-0.151
			(0.010)	(0.010)	(0.010)	(0.156)
Dummies Variables*						
Type	No	No	No	Yes	Yes	Yes
Economic Logic	No	No	No	Yes*	Yes*	Yes*
Partner Selection	No	No	No	Yes**	Yes**	Yes**
Functions	No	No	No	No	Yes**	Yes**
Sectors	No	No	No	No	Yes**	Yes**
Firms	No	No	No	No	No	Yes***
Intercept	0.611***	0.783***	0.307**	0.073	-0.084	4.679***
	(0.033)	(0.038)	(0.137)	(0.153)	(0.173)	(0.662)
McFadden R^2	0.08	0.12	0.13	0.14	0.15	0.32
% of well predicted obs.	68.4	69	69.5	69.7	70	77.8
N	3348	3348	3348	3348	3348	1803

Level of significance: *:10% ; **:5% ; ***:1%
We introduce all control dummies presented in Table 1.2.

Figure 1.1: Marginal effects



Mean of marginal effects presented in Table 1.5.

1.4.2 Robustness Check

1.4.2.1 Control Variables

In Table 1.1, columns 3 to 6, we present various robustness checks by successively introducing additional control variables that could potentially affect the probability of cooperative behavior.

First, cooperation could be driven by unobserved characteristics of the respondent firms. As a consequence, variables in our baseline model could be correlated with those unobserved characteristics and mistakenly appear to have an explanatory power. To control those potential biases, we introduce an initial set of control variables about firms (*Age*, *Size*, *Sales* and *Number of Relationships*) (see Model 3). Second, cooperation could also be explained by unobserved attributes particular to each relationship. For this reason, we add a second set of control variables about relationships (*Duration*, *Distance* of the partner, *Economic Logic*, *Type* and motivations for *Partner Selection*) (see Model 4). Moreover, we take into account the potential influence of functions affected by relationships and the sectors in which they take place by adding dummies for each different function and sector (see Model 5). Finally, to deal with the fact that described relationships are not equally distributed among the firms in the data set (Mean of Number of Relationships = 4.33; S.D. = 2.31-see Table 1.2), we have to control for the presence of firms-fixed-effects. Thus, we create dummy variables for each respondent firm (see Model 6).

The results of those successive estimations prompt several comments. First, some of our control variables appear significant. In particular, the significant ($p < 0{,}01$) and positive coefficient of our variable *Duration* indicates that the longer the initial foreseeable duration of the relationship, the more cooperative the relationship between partners will be. More precisely, according to a similar result obtained by Parkhe [1993], we find that the level of cooperation between partners is positively related to the length of time horizons. This suggests that relational concerns might

be at stake and generate *ex post* cooperation (Baker et al. [2002]). We can also observe that the introduction of our different sets of control variables lead to an increase of the explanatory power of our models and does not change the results previously obtained in the baseline model. The stability of our results (notably across firms, sectors, and functions) suggests that links between our explanatory variables and cooperation are weakly related to the more general environment but are essentially driven by the characteristics of the relationship itself. It also gives us some confidence that our findings are robust.

1.4.2.2 Common Method Assessment

As our data are coming from unique respondents, one may legitimately object that our results might be driven by multiple biases in our empirical investigation. The first potential weakness is due to common method bias. As underlined by Campbell and Fiske [1959], method biases are a problem since they are one of the main sources of systematic measurement error. This kind or error is problematic because it provides an alternative explanation for observed relationships between measures of different constructs that is independent of the one hypothesized, with serious confounding influence on empirical results, and yielding potentially misleading conclusions (Podsakoff et al. [2003]). Thus we assess whether common method bias exists by performing a Harman's one factor test. According to what is prescribed by Podsakoff et al. [2003], if either a single factor emerges from the factor analysis or several factors emerge but factor 1 accounts for the majority of the variances, then common method bias is a concern. In our data, the factor analysis of all our measurements leads to a solution that accounts for 63.62% of the total variance and factor 1 accounts for 11.18% of the variance. As a single factor did not emerge and factor 1 did not explain the majority of the variance, common method bias is unlikely to be a concern in our data.

1.4.3 Addressing Endogeneity Issues

Even if we do not face any simultaneity problems, we might be confronted with endogeneity issues. Our estimators provide consistent estimates, to the extent that our independent variables are independent of our error term ϵ. Nevertheless, there might be a correlation between some of our explanatory variables and the error term because of non-observed, omitted characteristics of the sector to which the contracting parties belong, and of the functions affected by the contract, even if we account for sector and function fixed effects in our empirical specification. Because of this, we have tried to go a step further by building instruments that are correlated with the decision reflected by our explanatory variables, but not with the decision to cooperate *ex post*.

To address this issue, we have to instrumentalize the explanatory variables of the baseline model and test their eventual endogeneity. Potential instruments are already present in the data (see Control Variables). In addition, we built two instruments: (1) the average prevalence of the variable we want to instrumentalize in the same function in different sectors (Instrument1); and (2) the average prevalence of the variable we want to instrumentalize in the same sector in different functions (Instrument2). These instruments are valid because the correlation between the decision to select a partner on the basis of reputation, for example, within a specific function in a given sector, is only correlated to Instrument 1 through aspects, which by construction are independent of sector-specific effects. Similarly, it is only correlated to Instrument 2 through aspects, which by construction are independent of both sector- and function-specific effects.

We run probit estimates of the variables we want to instrumentalize using the whole sample. Thereafter, we test for exogeneity of the variables under scrutiny, using the approach suggested by Rivers and Vuong [1988] and Nakamura and Nakamura [1998]. This method simply consists of estimating instrumented variables using exogenous variables of the model and our instruments and, afterwards, running the standard probit estimation augmented by the residuals of first-stage

estimations (see also Woolridge [2002]). Table 1.4 reports the results of first-stage estimations where we instrumentalize the variables of the baseline model. It also provides the p-value of Rivers-Vuong test for endogeneity. As can be seen, the endogeneity hypothesis is rejected for all our explanatory variables: *Formal Contract*, *Reputation* and *Strategic Importance*. This gives us confidence in the results previously mentioned.

1.5 Discussion

1.5.1 Our Results and Previous Literature

These results relating to the interaction between formal contracts and informal cooperation link our paper to the debate about the substitutability or complementarity between formal and informal governance structures. Relational governance and formal contracts have been considered as substitutes rather than complements for a very long time. In fact, many scholars consider that the presence of either device makes the presence of the other useless, or, from a starker perspective, dangerous. Lazzarini and Zenger [2002] refer to these two kinds of substitutability as, respectively, weak and strong substitution. Concerning the weak substitution, several authors emphasize that, by reducing relational risk, trust economizes on costly contract. In fact, trust involves the expectation of reduced opportunistic behavior and so relaxes the need for protective governance mechanisms. Similarly, Sullivan and Peterson [1982] argue that interpersonal ties between business leaders are to a large part substitutes for the redaction of complex contracts and Granovetter [1985] notes that formal institutions do not produce trust but are a functional substitute for it. This substitution is due to the enforcement capacities of informal institutions to enhance cooperative behavior without the costs and complexity associated with formal agreements (Dore [1983], Gulati [1995], Powell [1990], Uzzi [1996]). According to the strong substitution view, the existence of a formal con-

tract will undermine the possibility of implementing relational exchange. By its simple existence, a formal contract sows the seeds of mutual suspicion, causing a decline in mutual trust and making the development of cooperative behavior impossible (Macaulay [1963]). This strong substitution approach suggests a pernicious effect of formal controls on cooperation. But, following the intuition of North [1990][5], other authors study the way formal and informal dimensions of the relationship can complement one another and, when combined, can improve the overall performance of relationships. Poppo and Zenger [2002] and, more recently, Ryall and Sampson [2009] have presented evidence that suggests that relational governance and formal contracts can be complementary, increasing exchange performance. From this perspective, a formal contract secures an agreement, increases transparency in the partnership, facilitates learning processes about each partner's conduct, and helps to promote cooperation.

Our results suggest, in accordance with few other studies (Corts and Singh [2004]), that the real question is not to determine whether or not formal and informal modes of governance structure are substitutes or complements, but rather when they are so. Our results reinforce the idea that this debate is, primarily, an empirical issue. In fact, we find different net effects of formal contract on *ex post* cooperation, which are positive or negative depending on relationship's strategic intensity. As a consequence, our findings invite us to reconsider the role of contracts in interfirm relationships. They cannot be considered merely as pure incentive mechanisms; they also have to be viewed as a means of setting procedures for establishing *ex post* cooperation, adapting exchange, and resolving disputes (Crocker and Masten [1991], Luo [2002]). Thus, more than a simple complement, contract can be a condition for relational governance and *ex post* cooperation: "The process of contracting may itself promote expectations of cooperation consistent with relational governance" (Lazzarini and Zenger [2002]).

[5]"Formal rules can complement and increase the effectiveness of informal constraints. They may lower information, monitoring, and enforcement costs and hence make informal constraints possible solutions to more complex exchange" (North, 1990, pp. 46-47).

1.5.2 Limitations

Like any research, our study has limitations. Although our data make cross-sectional comparisons possible, our study is jeopardized by a lack of longitudinal insights. As a consequence, our data do not allow us to disentangle the effect of prior attempts and future business on the likelihood of relationships being cooperative. As Parkhe [1993] rightly emphasizes, "interfirm cooperation is complex, embedded in various institutional arrangements, and at once forward-looking (linked to the shadow of future) and backward-looking (linked to the cooperative history of the partners)". While our study does not suffer from the shadow of future concerns (our control variable *Duration* serves as a proxy for long-term commitment and results are consistent with previous empirical studies showing that long-term horizons foster cooperative behavior), the question of cooperative history is more problematic. Because we do not know if the relationships in our data set are new or renewed, we are not able to determine the existence of prior ties between partners. Such a lack is damaging, since it is obvious that the willingness of partners to cooperate and the role they assign to the formal contract will be influenced by their past history. The only way we can tackle this issue is to observe the impact of reputation since, as often emphasized in the literature, a reputation for reliability can act as a proxy for good behavior in the past. Indeed, our results suggest that reputation can act as insurance for trustworthiness and enhance the emergence of cooperative behavior. Nevertheless, a study of the effect of reputation on *ex post* cooperation has to determine precisely the source of reputation, which can come from personal learning (prior ties between the same partners) or from general knowledge about firms (network effects). It is legitimate to think that the trust coming from learning effect could lead to a higher level of cooperation than trust coming from reputation in the market, since learning during past common experiences also underlies the development of mutual knowledge and understanding. The evolutionary nature of the link between contract and cooperation clearly requires longitudinal investigation and the key research question is how a non-cooperative

relationship can become cooperative (and *vice versa*).

Our study is also limited by its setting (France). Like any sample focusing on only one country, all our observations are biased by their environment in terms of political and legal systems, regulatory modes, and business cultures. A cross-national setting could increase the generalization of our findings and would offer deeper insights into cross-cultural differences in the role assigned to formal contracts and the way firms achieve cooperation in their strategic relationships. All of these limitations form an important agenda for future research.

1.6 Conclusion

Many conditions are essential to allow contracting parties to achieve cooperation in their relationships. Results from our quantitative analysis suggest that the influence of formal contracts deserve attention. Indeed, while formal contracts have a negative impact on *ex post* cooperation when relationships are not particularly strategic, they appear to be an enhancing factor of cooperative behavior as soon as the intrinsic hazards of a relationship require higher *ex ante* contractual safeguards to secure agreements (*i.e.* particularly strategic relationships). As a result, on the one hand, formal contract can have a pernicious effect on the willingness of firms to implement cooperative behavior; and, on the other, under precise circumstances, formal contracts appear to be a prerequisite for the emergence of *ex post* interfirm cooperation. Consequently, the results of this study have important implications for governance research because, since formal contract can strengthen or weaken *ex post* cooperation, academics and practitioners have to think deeply about the *ex ante* efforts and costs incurred to frame an appropriate formal contract.

1.7 Appendix

Table 1.2: List of variables, definitions and summary statistics

Dummy variables (1=Yes ; 0=No)	**Yes**	**No**
Independent variable		
Cooperation: variable indicating whether the relationship is characterized by a high degree of cooperation.	1933 (57.7%)	1420 (42.3%)
Dependant variable		
Formal Contract: variable indicating whether the formal contract is considered a central element of the relationship.	821 (24.5%)	2532 (75.5%)
Strategic Importance: variable indicating whether or not the relationship is strategic for the development of firms.	1264 (37.7%)	2089 (62.3%)
Partner Selection		
Dummy variables indicating whether the partner was selected according to:		
Reputation: its reputation for reliability.	435 (13%)	2918 (87 %)
Delay: its guarantee of delays.	235 (7%)	3118 (93%)
Price: its price.	519 (15.5%)	2834 (84.5%)
Proximity: its geographical proximity.	221 (6.6%)	3132 (93.4%)
Label: its label certification for quality.	292 (8.7%)	3061 (91.3%)
Techni: its technical competence.	1086 (32.4%)	2267 (67.6%)
Long Term Contract: the guarantee to sign a long-term contract.	205 (6.1%)	3148 (93.9%)
Group: its belonging to the same group.	1476 (44%)	1877 (56%)
Economic Logic		
Dummy variables indicating whether the motivation of the relationship was:		
New Market: to access a new market.	888 (26.5%)	2465 (73.5%)
Investment: to secure a return on investment.	615 (18.3%)	2738 (81.7%)
Abs. Equipment: to compensate for equipment lacking.	870 (25.9%)	2483 (74.1%)
Abs Competence: to compensate for competences lacking.	440 (13.1%)	2913 (86.9%)
More Flexibility: to obtain more flexibility.	951 (28.4%)	2402 (71.6%)
Primary Business: to refocus on the primary business.	238 (7.1%)	3115 (92.9%)
Type		
Dummy variables indicating whether the type of the relationship is:		
Pooling Resources: pooling of resources.	1128 (33.6%)	2225 (66.4%)
Subcontracting: subcontracting.	631 (18.8%)	2722 (81.2%)
Exclusive Contract: exclusive contracting.	763 (22.8%)	2590 (77.2%)
Common Structure: managing a common structure.	295 (8.8%)	3058 (91.2%)
Other: none of the above.	409 (12.2%)	2944 (87.8%)
Functions and Sectors		
Dummy variables indicating whether the sector of the relationship is:		
Transport: transport.	1434 (42.8%)	1919 (57.2%)
Storage and Services: storage and services.	532 (15.9%)	2821 (84.1%)
Research: research.	210 (6.3%)	3143 (93.7%)
Design: design.	1001 (29.8%)	2352 (70.2%)
Dummy variables indicating whether the function concerned by the relationship is:		
Production: production.	1487 (44.3%)	1866 (55.7%)
Supplying: supply.	1376 (41%)	1977 (59%)
*Research*2: research.	386 (11.5%)	2967 (88.5%)
Distribution: distribution.	280 (8.3%)	3073 (91.7%)
Ordered variable	**Mean**	**S.D.**
Duration: variable equal to 1 when the foreseeable initial duration of the relationship is inferior to 1 year; 2 when the duration is superior to 1 year and inferior to 5 years; and 3 when the duration is superior to 5 years.	2.59	0.58
Distance: variable equal to 1 when the partner is located in the same city; 2 when it is located in the same region: 3 in the same country; 4 in Europe; and 5 outside Europe.	2.68	1.09
Continuous variable	**Mean**	**S.D.**
Sales: level of sales due to interfirms' relationships.	4.0	12.84
Size: in number of employees.	0.19	0.65
Number of Relationships: number of on going relationships.	4.33	2.31
Age: experience of the firm, in years.	23.13	20.41

Table 1.3: Pairwise correlations

	(1)	(2)	(3)	(4)	(5)	(6)
(1) *Formal Contract*	1.0000					
(2) *Reputation*	0.0296	1.0000				
(3) *Strategic Importance*	-0.0659	0.0427	1.0000			
(4) *Strategic Importance* x *Reputation*	0.0397	0.6294	0.3131	1.0000		
(5) *Strategic Importance* x *Formal Contract*	0.5122	0.0820	0.3759	0.2142	1.0000	
(6) *Duration*	-0.1433	-0.0020	0.0300	-0.0106	-0.0310	1.0000
(7) *Distance*	0.0246	0.0057	0.1008	0.0028	0.0852	0.0100
(8) *Age*	-0.0289	0.0194	0.0083	0.0167	-0.0076	0.0573
(9) *Size*	0.0565	-0.0352	0.0188	-0.0111	0.0355	-0.0416
(10) *Sales*	0.0098	-0.0243	0.0157	-0.0111	0.0331	0.0313
(11) *Number of Relationships*	0.0220	0.0414	-0.0644	0.0342	0.0151	-0.0628
	(7)	(8)	(9)	(10)	(11)	
(7) *Distance*	1.0000					
(8) *Age*	0.0369	1.0000				
(9) *Size*	0.0181	-0.0411	1.0000			
(10) *Sales*	0.0522	0.0235	0.6563	1.0000		
(11) *Number of Relationships*	0.0336	-0.0151	0.0508	0.0672	1.0000	

Table 1.4: First-stage estimations

	Probit *Formal Contract*	Probit *Reputation*	Probit *Strategic Importance*
Duration	-0.216***	0.068+	-0.003
	(0.041)	(0.041)	(0.049)
Distance	0.032	0.120***	-0.008
	(0.023)	(0.022)	(0.026)
Age	-0.006	0.008	0.013
	(0.013)	(0.011)	(0.014)
Size	0.115**	0.012	-0.173
	(0.052)	(0.043)	(0.122)
Sales	-0.002	0.001	-0.001
	(0.003)	(0.002)	(0.004)
Number of Relationships	0.040***	-0.048***	0.023*
	(0.011)	(0.010)	(0.013)
Inst.*Formal Contract*_Function Effect	-0.786		
	(1.639)		
Inst.*Formal Contract*_Sector Effect	-9.123***		
	(3.112)		
Inst.*Strategic Importance*_Function Effect		2.341	
		(2.303)	
Inst.*Strategic Importance*_Sector Effect		-5.942***	
		(2.067)	
Inst.*Reputation*_Function Effect			-8.277+
			(5.698)
Inst.*Reputation*_Sector Effect			-5.153
			(7.212)
Dummy Variables	yes	yes	yes
Intercept	1.132**	0.554	0.103
	(0.570)	(0.730)	(0.927)
McFadden R^2	0.06	0.04	0.04
Rivers-Vuong test : *p*-value	**0.93**	**0.62**	**0.74**
N	3348	3348	3348

Level of significance: *:10% ; **:5% ; ***:1%

Table 1.5: Marginal effects

Marginal effects (dy/dx)	1	2	3	4	5	Mean
Formal Contract	-0,252	-0,412	-0,415	-0,42	-0,417	-0,38
Reputation	0,1	0,028	0,026	0,052	0,051	0,05
Strategic Importance	-0,281	-0,407	-0,415	-0,424	-0,429	-0,39
Strategic Importance x *Formal Contract*		0,41	0,399	0,43	0,44	0,42
Strategic Importance x *Reputation*		0,109	0,117	0,12	0,127	0,12
Duration			0,09	0,099	0,104	0,1
Distance			-0,006	-0,004	-0,001	-0
Age			-0,01	-0,009	-0,009	-0,01
Size			-0,018	-0,025	-0,028	-0,02
Sales			-0,001	-0,001	-0,001	-0
Number of Relationships			-0,005	-0,007	-0,007	-0,01

For dummy variables, dy/dx is for discrete change from 0 to 1.

For continuous variables, it corresponds to an increase of 1 unit.

Chapter 2

Renegotiations and Contract Renewals in Public-Private Agreements.*

2.1 Introduction

While it is often postulated that public-private partnerships (PPPs) have the potential to achieve efficiency gains, it is also widely accepted that some room remains to improve PPPs and avoid failures. Among the reasons generally put forward to explain this mitigated situation, there is the fact that PPPs are routinely renegotiated (Engel et al. [2009b]), very shortly after contracts are awarded, with renegotiations that generally seem to favor the private party (Guasch [2004], Engel et al. [2009a]). On the one hand, renegotiations mitigate the potential advantages of competitive auctions which must allow the selection of the most efficient operator. However, competitive auction may lead to select the bidder most confident in his capacities to renegotiate. Hence, he proposes a price that is not financially sustainable. Then renegotiations occur, since the private operator cannot commit to

*This chapter is derived from an ongoing working paper with Julie De Brux and Stéphane Saussier. We are indebted to Ricard Gil, Steven Tadelis, Brian Silverman and participants of the 2009 International Conference "Contracts, Procurement, and Public-Private Arrangements" in Paris and the 2011 International School of New Institutional Economics held in Palo Alto for their comments and criticisms.

the terms of the contract, but the renegotiation occurs in a bilateral dependency framework where the operator can rent-seeking (Guasch et al. [2000]). On the other hand, the states of nature change over the life of the contract in ways that are not always anticipated by contracting parties. Consequently, renegotiations of inherently incomplete contracts are thus natural and do not necessarily imply any opportunistic behavior. As pointed out by Engel et al. [2009b], considering transport PPP contracts signed in the United States between 1991 and 2010, six out of twenty projects have undergone a major change in the initial contractual agreement. Even higher renegotiation rates have been observed in France for similar projects (Athias and Nunez [2008]).

Although it has been the object of much attention in the economic literature, the matter of renegotiations in contractual agreements still has not received any clear-cut answer. There is no consensus among economists on the view to adopt about these contractual amendments. Notably, the question of their impact on social surplus, profitable or damageable, is still left open. Even less studied is the question of this surplus allocation, *i.e.* which contracting party benefits from renegotiations. According to Guasch [2004], renegotiations are a sign of a "lack of compliance with agreed-upon terms and departure from expected promises". The consequence is that renegotiations reduce the strength of incentives, leading to a loss of global surplus (Guasch et al. [2006]). Using the Incomplete Contract Theory framework, Gagnepain et al. [2010] also show that the impossibility to full commitment (i.e. renegotiation of the contract) leads to welfare losses. According to the transaction cost economics view, renegotiations imply losses associated with efforts to evade the contract terms (Williamson [1985], Masten and Saussier [2000], Bajari and Tadelis [2001]). However, it is not clear that renegotiations are a sign of discord between parties. As for the defendants of the incomplete contract theory, they argue that renegotiations are simply the result of a need to adapt contractual agreements to a changing environment, without any loss (Grossman and Hart [1986]). In the end, the issue of the impact of renegotiations looks like an unresolved puzzle.

In this paper we shed some lights on this issue. Using an original data-set of public-private contracts in the French car park sector, we investigate the link between renegotiations and contract renewals. Because it is nearly impossible to assess the impact of renegotiations on contractual surplus we instead use contract renewal as a proxy. This permits us to assess indirectly the parties' perception about their previous relationship, and, *in fine*, their feeling of cooperative adaptations and surplus creation at renegotiation stages. Had all renegotiations a significantly negative outcome, parties would not be prone to contract again together.

Our database is made of 666 PPP contracts, distinguished by their types, *i.e.* concession and public procurement contracts that differ mainly concerning the discretionary power of the public administration to choose a co-contractor. Among those 666 contracts, we focus on the 252 which have expired. We codified every renegotiation and we investigate their impact on the probability to see the contract renewed with the same partner (166 of them was renewed and the others 86 did not). In order to do that, we take several features of contractual renegotiations and also relevant control variables into account.

Our results can be summed-up as follows. In our delegated contracts subsample, characterized by public authorities discretionary power, we find that there is a threshold below which frequency of renegotiations is positive (whatever the object of the renegotiations). We interpret this as the fact that renegotiating *per se* should not be interpreted as a sign of failure of the relationship. This result is reinforced by the fact that the scope of renegotiations (*i.e.* the number of dimensions targeted by the renegotiations) also impacts on the probability to be renewed. Depending on the types of dimensions that are renegotiated, the impact on the probability to see the contract renewed is different. Indeed, our econometric results reveal that some renegotiations clearly increase the probability to see a contract renewed; others do not. Hence, our results suggest a positive, negative or neutral impact on the contractual surplus depending on the kind of renegotiation that is considered as soon as public authorities have a certain extent of discretionary power to decide to renew a contract with their private partner, *i.e.* as soon as they

can use the *intuitu personae* principle. Indeed, we find no significant evidence of a correlation between renegotiations and the probability to be renewed in our public procurement subsample in which the discretionary power is supposed to be much lower.

This paper first contributes to the literature on contracts and renegotiations. Instead of studying the determinants of renegotiations as in previous studies (Guasch et al. [2008]), we focus on their consequences on contract renewal as an indirect measure of the impact of renegotiations on surplus. To our knowledge, this has never been done before and this sheds some lights on the consequences of renegotiations, not only on their sources. Our paper also contributes to the literature on contract renewal, which has been investigated, up to now, mainly as an incentive for investment strategies (Affuso and Newbery [2002], Gautier and Yvrande Billon [2009], Iossa and Rey [2009]). In this paper, we aim to fill a gap identified by Oxley and Silverman [2008] when they call for studies that enable to determine whether renegotiation represents a jointly beneficial move toward greater efficiency or whether it represents an opportunistic behavior by one of the partners. According to the authors, this question should be informed by "explicitly connecting renegotiation to (actual or perceived) performance effects, and to unpacking more disaggregated detail about which types of provisions are renegotiated in the presence of which triggering factor" (p. 231). Here, we use contract renewal as a perceived measure, *i.e.* as a proxy to assess the parties' perception about their previous relationship. This allows us to underline some evidence about the discretionary power of public authorities and the fact that they take into account information concerning previous experiences for concession contract.

The paper is organized as follows. Our next section presents the related literature on the issue of renegotiations. Then, section 3 describes the car parking sector and the main contractual arrangements we focus on. In section 4, we present our original dataset and our empirical strategy. Results are presented and discussed in section 5. We conclude with some public policy implications and some perspectives for future works.

2.2 What Are The Impacts of Renegotiations? The Puzzle

2.2.1 Literature Review on Renegotiations

Contract renegotiation has been the object of much attention in the economic literature, at least at the theoretical level. Few has been done at the empirical level explaining that the matter of renegotiations in contractual agreements still has not received any clear-cut answer. However, for a long time now, some studies have pointed out the fact that contracts are often renegotiated (Macaulay [1963]; MacNeil [1978]; Goldberg and Erickson [1987]are good examples). Such empirical observations explain, to a certain extent, the evolution of theoretical developments. On one side of the spectrum of the theoretical analysis, a large part of the contract theory is based on incentive issues in which initial developments insisted on the necessity of full commitment from contracting parties (Bolton and Dewatripont [2005]). In other words, in order to resolve efficiently adverse selection and moral hazard issues, the principal must be able to commit not to renegotiate and to accept *ex post* inefficiencies (i.e. once asymmetric information is resolved, the incentive compatible contract does not lead to the first-best anymore) or to frame contracts that are renegotiation proof (Dewatripont [1989]). However, in line with empirical observations, recent developments have focused on the impacts of limited commitment, due, for example, to imperfect institutions (Guasch et al. [2006, 2007, 2008]). On the other side of the spectrum, the incomplete contract theory suggests that renegotiations are unavoidable and useful as soon as the private operator needs compensation to develop investments that were non contractible *ex ante* and that become verifiable *ex post* (Grossman and Hart [1986]; Hart [1995]). Renegotiations are then originally viewed as necessary adaptations to fill contractual blanks, explaining why contracting parties have better renegotiate and complete

their contractual agreement once *ex post* contingencies arise.[6]

However, following empirical observations challenging the view according to which renegotiations lead to *ex post* payoffs that are systematically higher than expected *ex ante*, recent developments of the incomplete contract theory put forward the behavioral assumption that incomplete contracts provide reference points for entitlements in *ex post* trade (Hart and Moore [2008], Fehr et al. [2010]). In contrast with most of the existing literature, Hart and Moore [2008] do not assume that trade becomes fully contractible *ex post*. They make the assumption that the trading parties always have the possibility to provide perfunctory performance (*i.e.* shading behavior) instead of consummate performance if they feel they did not get what they thought they were entitled to. Thus, the disappointed party is aggrieved and shades. In these papers, it is shown that flexible contracts are likely to make one party dissatisfied.

In between those two views, relies transaction cost economics that has recognized for long the fact that contracts are inefficient governance structures that have to be adapted to their evolving environment, mainly because of the complexity of the environment and bounded rationality of economic actors. Renegotiations are thus viewed as necessary because of contracts' maladaptations; but, at the same time, as a risky adaptation process that should accommodate with potential opportunistic behavior (Crocker and Masten [1991], Crocker and Reynolds [1993], Saussier [2000]). Nonetheless, this literature provides very few insights concerning the overall effect of renegotiations on contractual surplus. And it is of no help when it turns to the precise question of the effects that should be expected depending on the scope and the kind of renegotiations that occur during the contract. Because contracts are incomplete and economic actors potentially opportunistic, contractual adjustment might reflect the necessity to adapt to new circumstances or the parties' actions to appropriate surplus.

One way to circumvent opportunistic behavior associated with renegotiations is

[6]However, although the renegotiation process, which is costless, enables to reach higher *ex post* payoffs, the level of incentives to invest *ex post* (leading to renegotiations, depending on the allocation of decision rights) is not necessarily optimal.

provided by repeated interactions. As underlined by the relational contract theory, reputational concerns enhance cooperative behavior during the sequence of the relationship. Indeed, the fact that contracting parties interact repeatedly makes possible to enforce informal agreements reducing opportunistic behavior because of the loss of future businesses such behavior would entail (Baker et al. [2002], Gil and Marion [2009]). The relational view thus suggests that renegotiation might not be an issue (*i.e.* cooperation relies on self-enforced informal contracts that are supposed to avoid opportunistic behavior) as soon as parties anticipate they will be renewed if they respect the *spirit* of the contract (MacNeil [1978]). It also suggests that contracting parties renew their relationships as long as they are satisfied with their previous relationship.

To sum up, this literature review does not enable to highlight a one-track approach concerning renegotiations and their effects. The empirical literature on renegotiations in public-private partnerships offers another view of this issue.

2.2.2 Renegotiations in Public-Private Contracts

Because they deal with services of general interest, public-private contracts and their renegotiations are especially under the scrutiny of regulation bodies. However, this does not prevent the occurrence of renegotiations. The literature on empirical contracting is sparse because private firms rarely share information on their agreements and even less frequently on their renegotiation decisions (Gil [2011]). For this reason, the majority of the few existing empirical literature on renegotiations mainly deals with government procurement. Many case studies of renegotiations in public-private agreements are given by Guasch [2004]. Studying more than 1000 concession contracts signed in Latin American countries, he found that 54.7% of transportation contracts and 74.4% of water and sanitation contracts were renegotiated between the mid 1980s and 2000. Renegotiations occur shortly after the award (on average 2.2 years after the award), and often, at first glance, favor the private party. The most common outcomes of renegotiations are delays,

tariff increases and reduction in investment obligations. This leads the author to consider renegotiations as having mainly negative impacts, reflecting opportunistic behavior from private partners and cancelling the potential advantages of competitive auctions. In other words, renegotiations are viewed as the consequence of aggressive bids in a context of *ex ante* lack of commitment from the government (Bajari et al. [2003], Guasch [2004]). Because the government is unable to commit not to renegotiate and because firms learn their type only after they propose a bid, if a firm wins a call for tenders and discovers she is inefficient (*i.e.* negative profits), she will be prone to ask for renegotiation (Guasch and Straub [2006], Guasch et al. [2008]). Alternatively, other researches deal with government-led renegotiations (Guasch et al. [2007]) and renegotiations that enable incumbent governments to circumvent budgetary rules before elections (Engel et al. [2009a]).

Whoever is at the origin of the renegotiation process, the very few empirical literature and case studies on renegotiations has underlined very contrasted outcomes: most of the time, they are viewed as a game in which there are losers and winners (Estache [2006]) or, more scarcely, as a win-win game (De Brux [2010]) depending on contracting parties' behavior and the reason why renegotiations occur.

However, to the extent of our knowledge, no econometric study collected data in order to assess the impact of renegotiations. The only one we are aware of is Bajari et al. [2006], but they focus on the impact of the anticipated cost of renegotiations on the bids proposed by competitors. The authors find that the level of the bids differs with the expected difficulty to renegotiate (*i.e.* signing a rigid or a flexible contract). We depart from their approach since our goal is to look at the impact of renegotiations on contractual surplus. Nevertheless, because it is very difficult, not to say impossible, to assess the general impact of renegotiations on the contractual surplus, we analyze this impact on the willingness of the parties to pursue their relationship. Indeed, for a given contract that is ending, we can reasonably believe that if parties are satisfied, the probability to renew their contract is higher compared to the case where they would feel prejudiced.

Undoubtedly, the choice of partner's renewal can be dictated by the bilateral de-

pendency and/or by the absence of other competitors. In other words, the probability for a public authority to renew depends on those credible alternative options that are related to the asset specificity at stake in the relationship and also to the competitive pressure on the market. However, as it will be discussed in the next section describing the French car park sector, we focus on a sector characterized by a standardized service and by a high level of competition. Consequently, it allow us, without taking too much risk, to use contract renewal as proxy of satisficing contractual surplus in the end of the contract.
The next section describes the sector and the data we collected in order to conduct our analysis.

2.3 The French car park sector

2.3.1 The main characteristics of the sector

In most European countries, many on-street and off-street car parks are public, so that municipalities have the responsibility of their provision. The positive externalities and social benefits (environmental concerns, intermodality, urban development, etc.) derived from a high quality of construction and efficient management of car parks are the reasons why they are in the bosom of public authorities. However, although public authorities keep ownership and have to control and monitor car parks, they can outsource the provision of such infrastructure and services through public-private arrangements. Concerning French car parks, public authorities have experienced public-private arrangements for long. Indeed, the first concession of car park was awarded in France in 1962 to the firm "*Grands Travaux de Marseille*". Since, the use of such outsourcing to a private operator has become widespread. According to the French Ministry of Sustainable development [2009], the market of car parks is dominated by private operators, by 73%. 27% are provided in-house, through public provision.

The history of the car park sector is characterized by a growing level of competitive pressure, between French firms (local operators as well as bigger companies); and more recently between national and foreigner operators (Baffray and Gattet [2009]). This trend of the competitive pressure was also confirmed by interviews we had with different managers of the sector. Consequently, when public authorities decide to use a public-private arrangement for the provision of their car parks, they have to select among several national and international companies[7] as well as local firms. Even if centralized data does not exist, we know that there can be up to ten competitors and, on the contrary, calls for tenders with only one bidder are extremely rare. In addition to this fierce competition, it is always possible for a municipality to go back to in-house provision when the contract is over. This is notably made possible by the nature of the provided service. Indeed, car parks management is a highly standardized service and parties are not locked-in together through a bilateral dependency, *i.e.* there is no asset specificity subject to quasi-rent appropriation.

Prior to selecting their partner, public authorities also have to choose between concession and public procurement when they decide to outsource. Next subsections describe each of these public-private contractual arrangements and the main differences between them.

2.3.1.1 Concession

A relevant way to highlight the difference between concession and public procurement is to describe the way those two kinds of contractual arrangements are awarded. We start with the award procedure of concession contracts. The first phase is a prequalification stage that enables private firms to become candidates. The opening is publicly advertised and everyone can apply. Then, candidates are prequalified on the basis of their previous experience and on their financial robust-

[7] Vinci Park, Q-Park, Epolia, Efia, Interparking, Parking de France, UrbisPark, AutoCité and SAGS are the most frequent bidders in France.

ness. Second, the public authority has to write the call for tenders that specifies the objectives to be reached by the operator and the selection criteria. Those latter generally consist in the acceptability of the level of prices the bidders intend to charge users, the rent the private operator is willing to pay to the public authority in counterpart for the use of the public ground, the technical quality of the bid (as the call for tenders is output oriented, the bidders must precise their means to reach the specified goals), and the "general quality of the bid". Finally, there is generally a third and last step, when the second one enables to determine a short-list of two or three bidders. This third step is a direct negotiation between the public authority and each of the remaining bidders. Thus, although the selection procedure of concession contracts appears rather formal, we can observe that for each step, there is room for discretionary power from the public authority. The award procedure refers to vague terms and the interpretation is left to the discretion of public authorities. Consequently, public decision makers are allowed not to consider the financial criteria only and they can also take their previous experiences, the quality of the bid as well as the quality of negotiation into account. As soon as past common experiences is a possible criterion of selection, it is relevant to presume that contract renewals are all the more likely to occur than previous experience between parties went well.

In addition to discretionary power, another main feature of these concession contracts is that the private operator bears the demand risk, so that he is remunerated with users fees. These contracts are generally long-term ones, so that private operators can invest on renovate the infrastructure, and have time to pay it off. The direct consequence of long duration is that these contracts are subject to political, economic, social and technical changes that may occur during the execution of the contract. Changes that occur during the execution of the contract may be exogenous to the contract (developments in technology, economic shocks, changes in legislation or legal interpretation) or may directly result from internal drivers (evolving business requirements) or contract maladaptations (inappropriate initial

contractual design). Such changes may involve adaptations of the service.[8]

2.3.1.2 Public procurement contracts

Compared to concession, the award procedure of public procurement contracts is more strict. It only includes one stage, with standard criteria (the price is generally the most important one) and well defined tasks delegated to the private operator. Thus, although the full neutrality of public authorities in such procedures cannot be proved, still, it is relevant to argue that they have less discretionary power than in concession procedures. Public procurement contracts are not global contracts so that they do not include both construction and management. In the car park sector, they mainly concern the provision of the service, instead of the construction of the infrastructure and their duration is shorter than concession contracts.

As they are short-term, less complex and more complete[9], one could expect that renegotiations are less likely to occur, than in concession. Nevertheless, in public procurement contracts, residual control rights stay in the hands of public authorities (Bennett and Iossa [2006]), so that any single verifiable change requires the approval of the public authority to be implemented, and thus a renegotiation. So, relatively to concession contracts, one could also expect renegotiations to be more systematic.

Nonetheless, whatever the frequency of renegotiations, they should have no impact on the probability of contract renewal, since the public authority must base his decision to award a contract on the price criteria (*i.e.* no discretionary power). Indeed, previous experiences should not be taken into account in the decision to renew or not a contract, as illustrated by a recent statement from the Administra-

[8] Besides, the French legislation takes this necessity of renegotiations into account, through the "mutability principle", since 1910. The first judicial decision concerned urban public transport but the principle was generalized to all public services.

[9] The operator is in charge of few tasks. Moreover, a specification booklet was established by State administration in collaboration with representatives of private operators and of association of local councilors in order to propose a contract framework, that public authorities are free to use.

tive Court of Paris. In 2009, a public authority in charge of public procurement contracts in the field of social housing was sanctioned for disqualifying a candidate because of a bad past experience with him. Hence, the court condemned the public authority to re-organize the call for tenders and to evaluate the candidacy of each operators, including the complainant.[10]

2.3.2 Scope of the database

In the French car park sector, there is no regulation authority, so that the data are not centralized and very hard to bring together. In order to access to data, we seized the opportunity we have been given to have access to the contracts of the French leading company (42% of the market share among private operators[11]). Thus we collected all the contracts signed between 1963 and 2008 with 135 different public authorities, *i.e.* a total of 666 contracts. For most of the contracts, we accessed to the entire document and for all the others, we obtained fact-files redrawing the history of contracts and their respectives renegotiations.

We consider that a contract is renegotiated when a revision, not envisioned in the original contract, occurs.[12] For instance, changes in tariffs, duration, additional investments or conditions of the financial equilibrium are coded as contract renegotiations. Calls for renegotiations can be led by the municipality, by the private operator or by both. In the database, we were able to identify who was the originator of the renegotiation just for a tiny number of cases. As a consequence, we do not take into account this aspect of renegotiations.

Among the 666 contracts, we pay particular attention to the expired contracts to explore whether the sequence of renegotiations may have an impact on their renewal. Thus we are looking into 252 expired contracts and the 782 renegotiations out of them. Among those 252 expired contracts, we note that 131 of the

[10] Administrative order n°0907878, Administrative Court of Paris, June 2009.

[11] That is 30.6% of the total market shares.

[12] We use the words amendment and renegotiation indifferently.

expired contracts have never been renegotiated (52%). It indicates that if contractual amendments are not the rule, they nevertheless are usual. Furthermore, we observe that 78.5% of expired public procurement contracts we study are renewed and that this percentage falls down to 44.7% for concession contracts. Those rates of contract renewal confirms, as previously argued, that public authorities have credible alternative options when contracts turn to the end.

Table 2.1 highlights some stylized facts that provide intuitions concerning the potential link between renegotiations and renewals in each type of contractual agreement.

Table 2.1: Contractual agreements, renegotiations and renewal

	All Contracts	Delegated Management	Public Procurement
Number of expired contracts	252	94	158
Number of contract renewals	166	42	124
Rate of contract renewals	65.9	44.7	78.4
Average number of renegotiations per year of expired contracts	0.420	0.381	0.453
Average number of renegotiations per year of expired contracts leading to renewal	0.443	0.402	0.458
Average number of renegotiations per year of expired contracts not leading to renewal	0.391	0.364	0.433

Student t-tests confirm the difference of means of renegotiations between concession and public procurement. Contracts that are renewed with the same operator once the contract has expired are those that were previously the most renegotiated. However, t-tests do not allow to conclude that the means of renegotiations between renewed and not renewed contracts are statistically different from each other, neither for concession contracts nor for public procurement ones. Nevertheless, it reinforces our thinking that the relationship between renegotiations and contract renewals requires deeper refinements. To summarize, the car park sector seems a relevant application to study how renegotiations affect the turn of a relationship, since it is a mature and competitive market, characterized by a standardized service, by frequent renegotiations and by the possibility to observe contract re-

newals. This is precisely the object of our empirical investigation presented in the next section.

2.4 Propositions and Used Variables

Given the characteristics of the car park sector, and the extent of our original database, we built several variables to understand the impact of the different aspects and features of renegotiations on the likelihood of renewal. In what follows, we describe these variables (summary statistics are provided in Table 2.5 - Appendix), and we formulate some propositions on the expected signs when it is possible. We recall that there is no one-track approach concerning renegotiations in PPPs and their effects. Consequently, we do not test any specific model, but instead we provide empirical results of direct relevance to several of the key ideas put forth by previous studies about renegotiations.

2.4.1 Dependent variable

Our dependent variable $Renewed_i$ takes the value 1 if the expired contract was followed by a renewal after a new call for tenders, and 0 otherwise. In our database, the renewal rates of concession and public procurement contracts are respectively equal to 43.7% and 77.7%. In practice, there are three ways to interpret the fact that a contract is not renewed: the choice of the public authority to select another operator, the choice of the public authority to go back to public provision, or the choice of the private operator not to bid again for the contract. Whatever the case, a common explanation may that parties are not willing to contract again together because of dissatisfaction concerning their previous contractual relationship. Nevertheless, the information we collect from interviews with expert of the sector uncover that, in accordance with a high level of competition, cases where the private operator is not candidate to its own succession are extremely scarce. Thus

we can reasonably argue that the renewal decision is mostly the municipalities' responsibility. Obviously, one can argue that another explanation of non contract renewal can be the existence of a cheaper offer made by a competitor and we unfortunately do not have such information. Nevertheless, in line with the high level of competition in the sector, it is possible to assume that the likelihood of cheaper offers can be considered as identically distributed among our observations. Hence we believe that this missing information is not really penalizing.

2.4.2 Some Propositions and Main Independent Variables

As previously said, this paper looks at the impact of renegotiations on contract renewal. This potential impact might exist through different channels suggesting several potential explaining variables for our analysis.

2.4.2.1 Renegotiation or no renegotiation

The first obvious way to assess the impact of renegotiating a contract on the renewal probability is to distinguish between contracts that have been renegotiated and others. Thus we created a dummy variable $NoReneg_i$ that takes value 1 if the contract i is not renegotiated at all during its execution and 0 otherwise. In our sample more than 73% of our concession contracts have been renegotiated and only 32.9% in our public procurement sample.[13] This difference is mainly due to the fact that, as previously said, public procurement concerns generally more simple task, without any bundling and give rise to shorter contract duration compared to concession contracts. This observation is perfectly in line with Guasch et al. [2008] pointing out the importance of the uncertainty characterizing a contract to explain the probability to renegotiate.

[13]In spite of a lower percentage of renegotiated public procurement contracst, table 2.1 shows that when they are renegotiated, they are renegotiated at a higher frequence than concession contracts

Because looking at the occurrence or not of renegotiations is only a very crude measure of renegotiations in a contract (measuring only the existence, but giving no information on the frequency of renegotiations or its types) we do not expect this variable to play a central role in the explanation of contract renewals.

2.4.2.2 Frequency of renegotiations.

In addition to the fact that a contract is renegotiated or not, the frequency of renegotiations might impact on the contractual surplus and *in fine* on the willingness of the parties to renew the relationship. On the one hand, a high frequency of renegotiations may lead to higher transaction costs (and to potential opportunism) that have a negative impact on contract renewal. On the other hand, if renegotiation are pursuing the adaptation of contractual terms to their environments, hence increasing efficiency, the net effect might be positive. We capture the frequency of renegotiations by using the variable $AverageReneg_i$. This variable is the number of renegotiations per year in each contract i. The ratio measure (number of renegotiations / duration of the contract) appears the most relevant since renegotiating four times a two-year contract is not the same as a twenty-year contract. We also include a squared term of our variable $AverageReneg_i$ in our regression in order to identify a potential non-linear effect. This intuition relies on the argument that contract are governance mechanisms that should be rigid enough to reflect real commitment from contracting parties and flexible enough to permit adaptation as environment evolves. We expect this variable to play a role in the decision to renew contracts or not.

Nevertheless, we push the analysis further. First, we focus on the date when renegotiations occur. Second, although the variable $AverageReneg_i$ points us on a way toward a noticeably finer measure of what renegotiations are, we believe it is not sufficient. That is why, in line with Oxley and Silverman [2008], we also differentiate renegotiations according to their type. Indeed, that might have different effects on the willingness of contracting parties to renew the contractual relationship.

2.4.2.3 Celerity of the first renegotiation

In order to investigate more in depth the relationships between renegotiations and contract renewals, we pay attention to the celerity of the first renegotiation. Indeed, this celerity can be used as a proxy of opportunism in the contractual relationship as suggested by Guasch [2004]. Fast contract renegotiations after the signature can reflect an aggressive bidding giving rise to effort in order to evade from contractual obligations (*i.e.* the candidate voluntarily under-estimates the costs of the service being confident on his ability to renegotiate contractual terms). They can also emerge because of winner's curse effect (*i.e.* the too much optimistic winner is unable to keep its promises and calls for a revision of contractual terms). In any case, we expect that the faster the first renegotiation, the lower the probability of contract renewal. In our sample, renegotiating fast seems to be quite scarce. In fact, only 5.21% of concession contracts and 7.7% of public procurement contracts are renegotiated during their first year of execution. Those percentages respectively reach 52.1% and 39.3% if we focus on the three first years of the contract. Nevertheless, renegotiating during the first year is different if the contract lasts two or twenty years. Thus, in order to obtain a more relevant measure of the celerity of the first renegotiation, we built the following variable:

$$Celerity_i = \frac{1}{x} \quad \text{where} \quad x = \frac{[\text{Date of the first renegotiation} - \text{Date of Signature}] + 1}{\text{Duration}}$$

We divide the time laps between the signature and the first renegotiation by the total duration of each contract i. As a result, the lower x, the faster the renegotiation. Afterwards, we use the inverse of x. In this way, contracts that are never renegotiated are coded 0 and, for all the renegotiated contracts, the higher $1/x$, the faster the first renegotiation.[14] As a consequence, if the celerity of the first renegotiation is a sign of opportunism in the contractual relationship (Guasch [2004]) making the parties less prone to contract again together, we should observe

[14]The fact that expired contracts that were not renegotiated ($Celerity_i$=0) are, in a way, assimilated to contracts that are very lately renegotiated ($Celerity_i \to 0$) is controlled by the presence of our variable $NoReneg_i$ in our regressions.

a negative coefficient associated with our variable $Celerity_i$.

2.4.2.4 Close-to-the-end last renegotiation

Symmetrically, we also pay attention to the proximity of the last renegotiation to the expiration of the contract. Because several studies suggest that public authorities give more attention to recent behavior compared to older ones, due to bounded rationality issues or obsolescence effect of older information (Iossa and Rey [2009]), we expect renegotiations that are close to the expiration of the contract to play a role on the decision to renew a contract or not. If public authorities pay more attention to their latest interactions with their interlocutor and have a short-term memory, it is likely that renegotiations that are close to the end of the contract will have a strong influence on the turn of the relationship.
Compared to our celerity variable, renegotiating during the last year of the contract is much more common. Indeed, 38.5% of concession contracts and 16.7% of public procurement contracts are renegotiated during the last year.
Our variable $Last_i$, embodying the proximity of the last renegotiation to the expiration, is built similarly than the variable $Celerity_i$:

$$Last_i = \frac{1}{y} \quad \text{where} \quad y = \frac{[\text{Date of expiration} - \text{Date of the last renegotiation}] + 1}{\text{Duration}}$$

As a result, the lower y, the closer to the expiration date the renegotiation. Using the inverse ratio, contracts never renegotiated are coded 0 and, for all the renegotiated contracts, the higher $1/y$, the closer to the expiration the last renegotiation is.[15]

[15]Here again, the fact that expired contracts that were not renegotiated ($Last_i$=0) are, in a way, assimilated to contracts that are very early renegotiated ($Last_i \to 0$) is controlled by the presence of our variable *NoRenegi* in our regressions.

2.4.2.5 Renegotiation Types

To disentangle the effect of the frequency of renegotiation depending on their types, we detail more precisely the object of renegotiations by codifying their types, *i.e.* the contractual dimension they are concerned with. Then, we extract the frequency of renegotiations according to those types.

The variable $RenegTariff_i$ is the average number of renegotiations per year in each contract i dealing with a change in tariffs charged to users of the service. Renegotiations on tariffs can take the form of an increase in tariffs and/or the implementation of specific tariffs for regular users (in this latter case we also codified the renegotiation as $RenegQuality_i$.) They only occur in concession contracts. Indeed, in public procurement, tariffs are only decided by the public authority and the private operator has no payoff rights.

The variable $RenegInvestment_i$ stands for the average number of renegotiations per year in each contract i about an additional investment that had not been foreseen in the contract. This additional investment may come from the requirement of the public authority, or from a miss-anticipated spending from the private operator. In the former case, the compliance of the operator might lead to higher probability of contract renewal; while in the latter case, the miss-anticipated spending by the operator might require to increase tariffs or to revise the financial provision and can make the public authority reluctant to contract again with the same operator. Thus, we cannot formulate expectations about the impact of this variable.

The variable $RenegQuality_i$ is the average number of renegotiations per year in each contract i improving the quality of service. Most of the time, the literature considers quality as a hardly contractible dimension. Even if it the case in the car parks sector, we are able to identify *ex post* adaptations aiming at improving the quality of the service. This process of improvement might be accompanied with an additional investment ($RenegInvestment_i$ here above), as it is the case for example when a new elevator is implemented to facilitate the access to disabled persons, or when free bike rentals are proposed to users so as to promote green cities. Or

it might just consist in the implementation of specific tickets, for regular users. In this latter case, we also codified the renegotiation as $RenegTariff_i$.

The variable $RenegFinanEq_i$ stands for the average number of renegotiations per year in each contract i about changes of the financial equilibrium of the contract. Those changes might have different sources: an error of anticipation, an *ex post* shock, an additional investment that cannot be offset by an increase of tariffs for instance. In concession, these renegotiations lead to a decrease in the rent private operators pay to the public authority in counterpart for the use of the public ground or asset. In public procurement, these renegotiations lead to a increase in the payment for the private operator. Finally, the variable $RenegDuration_i$ represents the average number of renegotiations per year in each contract i about an extension of the contract duration. Nevertheless, since 1993 "Sapin Law", it is forbidden to significantly extend the duration of the contract. Most of the time, the renegotiations on contract duration we observe are concerned with very short extension (less than one year). It corresponds to the (frequent) situation where the public authority needs more time to organize a new call for tender for contract renewal.

In our database, the more common renegotiations are related with duration, while the less frequent ones deal with the financial equilibrium. We expect more conflicting renegotiation types, such as renegotiation on tariff or financial equilibrium, to decrease the probability to renew a contract. Renegotiations concerning quality are less conflicting, usually at the initiative of the private operator with the possibility of the public authority to accept or refuse the implementation of higher quality levels. Hence, such type of renegotiation is supposed to be less contentious and more likely to increase the probability of renewal.

We also introduce a last variable, $RenegIndex_i$, which stands for the average number of renegotiation per year in each contract i about a change in the indexation clause to which several aspects of the contract may be attached. Such indexation clauses are a function of different indexes, such as the price index of workforce in building trade and the price index of different materials (cement, concrete, etc.).

It is generally foreseen in the original contracts that renegotiations will take place if prices indexes disappear or if they have no more sense for the contract. Such a contractual amendment does not fit the definition of renegotiation we adopt earlier in this paper. However, it appears to present a great interest. Indeed, as soon as those renegotiations are formally foreseen, they should have no impact on contractual surplus. Consequently, we expect this variable to be absolutely not significant and the contrary should cast doubt on the reliability of our data-set.
Finally, it is important to note that one amendment might concern several features of the contract. Hence, our variable $AverageReneg_i$ is not the simple addition of our variables accounting for the average number of renegotiations for each renegotiation type.

2.4.2.6 Scope of renegotiations.

Lastly, we believe that the question of the scope of renegotiation is also relevant. In fact, in addition to the frequency of renegotiations, it is important to focus on the number of contractual dimensions that are concerned by *ex post* modifications. The reason of this major interest is intuitive: as public authorities and private operators might have contradictory objectives, it is probably easier for the diverging interests to meet if several dimensions are renegotiated. What one party looses on one dimension can be recovered on other dimension avoiding a zero sum game. That is why we expect that the larger the scope of renegotiations, the higher the probability for a contract to be renewed. To take this into account, we built the variable $Scope_i$ which corresponds to the number of renegotiated dimensions of each contract i during its lifetime. Each type of renegotiations described here above is a dimension. As a result, the variable $Scope_i$ is an ordinal variable equal to 0 when there is no renegotiation and equal to 5 if the contract i is concerned by all the previously cited types of renegotiations (excluding *RenegIndex*).
Obviously, the different features of renegotiations mentioned above are not the only relevant factors influencing contract renewal. In order to tackle this issue and

to obtain a robust analysis of the impact of renegotiations on contract renewal, we also introduce a set of control variables that could potentially play a role. As described hereafter, those variables aim to take past experiences, perspective of future business and political influence (among others) into account.

2.4.3 Control variables

2.4.3.1 Past experiences

As emphasized previously, discretionary power of public authorities allows them to take past experiences into account. However, past experiences cannot be restrained to the renegotiations of the scrutinized contract. The municipality can share an older past history with the private operator. Thus, we include the variable $PastExperiences_i$ which stands for the number of other expired contracts the private operator and the municipality shared in the past. On average, the private operator had more than two past contracts with each municipalities. Nevertheless, we can also underline that more than 30% of the expired contracts were first contracts. Because this variable may reflect mainly the skills developed by contracting partners in order to interact efficiently together, with low transaction costs, we expect this variable to impact positively on the probability for a contract to be renewed.

2.4.3.2 Future business and reputational concerns.

As emphasized by the relational contract theory, perspectives of future business allow to deter opportunism and to encourage cooperative behavior. Thus, we also take into account the impact of future business and reputational concerns by including two other variables. The first one, $MultiContract_i$, is the number of other ongoing car park contracts the co-contractors have together at the date of expiration of each contract i. This variable enables to capture businesses in

which the parties are already engaged and that are still running for a certain period of time. It also provides a measure of the severity of the punishment the local authority might apply to an opportunistic partner by not renewing several contracts instead of one (Desrieux et al. [2010]). In our database, the private operator and the municipalities share on average 1.6 contracts in addition to the the scrutinized contract. Nevertheless, we also observe that 43% of the cases correspond to the situation where the private operator and the municipalities share the only studied contract.

The second one, $SameArea_i$, stands for the number of other contracts the operator has with other public authorities belonging to the same region at the date of expiration of each contract i. Indeed, the reputation effect can also be effective in a broader area than the only concerned city. This geographic reputation effect, if any, is likely to play in a way that benefits the operator. Indeed, in a perspective to have future contracts with the same authority, and with other authorities as well, the private operator is prone to refine his reputation and to act in a way that satisfies the authority. This makes him more likely to be eligible to contract renewal under concession when he has ongoing contracts with neighbors municipalities.[16] In general, both for concession and public procurement contracts, the private operator has almost five other ongoing contracts in the same region. We expect those two variables to play a positive role on the probability to renew a contract.

2.4.3.3 Political dimensions.

Several articles have already pointed out the role of the political dimensions in the decision to privatize public services.[17] One could also think that the choice of contract renewal could be influenced by political issue as well. That is why, we introduce the variable $ChangeOfMayor_i$ which is a dummy variable accounting for

[16] For the construction of these two variables, our observations are based on the 666 contracts, *i.e.* also on the ongoing contracts.

[17] See for example the theoretical analysis provided by Boycko et al. [1996] and the empirical analysis of local public services in the US done by Lopez-De-Silanes and Chong [2004]

a change of mayor in the last year preceding the contract expiration. With this variable, we depart from previous works which take into account the influence of politics by focusing on the political color of the public authority.
If it might be relevant to take into account the political color when we analyze the choice of the governance structure, two reasons make us believe that the change of mayor is a better proxy of political influence in our settings. First, in small municipalities, it is frequent to find apolitical mayors who do not officially belong to a particular party. Second but of primary importance, we think that more than the change of ideology (left-wing *vs* right-wing), the most important element is the change of the interlocutor, as it can represent a breach in the dialog between the operator and the municipality. Furthermore, a change of political color is necessarily a change of mayor while the change of mayor can occur without change of political color. In our dataset, the situation of a change of mayor during the year preceding the re-auctioning of the contract occurs 20 times in the case of concession contract (21.8%) and 17 times in the case of public procurement case (10.7%). We expect a breach in the dialog between the interlocutors, due to a change of mayor to have a negative impact on the likelihood of contract renewal.

2.4.3.4 Size and competition

As previously pointed out, the level of competitive pressure might impact on the probability to be renewed. However, as also previously mentioned, there is no centralized data about the number of candidates and their respective bids in each call for tenders. We thus have to find a way to approximate the potential competition. We tackle this by controlling our estimates with our variable $Size_i$ which stands for the number of inhabitants at the date of expiration. As illustrated by Coletto-Labatte [2008] in his study of competition in the car park sector in France, the means of the number car parks and of the number of present operators is an increasing function of the size of the cities. Thus, the risk for the incumbent to face a fierce competition for the field can be assumed to be higher in big municipalities

than in small ones. Consequently, even if it is an imperfect measure, it is possible to capture the level of competitive pressure through this variable $Size_i$.

2.4.3.5 Other variables

As we investigate the impact of the frequency of renegotiations, we must have to control our estimations by including a variable that stands for the duration of each contract ($Duration_i$). In this way, we are able to interpret the marginal effect of our variable $AverageReneg_i$. The coefficient of this latter really captures the impact of the frequency of renegotiations and cannot be imputed to the duration of the contract.

We also control for the different tasks the operator is in charge of by including the variable *Build* which is a dummy variable that takes the value 1 if the private operator was in charge of the construction of the car park, and 0 otherwise. As there is no construction in public procurement contracts, we only observe the impact of this variable in the case of concession. In our data, the operator has to build the car park in addition to the operation in 16 cases among the 94 expired contracts we study.

Finally, as the estimation results could be driven by unobserved characteristics of the municipalities and/or the sector, we control for those potential biases by introducing the variable $Year_i$ that stands for the year of expiration of contract i and by clustering our data on the municipality level.

2.5 Method and Results

2.5.1 Econometric specifications

Our goal is to explore the impact of the different features of renegotiations that may influence the cooperative adaptations over the contractual relationship and

thus the likelihood of contract renewal. We estimate the following model:

$$Z_{it}^{*} = X_{it}^{'}\alpha + Y_{it}^{'}\beta + \epsilon_i$$

Where Z_{it}^{*} is the feeling of satisfaction concerning contract i at renewal date t, that is a latent variable that we cannot observe. What we can observe is the fact that the contract is renewed or not at its renewal time. We consider the renewal decision as an indicator for whether our latent variable Z_{it}^{*} is positive:

$$Renewed = \mathbf{1}_{\{Z^{*}>0\}} \Leftrightarrow \begin{cases} 1 \texttt{ if } Z^{*} > 0 \\ 0 \text{ otherwise} \end{cases}$$

Hence our problem boils down to a probit estimation of the following model:

$$Renewed_{it} = a.X_{it} + b.Y_{it} + e_i$$

Where $Renewed_{it}$ is the binary variable that indicates whether contract i is renewed or not at time t; X_{it} is a vector of variables that groups the different features of renegotiations we want to estimate (*NoReneg, Celerity, Last, AverageReneg, RenegTypes, Scope*); Y_{it} is a vector of control variables that may also influence contract renewal (*PastExperiences, MultiContract, SameArea, ChangeOfMayor, Size, Duration, Year*) and e_i is the error term (we assume that $e_{it} \rightsquigarrow (0, \Sigma)$). Our main interest is on the coefficient a that captures the impact of the different renegotiation features.

2.5.2 Results

2.5.2.1 The impacts of renegotiations (concession contracts)

Table 2.2 provides the results of our probit estimates concerning concession contracts. Model 1 is the simplest model we can imagine. It only includes our set

of control variables and the dummy variable indicating whether the contract was renegotiated or not (*NoReneg*). Models 2 to 5 take into account the different features of renegotiations separately (with control variables). Finally, Model 6 gathers all our independent variables and Model 7 proposes a finest analysis of our variable *Scope*. This latter fully specified model allow us to reach a satisfying McFadden r^2 and a high predictive power (80.8% of correctly specified predictions).[18]

First of all, the results suggest that the fact to renegotiate or not a contract is not strongly and significantly correlated with the decision to renew or not a contract. The coefficients associated with our variable $NoReneg_i$ is negative but not significantly stable across estimates. This first result invalidates the literature describing renegotiations in general as being a negative event in the life of a contract and confirms our objective to investigate in further details the relationship between renegotiations and contract renewals. Indeed, this result does not disqualify analysis pointing out the role of renegotiations in contractual agreement. It suggests that it might be useful to go a step further by distinguishing renegotiations by their types, frequency and celerity. That is what we do in the following estimates. Our results about the celerity of the first renegotiation seem to confirm what is push forward by Guasch [2004] and Estache [2006]. Indeed, our variable *Celerity* is negatively and significantly correlated with our dependent variable *Renewed*, meaning that renegotiating quickly adversely impacts the pursuit of the relationship. This result is consistent with the idea that renegotiating fast can be a matter of aggressive bid or of winner's curse effect in the French car park sector. At the opposite, we find a positive and significant coefficient associated with our variable *Last* embodying the proximity to the expiration of the last renegotiation on the probability of contract renewal. As there exist information decay through time, parties tends to over-evaluate recent renegotiations. The fact that this variable is positive and significant leads, at least, to one interesting finding: to renegotiate the contract is here interpreted as a positive event; or at least that the private

[18] A naive prediction would allow to obtain a rate of 56.3% at most. The predictive power of the fully specified model is also confirmed by the Pearson and Hosmer-Lemeshow goodness-of-fit tests.

operator is prone to renegotiate in a way that is satisfying the public authority in order to improve his likelihood of renewal.

Results concerning the impact of the frequency of renegotiations suggest that there exist an impact of the frequency of renegotiation during the execution of a contract on its probability to be renewed with the same partner. We find that *AverageReneg* is significantly and positively correlated with the probability to renew the contract with the same operator. As for our variable $AverageReneg^2$, we observe a significant and negative correlation with our dependent variable. This non linear effect of the variable *AverageReneg* suggests that there might exist an optimal frequency of renegotiations. This result is not at odds with previous findings. It reflects the fact that contract are governance mechanisms that should be rigid enough to reflect real commitment from contracting parties but that also should to be flexible enough to permit adaptation as environment evolves.

Turning now into the renegotiation types and their impact on the probability to renew a contract, we find that the dimensions on which contracts are renegotiated are crucial. As expected, we observe different correlations depending on the dimensions concerned with contractual amendments. The coefficient associated with the variable *RenegQuality* is positive and significant across estimates. As those renegotiations enable to improve the quality of the service offered to users, they make public authorities more prone to contract again with the same operator. The positive and significant correlation we observe is, hence, not surprising. On the contrary, the coefficient associated with the variable *RenegFinanEq* is negative and significant across estimates. As previously emphasized, those renegotiations come, most of the time, from an error of anticipation, an *ex post* shock or an additional investment that cannot be compensated with an increase of tariffs. Furthermore, these renegotiations generally lead to a decrease in the rent private operators pay to the public authority in counterpart for the use of the public ground or asset. For this reason, they seem to make public authorities less prone to contract again with the same operator.

We also find a negative impact of renegotiations dealing with additional investment

as suggested by the negative and significant coefficient of the variable *RenegInvestment* in model 5, suggesting that parties can feel prejudiced when they renegotiate on this aspect. Indeed, as previously emphasized, additional investments can be the consequence of a direct requirement of the public authority (and in this case the compliance of the operator might lead to higher probability of contract renewal) or of a miss-anticipated spending by the operator requiring to increase tariffs or to revise the financial provision (and in this case the public authority might be reluctant to contract again with the same operator). In our data, the second possibility seems to overcome the first one.

Our variable *RenegTariff* does not appear significantly stable across estimates. However, the negative sign associated with this variable is consistent with the argument that increasing tariffs is negatively perceived by public authorities in their decision to re-award the contract with the same operator, even if those raises are due to quality improvements.

Throughout, our results about the several types of renegotiations suggest that they impact differently on the relationship during the contract lifespan, conditioning the probability of contract renewal.

Our results also highlight that the scope of renegotiations matters in the case of concession. Indeed, the positive and significant sign associated with our variable *Scope* seems to indicates that contracts have greater chance to be renewed when renegotiated dimensions are numerous. This effect is investigated in greater details in model 7 where we put a dummy for each possible "scope configuration" (*i.e.* number of different dimensions renegotiated during the contract lifetime). It appears that the probability of contract renewal is higher when contract are renegotiated on two, three or four dimensions rather than zero. Interestingly, we also find that contracts have lower chance to be renewed when they are renegotiated on one dimension rather than zero. Still, it seems to suit the story according to which parties would prefer to contract again together when the previous contract was a win-win game, rather that a zero-sum game.

Table 2.2: Probit analysis of concession contracts renewals

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	Probit	Probit	Probit	Probit	Probit	Probit	Probit
	Dependant variable : ***Renewed***						
NoReneg	-0.445**	-0.299	-0.180	-0.516**	-0.128	0.403	-0.535
	(0.226)	(0.291)	(0.277)	(0.225)	(0.245)	(0.293)	(0.705)
Celerity		-0.044*				-0.121***	-0.268***
		(0.024)				(0.025)	(0.058)
Last		0.059***				0.061***	0.085***
		(0.017)				(0.019)	(0.028)
AverageReneg			2.129***			3.292***	6.121***
			(0.812)			(0.778)	(0.974)
AverageReneg2			-1.526**			-2.365***	-5.226***
			(0.664)			(0.704)	(0.615)
Type of Renegotiations							
RenegTariffs				-3.844*		-3.851	-1.891
				(2.062)		(2.779)	(1.841)
RenegInvestment				-1.796+		-3.853***	-4.738***
				(1.147)		(1.378)	(1.664)
RenegQuality				10.510**		9.437***	11.272**
				(4.354)		(3.188)	(5.340)
RenegFinanEq				-12.275***		-16.307***	-23.132***
				(2.555)		(2.843)	(3.512)
RenegDuration				0.001		-0.544	0.816
				(0.396)		(0.907)	(0.873)
RenegIndex				-1.794		-2.164	-3.872
				(5.572)		(5.303)	(4.160)
Scope of Renegotiations							
Scope					0.143	0.455***	
					(0.100)	(0.149)	
OneDimension							-1.528**
							(0.761)
TwoDimensions							0.923
							(0.750)
ThreeDimensions							1.396*
							(0.771)
FourDimensions							2.407***
							(0.828)
FiveDimensions							0.020
							(0.508)
Control Variables							
PastExperiences	-0.275***	-0.290***	-0.305***	-0.160*	-0.254***	-0.208	-0.359***
	(0.090)	(0.094)	(0.080)	(0.094)	(0.077)	(0.145)	(0.112)
MultiContract	0.390***	0.398***	0.401***	0.291*	0.378***	0.311*	0.435***
	(0.140)	(0.131)	(0.129)	(0.154)	(0.142)	(0.187)	(0.161)
SameArea	0.097***	0.102***	0.106***	0.122***	0.097***	0.131***	0.157***
	(0.022)	(0.021)	(0.023)	(0.029)	(0.022)	(0.025)	(0.021)
ChangeOfMayor	-0.561**	-0.494***	-0.433	-0.473*	-0.527*	-0.523***	-0.792***
	(0.282)	(0.185)	(0.357)	(0.255)	(0.287)	(0.165)	(0.190)
Year	0.115	0.093	0.129	0.072	0.113	0.039	0.149
	(0.091)	(0.084)	(0.099)	(0.113)	(0.092)	(0.115)	(0.123)
Size	1.258	1.212	1.669	0.503	1.169	0.899	0.822
	(2.419)	(1.943)	(2.750)	(2.001)	(2.355)	(1.589)	(1.791)
Build	-0.368	-0.622	-0.327	-0.469	-0.298	-0.773**	-0.964**
	(0.529)	(0.512)	(0.498)	(0.534)	(0.519)	(0.394)	(0.407)
Duration	-0.007	-0.026	-0.002	-0.003	-0.011	-0.016	-0.009
	(0.020)	(0.026)	(0.019)	(0.018)	(0.020)	(0.023)	(0.030)
Cluster	yes	yes	yes	yes	yes	yes	yes
Intercept	-230.273	-187.135	-259.711	-145.296	-227.396	-80.427	-299.037
	(182.013)	(167.424)	(197.619)	(225.879)	(184.364)	(229.674)	(245.218)
r2	0.14	0.21	0.17	0.25	0.15	0.39	0.47
Predict	66	68.1	66	70	66	81.9	80.8
N	94	94	94	94	94	94	94

Level of significance: $^{+}$:15%, *:10%, **:5%, ***:1%.

2.5.2.2 Other relevant variables (concession contracts)

The variable *PastExperiences* impacts negatively on the likelihood of contract renewal. This result comes as a surprise since it lies in opposition with the argument of learning and mutual understandings developed through time. A possible explanation could be that public authorities are not willing to stay for too long with a same operator, in order to benefit from the advantage of competition and to avoid potential routines. Results concerning our variable *Built* come as a surprise as well. Contrary to one would have expected, the construction of the infrastructure does not seem to provide a competitive advantage to the incumbent (contrary to previous results such as the study of Zupan [1989]).[19]

On the contrary, our variables linked to future business and reputational concerns are more consistent with reasonable expectations. We observe that the variables *MultiContract* and *SameArea* have a positive and significant impact on the probability of contract renewal. Such findings can be analyzed through the lens of relational contracting. Indeed, it is legitimate to assume that a higher number of other on-going contracts with the same municipality as well as with neighbor municipalities makes the threat of ending relationships more penalizing. Cooperation and compliance to public authorities' expectations are more likely to occur in such a context. Hence, it is understandable to observe that those two variables are positively and significantly correlated with contract renewal.

As previously emphasized, we do not focus on political influence properly but we rather focus on the existence of a potential breach of the dialog between the public authority and the operator. Such a breach is more likely to occur when the mayor of the city changes. Indeed, we find that a change of mayor during the last year of the contract reduces the probability of its renewal as illustrated by the negative and significant coefficient associated with our variable *ChangeOfMayor*. This result could also be interpreted as an illustration of a relational dimension of

[19]This result may be driven by the small number of cases in the database. The majority of contracts including construction are still running.

contractual relationship.

Finally, concerning the variable *Size* which accounts to capture the level of competition, the results indicates a negative sign associated with this variable. Such an observation is perfectly consistent with the argument that contract renewal is less likely to occur when a competitor formulates a better offer. Nevertheless, this correlation, even if it is stable across regressions, does not appear significant, meaning that competition is not a main factor explaining concession contracts renewals.

All those control variables allow us to check the robustness of our results. Nevertheless, other variables concerning specific effects of cities or general evolution of the sector might be missing. As a consequence, the main variables of our models could be correlated with those unobserved characteristics and mistakenly appear to have an explanatory power. We take this bias into account in two different ways. First, to deal with general evolution in the car park sector that might influence the probability to be renewed (such as an increase of the competitive pressure), we include the variable *Year*. Second, in order to tackle the issue of municipalities' fixed effects, we cluster our dataset at the city level. As observed in table 2.2, the variables *Year* is not significant. As for data clustering, the regressions we ran without cities clustering lead to same results with a slight loss of significance.

We also check for our results' robustness by running a Principal Factor Analysis on the frequency of renegotiations and their types. The primary purpose is to group objects based on the characteristics they possess with respect to some predetermined selection criteria. Once the PFA is performed, the resulting groups should exhibit high internal (within-cluster) homogeneity and high external (between-cluster) heterogeneity. In our empirical settings, as contracts are subject to different types and different frequency of renegotiations, we identify groups of contract according to their renegotiations types and frequency. The PFA drives us to the identification of three classes of contract, classified according to the frequency of renegotiations they are concerned with. The first class contains the no or few renegotiated contracts, the third class brings together the most renegotiated contract and the second class regroups intermediary levels of renegotiations. When we in-

clude those classes in our probit estimates, we find that contracts which belong to the second class are more likely to be renewed than less renegotiated contracts and than most renegotiated contracts as well. Here again, such a result suggests that an optimal level of renegotiation frequency is required during the contract execution to generate the willingness of the parties to renew the contract. We do not make those additional estimates appear in Table 2.2 in order to avoid redundant findings.

2.5.3 Discretionary Power and Contractual Arrangements

The two previous subsections described how, through the spectrum of renegotiations, the quality of previous interactions and reputation can be taken into account to decide whether to renew a contract or not in concession. Thus, one could expect such an analysis to be duplicated to all public-private arrangements, and namely public procurement contracts that have been codified in our database as well. This is what we do in Table 2.3. Results do not hold anymore.

Nevertheless, as previously mentioned, one of the main differences between concession and public procurement is about the discretionary power the public authority has. This discretionary power is mostly expressed at the stage of the award procedure we detailed in subsection 2.3.1. In concession procedures, there is room for negotiation and previous experiences considerations, whereas public procurement procedures are much more rigid. Thus, unsurprisingly, the results that we reach regarding the frequency, the type and the scope of renegotiations in concession disappear by and large under public procurement. This is consistent with the statement of the Administrative Court of Paris, that sanctioned a public authority for disqualifying a competitor in the name of a bad past experience, and perfectly illustrates the fact that public authorities have very few discretionary power.

Nonetheless, the decisions taken by public authorities to renew a contract or not do not seem to be totally impervious to relational aspects and previous experiences. Indeed, some aspects play a role in the decision to re-award a contract to the same

operator: the variable *Celerity* is significant and is negatively correlated with the probability to be renewed; the same effect is found for *RenegFinanEq* and for the control variable *ChangeOfMayor*.[20] The explanations we find to understand why it is those three variables that have an explanatory power are the following. *Celerity* and *RenegFinanEq* rely on the same kind of possible explanation: as mentioned previously, public procurement contract are shorter term and more rigid contracts than concession. The tasks the private operator is in charge of are less complex and can generally be well defined, thus the bidders are predominantly selected on the basis of the price they propose to be awarded the market.[21] Consequently, proposing a low price can be a strategy from the operator to be awarded the contract, being confident in his capacity to renegotiate *ex post*. It is thus easy for the public authority to detect such an aggressive bidding strategy, which may explain the unwillingness to contract again with the same partner. As for *ChangeOfMayor*, it can rather be related to a strategy from the public authority. We remind that this variable is equal to 1 if there was a municipal election in year before the end of the expired contract, leading to a change of mayor. Thus, in order to differentiate himself from the incumbent, and to make his opposition visible, the new mayor may be prone to change the operator, whatever the quality of the new bid. This seems to indicate that discretionary power is not completely absent from public procurement procedures.

A negative and significant correlation between contract renewal and the size of the municipality also appears in Table 2.3. It indicates that the level of competition seems to impact on the probability to be renewed. In the case of concession contracts, which are longer and more complex contractual agreements, the size of the city matters but the cooperative adaptations through renegotiations appear as a

[20]Note that in the models associated with public procurement contracts, the variable *RenegTariff* disappeared. Indeed, in such contracts, the evolution of tariffs does not impact the revenue of the operator who is paid by the public authority a predetermined price. Thus, if tariffs change under public procurement, it is the decision of the public party, who does not have to write it in the contract, as it is a unilateral decision. So, there are no *RenegTariff* in our public procurement sub-sample. The variable *Built* disappears as well since there is no construction in the case of public procurement.

[21]This price has not to be confused with the fees charged to users.

more important factor to focus on. As for public procurement contracts, which are shorter and less complex contractual agreements, it is not surprising to observe that the competitive pressure plays a stronger role on contract renewals.

Table 2.3: Probit analysis of Public Procurement contracts renewals

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	Probit	Probit	Probit	Probit	Probit	Probit	Probit
				Dependant variable : ***Renewed***			
NoReneg	0.171	0.145	0.147	0.431	-0.147	0.450	1.219
	(0.393)	(0.368)	(0.462)	(0.515)	(0.493)	(0.753)	(1.845)
Celerity		-0.167***				-0.221***	-0.250***
		(0.051)				(0.080)	(0.075)
Last		0.033				0.074	0.105
		(0.104)				(0.113)	(0.130)
AverageReneg			-0.121			-0.105	-0.106
			(0.359)			(0.298)	(0.349)
$AverageReneg^2$			0.040			0.055**	0.050*
			(0.039)			(0.027)	(0.026)
Type of Renegotiations							
RenegInvestment				-0.301		-0.241	0.151
				(0.480)		(0.783)	(0.923)
RenegQuality				-0.043		-0.135	-0.100
				(0.566)		(0.464)	(0.536)
RenegFinanEq				-3.278***		-3.519***	-3.131***
				(0.614)		(0.573)	(0.531)
RenegDuration				-0.012		-0.212	-0.150
				(0.087)		(0.265)	(0.326)
Scope of Renegotiations							
Scope					-0.241+	0.107	
					(0.152)	(0.416)	
OneDimension							0.730
							(1.628)
TwoDimensions							0.398
							(1.843)
ThreeDimensions							-
							-
FourDimensions							-
							-
Control Variables							
PastExperiences	-0.220***	-0.243***	-0.220***	-0.281***	-0.240***	-0.314***	-0.317***
	(0.077)	(0.078)	(0.074)	(0.097)	(0.073)	(0.114)	(0.113)
MultiContract	0.254**	0.264***	0.252***	0.334**	0.262***	0.352***	0.356***
	(0.099)	(0.098)	(0.093)	(0.130)	(0.092)	(0.134)	(0.132)
SameArea	0.038**	0.042***	0.039**	0.061***	0.042**	0.069***	0.070***
	(0.017)	(0.016)	(0.017)	(0.021)	(0.018)	(0.021)	(0.020)
ChangeOfMayor	-0.592+	-0.599+	-0.599+	-0.485	-0.564	-0.542*	-0.576
	(0.411)	(0.376)	(0.381)	(0.349)	(0.408)	(0.321)	(0.402)
Year	0.136*	0.160**	0.141*	0.099	0.143**	0.139	0.167+
	(0.070)	(0.070)	(0.082)	(0.095)	(0.068)	(0.121)	(0.109)
Size	-4.147*	-3.633	-4.041*	-4.119+	-3.715+	-3.654	-4.460+
	(2.388)	(2.533)	(2.321)	(2.523)	(2.527)	(2.710)	(2.850)
Duration	-0.071+	-0.035	-0.068*	-0.089*	-0.058	-0.078	-0.058
	(0.047)	(0.056)	(0.041)	(0.049)	(0.047)	(0.089)	(0.093)
Cluster	yes	yes	yes	yes	yes	yes	yes
Intercept	-271.507*	-320.233**	-282.402*	-198.571	-284.605**	-276.890	-335.167+
	(139.972)	(140.316)	(164.799)	(190.148)	(136.342)	(241.799)	(217.351)
r^2	0.11	0.12	0.12	0.17	0.12	0.2	0.21
Predict	80.4	77.8	79.7	81.9	80.4	79	80.1
N	158	158	158	158	158	158	158

Level of significance: $^{+}$:15%, *:10%, **:5%, ***:1%.

2.5.4 Alternative stories

One question that is not directly addressed in the paper is whether the willingness of the contracting parties to renew a contract is the result of the contractual surplus generated by the relationship or is driven by something else. For example, one might think that it might reflect corruption effect or collusion effect. Those both phenomena correspond to situation where the public and the private partners benefit from a situation, but users loose. Thus, these two possibilities should be excluded to conclude that contract adaptations in the car park sector benefit to all the parties at stake (the public authority, the private partner and users). Such possibilities deserve discussions, since we indeed do not have any performance measure of the contract nor any users' satisfactory index. The public authorities are implicitly assumed to be benevolent and this is one limit of our paper.
If it was corruption instead of legitimate discretionary power valorizing cooperative renegotiations that explained contract renewals, we should observe that the more frequent renegotiations are, the more corrupt the public authority, the more willing both parties are to renew a contract. In this case, we would expect that the contractual relationship between the private operator and the public authority would be stable over time, and contracts would be renewed constantly. Furthermore, we would expect public authorities to be indifferent to tariff increases. Then, more frequent renegotiations concerning tariffs should not prevent from contract renewals. Our results go the other side. Notably, although the variable *RenegTariffs* is not always significant, the negative correlation between tariffs renegotiations and the variable Renewed suggests that contracts with renegotiations dealing with price evolution have lower probability of renewal, which seems to suit the benevolence assumption. Although this alternative corruption story deserves to be studied in further details in some future works, these preliminary results provide support for the intuition according to which discretionary power and contract renewals differ from corruption, at least in this dataset. Future investigations should address the conditions under which they differ.

One might also think that users do not benefit from renewal to a same private operator, if there is collusion between the different private operators present in the market. In this case, the public authority also suffers from this situation, since she generally cannot detect and provide evidence for such collusion. Given what this dataset allows to analyze, had there been collusion between bidders, we would observe that there is a concentrated and stable number of bidders. This would enable an easier implementation of the collusive arrangement, and thus, the rate of renewal of the private operator would be high. However, once again, the data do not confirm this intuition. Even if we unfortunately do not have the number of bidders per call for tenders, we know that in spite of numerous firm mergers, the number of national private operators present on the car park market has increased for the past ten years and that local operators are also more and more numerous (Baffray and Gattet [2009]). This increasing number of actors must make the possibility of collusive agreements more hardly sustainable. Moreover, we learn from interviews with managers in this sector that there are on average 5 bidders per call for tenders, which is very high compared to other sectors.[22]. The rate of renewal of the private operator in this study data is relatively low (less than 50% for concession contracts), compared to other sectors, and typically in urban public transport where the rate of incumbent renewal is around 90% in France (Amaral et al. [2008]), as well as in the water sector (Guérin-Schneider and Lorrain [2003]). These empirical evidence seem to allow to conclude that, at least in the car park sector, users do not suffer from corruption or collusive behaviors.

[22]For instance, the average number of bidders in the French urban public transport sector is 1.4, and in 65% of cases, there is only one bidder (GART [2005]), and in the French water sector, there are on average 2.2 bidders per call for tenders (Guérin-Schneider and Lorrain [2003])

2.6 Conclusion and Public Policy Implications

In this paper, we tried to provide some new insights on the issue of renegotiations that have been generally analyzed through the lens of opportunism. Using an original data-set of 252 expired contracts in the car park sector, we assess the impact of renegotiation on the pursuit or not of contractual relationships. Indeed, renewing a contract can reasonably be interpreted as the fact that the previous one was satisfying for both partners. In our concession sample, we find it is necessary to distinguish the types of renegotiations to evaluate their impact on renewal. In addition, we find a non-linear effect concerning the frequency of renegotiation on the probability to renew a contract. This effect also seems to be confirmed by the scope of renegotiations. These are very innovative results, since we went over the step of looking only at the occurrence of renegotiations or not, and we paid particular attention to the effects of targeted features of renegotiations on the likelihood of contractual renewal. To the best of our knowledge, the only results that existed up to now came from summary statistics (Guasch [2004]), but with no econometric treatment. In some way however, we approve Guasch's work concerning the celerity of renegotiations: the quicker the renegotiation after the signature, the lower the probability to renew the contract. This could be interpreted as a sign of aggressive bidding. However, in spite of the originality of our empirical study, a main concern about the paper is the potential presence of reverse causality. One could easily argue that the party has already decided to renew the contractor and that drives some of the renegotiations that we observe and not others. Although this timing does not correspond to what is legally foreseen by the law, it cannot be completely excluded. Consequently, most of the coefficients must be interpreted as correlation. Further extensions have to be made in order to try to find *ad hoc* instrument in order to tackle the endogeneity issue of renegotiation frequency (an attempt of assessing this endogeneity issue is provided in appendix). Nonetheless, there is not much evidence out there on the issue of renegotiations and contract renewals in PPPs and we believe our work is a first step in this under-studied field

of research. Some future work could also insist on the origin of the renegotiation. In our case, detecting for certain who asked for the renegotiation, between the public authority and the private operator, was impossible to do when reading the contracts and the amendments. Knowing if the same party is always at the origin of the renegotiation would enable to better understand why a party would feel prejudiced during the contract execution. A lot has still to be done to distinguish opportunistic and cooperative behavior in contractual renegotiations.

Ultimately, more than providing empirical results for the theoretically unclosed debate about the opportunity of renegotiation, some public policy implications could be derived from our paper. In fact, most of our results do not hold anymore when we investigate public procurements that involve more rigid procedures. This last result highlights the importance of the role of the discretionary power of public authorities. We also provide some explanations in order to distinguish discretionary power from corruption. But some future investigation should be launched to access the content of the alternative bids which did not win the call for tenders. This would help to understand the choice of public authorities. Unfortunately, this information was not available for this dataset. Nevertheless, at a period where the European Union tries to set up a legal framework for public-private partnerships of its member states, we could recommend not to categorically reject the possibility for public authorities to use their discretionary power. Our paper also conducts to accept renegotiations as necessary adaptation processes that are punished when they lead to unbalanced results between the parties.

2.7 Appendix

2.7.1 Endogeneity issue: a first attempt

As previously said, although we argued that some features of renegotiations have an impact on the probability for the municipality to renew the same operator, it is impossible for us to completely exclude the existence of a reverse causality (i.e. the decision to renew have an influence on the way contracts are renegotiated). Moreover, endogeneity may come from non-observed, omitted characteristics of the sector and/or the municipalities. Thus, in this section, we attempt to mitigate econometric problem caused by endogeneity. As well known by now, the textbook solution to endogeneity is to implement some type of instrumental variables (IV) estimation procedure. Once potential endogenous variables are identified, the standard procedure requires to find, in addition to the variables already used in the previous estimations, some appropriate instrumental variables that are correlated with the endogenous regressor but uncorrelated with the error in the structural equation. In this paper, as a first attempt, we will only try to endogenize the average number of renegotiations (*AverageReneg*).

2.7.1.1 Instrumental Variables

To instrument our variable *AverageReneg*, we use two variables accounting for reasons that can initially motivate the renegotiations during the contract lifetime but not the renewal decision of the public authority.
The first instrumental variable we propose is the political color of the municipality at the date of signature (*PoliticalColor*). We argued in Section 2.5.2.2 that the political color of the public authority at the date of expiration was not suitable to explain contract renewals, and we proposed a relational variable instead (*ChangeOfMayor*). However, we consider as relevant to use the political color of

the mayor at the date of signature of each contract i as a proxy of the confidence or mistrust toward private participation for the delivery of a public service. Indeed, left-hand wing politicians may have an higher mistrust toward private participation than right-hand wing mayors. Hence, it can explain a preference for more flexible or more rigid contractual specification and, *de facto*, it can explain the average number of renegotiations. Our variable *PoliticalColor* is ordered from 1 to 5, encompassing the extreme left (1) until the extreme right (5).[23] We expect to right-wing inclined municipalities to be more prone to renegotiate and, hence, to observe a positive coefficients associated with the variable *PoliticalColor*.
The second variable we use is the experience of the municipality in terms of outsourcing of public services. For each city, we calculate the difference between the date of signature of each contract i and the date of signature of their first outsourcing of car park services. Hence, our variable *ContractExperience* claims to be a proxy of the municipalities' know-how in crafting more sophisticated contractual agreements, less prone to renegotiations. In our sample, there are novice as well as highly experimented municipalities.[24] Associated with this variable: we expect that more experienced public authorities are less prone to renegotiate their contracts.

2.7.1.2 Results

Table 2.4 provides the results of our IV probit estimates. In the case of concession contracts, we observe that our variable *ContractExperience* is a good instrument. In fact, there is a negative and significant correlation between this variable and the average number of renegotiations meaning that more experimented municipalities are less likely to appeal for renegotiations. On the contrary, the political color at the date of signature does not directly impact on the number of renegotiations

[23] 1 = extreme left-wing ; 2 = left-wing ; 3 = centre ; 4 = right-wing ; 5 = extreme right-wing. Apolitical municipalities are coded as centre.
[24] *ContractExperience* is distributed from 0 to 39, the mean is equal to 14.1 years and the standard deviation is equal to 11.3 years.

(the coefficient associated with the variable *PoliticalColor* is not significant). The other results of the first stage estimates of concession contracts suggest that the duration (*Duration*), the fact that the operator had to build the car parks (*Build*) and the scope of the renegotiations (*Scope*) has a significant impact on the average number of renegotiations. More precisely, the average number of renegotiations is all the higher than the tasks outsourced to the operator include the construction of the park and than the contract is renegotiated in several dimensions. On the contrary, this average number of renegotiations is lower when the duration of the contract is long. Moreover, all the control variables we use for the estimates of contract renewal are not influencing the average number of renegotiations (*PastExperiences*, *MultiContract*, *SameArea*, *ChangeOfMayor*, *Year*, *Size*). Turning now to the second stage of the estimates, we obtain a positive and significant correlation between our variable *Renewed* and our instrumented variable *AverageReneg*. Such a result is consistent with what we find previously (section 2.5.2.1). We also observe that, in spite of a slight loss in significance, other independent variables have the same effect than in probit estimates that make no correction for endogeneity. *PaxtEsperiences* and *ChangeOfMayor* negatively impact on contract renewal while *SameArea* and *MultiContract* positively do.

Concerning public procurement contracts, we fail to identify good instruments. Neither our variable *PoliticalColor* nor our variable *ContractExperience* has an impact on the average number of renegotiations of public procurement contracts. The second stage of our estimates reveals a negative and significant sign associated with the instrumented variable *AverageReneg*. This result can be interpreted as follows: public procurements contracts, which are less complex, are less likely to appeal for renegotiations. Hence, contract renegotiations can be analyzed through opportunism and, *de facto*, implies a lower probability to be renewed for the private operator. Nonetheless, we cannot draw any conclusions from this second stage estimations since we poorly instrument the variable *AverageReneg* in the case of public procurement contracts. The only results that seems to fit we what we find previously is the negative and significant impact of the variable *Size* (our proxy for

the competition level) on both the average number of renegotiations and the probability of contract renewal. It confirms, in a way, that the competitive pressure plays a role of first importance in public procurement. Further researches need to deeply investigate the differentiate role played by competition between concession and public procurement contracts.

Table 2.4: IV-probit Analysis

	First Stage		**Second Stage**	
	Dependant variable = *AverageReneg*		Dependant variable = *Renewed*	
	Concession	Public Procurement	Concession	Public Procurement
AverageReneg	-	-	2.411***	-1.272***
	-	-	(0.675)	(0.213)
Scope	0.135***	0.540***	-0.184	0.664***
	(0.019)	(0.107)	(0.153)	(0.084)
PastExperiences	-0.000	-0.061*	-0.128+	-0.102+
	(0.011)	(0.032)	(0.087)	(0.065)
MultiContract	0.010	0.111*	0.219**	0.183**
	(0.014)	(0.059)	(0.093)	(0.086)
SameArea	-0.007	-0.007	0.063**	-0.006
	(0.005)	(0.012)	(0.027)	(0.016)
ChangeOfMayor	0.021	0.202	-0.363**	0.242
	(0.076)	(0.175)	(0.173)	(0.224)
Year	-0.018	-0.064**	0.102	-0.062
	(0.013)	(0.032)	(0.083)	(0.048)
Size	0.299	-1.968*	0.669	-2.403*
	(0.365)	(1.099)	(1.474)	(1.377)
Build	0.194*	-	-0.513	-
	(0.107)	-	(0.436)	-
Duration	-0.019***	-0.133***	0.045+	-0.171***
	(0.005)	(0.041)	(0.030)	(0.035)
Instrument				
ContractExperience	-0.012***	0.005	-	-
	(0.004)	(0.009)	-	-
PoliticalColor	0.002	0.004	-	-
	(0.020)	(0.008)	-	-
Intercept	36.508	128.880**	-205.333	124.738
	(26.964)	(64.411)	(165.819)	(95.659)
Athrho	-	-	-1.204**	3.043+
	-	-	(0.526)	(2.011)
Lnsigma	-	-	-1.241***	-0.254+
	-	-	(0.120)	(0.163)
r^2	0.51	0.29	-	-
Predict	-	-	59.6	61.1
N	94	158	94	158

Level of significance: $^{+}$:15%, *:10%, **:5%, ***:1%.

2.7.2 Figures and tables

Figure 2.1: Optimal level of Renegotiations

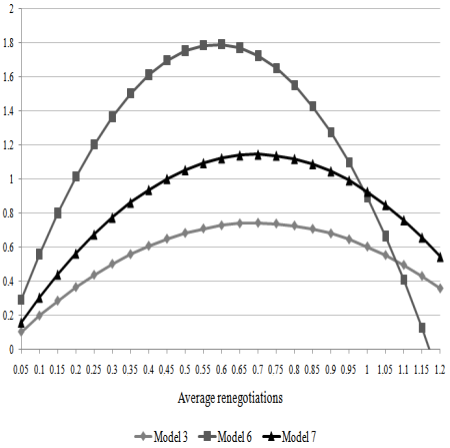


Table 2.5: Variables : descriptives statistics

	Concession					Public Procurement				
Variables	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Renewed	94	0.44	0.50	0	1	158	0.78	0.41	0	1
NoReneg	94	0.26	0.44	0	1	158	0.67	0.47	0	1
Celerity	94	3.83	4.95	0	30	158	0.61	1.31	0	12
Last	94	8.20	8.69	0	34	158	0.75	1.69	0	13
AverageReneg	94	0.38	0.41	0	2.50	158	0.45	0.91	0	8
$AverageReneg^2$	9	0.31	0.74	0	6.25	158	1.05	5.39	0	64
RenegTariff	94	0.05	0.15	0	1	.	.	.	.	.
RenegInvestment	94	0.08	0.20	0	1	158	0.05	0.21	0	2
RenegQuality	94	0.04	0.09	0	0.40	158	0.05	0.25	0	2
RenegFinanEq	94	0.01	0.04	0	0.22	158	0.02	0.11	0	1
RenegDuration	94	0.14	0.23	0	1.33	158	0.20	0.78	0	8
RenegIndex	94	0.02	0.05	0	0.20	.	.	.	.	.
Scope	94	1.54	1.54	0	5	158	0.45	0.87	0	4
OneDimension	94	0.29	0.46	0	1	158	0.20	0.40	0	1
TwoDimensions	94	0.16	0.36	0	1	158	0.04	0.19	0	1
ThreeDimensions	94	0.07	0.26	0	1	158	0.04	0.19	0	1
FourDimensions	94	0.09	0.29	0	1	158	0.02	0.13	0	1
FiveDimensions	94	0.06	0.24	0	1	158	0	0	0	0
PastRenewal	94	0.05	0.22	0	1	158	0	0	0	0
PastExperiences	94	2.02	2.26	0	11	158	2.66	3.28	0	14
MultiContract	94	1.67	1.91	0	10	158	1.65	2.43	0	10
SameArea	94	4.97	5.57	0	19	158	4.98	5.25	0	19
ChangeOfMayor	94	0.21	0.41	0	1	158	0.11	0.31	0	1
Year	94	2004.26	2.40	1996	2008	158	2005.26	2.05	1999	2008
Size	94	95797	119490	3387	845420	158	51839	52561	516	283288
Build	94	0.17	0.37	0	1	.	.	.	.	.
Duration	94	15	10.87	0.50	40	158	2.30	2.17	0.08	13
ContractExperience	94	18.55	10.51	0	37	158	12.40	11.05	0	39
PoliticalColor	94	3.2	1.10	1	4	158	3.22	1	1	5

Table 2.6: Correlations

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. *Renewed*											
2. *NoReneg*	0.135										
3. *Celerity*	-0.269	-0.308									
4. *Last*	-0.131	-0.328	0.311								
5. *AverageReneg*	0.029	-0.444	-0.014	-0.063							
6. $\mathbf{AverageReneg}^2$	0.047	-0.171	-0.052	-0.063	0.837						
7. *RenegTariffs*	-0.019	-0.212	0.068	0.014	0.316	0.146					
8. *RenegInvestment*	-0.061	-0.316	0.057	0.036	0.326	0.103	0.566				
9. *RenegQuality*	0.021	-0.252	0.046	-0.013	0.351	0.163	0.595	0.433			
10. *RenegFinanEq*	-0.097	-0.160	0.062	-0.002	0.060	-0.006	-0.007	0.061	0.019		
11. *RenegDuration*	-0.002	-0.292	-0.068	-0.070	0.728	0.812	0.150	0.128	0.099	0.058	
12. *RenegIndex*	0.130	-0.266	-0.056	-0.070	0.274	0.082	-0.035	0.088	-0.016	0.005	-0.018
13. *Scope*	-0.119	-0.692	0.484	0.313	0.302	0.086	0.386	0.510	0.348	0.218	0.145
14. *PastExperiences*	-0.043	0.053	-0.098	0.002	-0.078	-0.052	-0.086	-0.084	-0.065	-0.039	-0.061
15. *MultiContract*	-0.035	-0.027	0.010	0.085	0.004	0.006	-0.063	-0.037	-0.034	-0.029	-0.009
16. *SameArea*	0.145	0.096	-0.086	-0.103	-0.015	-0.013	0.126	0.008	0.016	0.121	0.014
17. *ChangeOfMayor*	-0.188	-0.128	0.167	0.051	0.060	0.033	0.068	0.080	-0.032	-0.037	0.000
18. *Year*	0.143	0.016	-0.070	-0.016	-0.116	-0.107	-0.159	-0.099	-0.062	0.015	-0.082
19. *Size*	-0.152	-0.139	0.164	0.235	-0.044	-0.054	-0.049	-0.007	-0.019	-0.025	-0.023
20. *Build*	-0.192	-0.075	0.199	0.510	-0.104	-0.046	-0.047	-0.039	-0.049	-0.025	-0.065
21. *Duration*	-0.325	-0.219	0.568	0.752	-0.163	-0.102	-0.021	-0.018	-0.054	0.003	-0.136
22. *ContractExperience*	-0.305	-0.186	0.229	0.306	-0.057	-0.041	-0.009	0.004	-0.037	-0.001	-0.057
23. *PoliticalColor*	0.016	-0.026	0.045	-0.085	-0.002	0.017	0.044	0.041	-0.043	0.065	0.071

	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.
13. *Scope*	-0.015										
14. *PastExperiences*	0.013	-0.138									
15. *MultiContract*	-0.012	-0.043	0.872								
16. *SameArea*	-0.108	-0.072	-0.041	-0.175							
17. *ChangeOfMayor*	-0.035	0.126	-0.094	-0.076	0.051						
18. *Year*	0.134	-0.072	0.202	0.035	-0.084	-0.147					
19. *Size*	-0.032	0.111	0.420	0.498	-0.210	0.082	-0.034				
20. *Build*	-0.064	0.106	0.032	0.055	-0.038	0.079	0.021	0.235			
21. *Duration*	-0.119	0.311	-0.046	0.044	-0.122	0.199	-0.034	0.271	0.671		
22. *ContractExperience*	-0.043	0.204	0.615	0.689	-0.245	0.079	0.065	0.615	0.320	0.385	
23. *PoliticalColor*	-0.057	0.059	0.094	0.090	0.130	-0.094	-0.037	-0.022	-0.006	-0.050	0.084

Table 2.7: Variables : definitions

Variables	**Definitions**
Renewed	dummy variable equal to 1 if the expired contract was followed by a renewal
NoReneg	dummy variable equal to 1 if the expired contract was not renegotiated
Celerity	time lag between the signature of the contract and the first renegotiation, divided by the duration
Last	time lag between the expiration of the contract and the last renegotiation, divided by the duration
AverageReneg	number of renegotiations per year
$AverageReneg^2$	square of the number of renegotiations per year
RenegTariff	number of renegotiations per year dealing with a change in tariffs
RenegInvestment	number of renegotiations per year dealing with a new investment
RenegQuality	number of renegotiations per year dealing with a quality improvement
RenegFinanEq	number of renegotiations per year dealing with a change in the financial equilibrium
RenegDuration	number of renegotiations per year dealing with a change in the contract duration
RenegIndex	number of renegotiations per year dealing with a change in the indexation clause
Scope	number of dimensions renegotiated during the contract
OneDimension	dummy equal to 1 if the contract was renegotiated in one dimension
TwoDimensions	dummy equal to 1 if the contract was renegotiated in two dimensions
ThreeDimensions	dummy equal to 1 if the contract was renegotiated in three dimensions
FourDimensions	dummy equal to 1 if the contract was renegotiated in four dimensions
FiveDimensions	dummy equal to 1 if the contract was renegotiated in five dimensions
PastExperiences	number of other expired contracts the private operator and the public authority had together at the date of expiration
MultiContract	number of other contracts the private operator and the public authority currently have together at the date of expiration
SameArea	number of other public authorities in the same region with wich the operator has contracts at the date of expiration
ChangeOfMayor	dummy variable equal to 1 if there was a change of mayor during the last year before the end of the contract
Year	year of expiration of the contract
Size	number of inhabitants of the municipality at the date of expiration
Build	dummy variable equal to 1 if the construction of the infrastructure was included in the contract
Duration	duration of the contract
ContractExperience	difference between the date of signature of each contract i and the date of the first outsourcing of car park services by the municipality
PoliticalColor	political color of the mayor at the date of signature

Part II

The Dynamics of Contractual Incompleteness

Chapter 3

Reputation and the Dynamics of Contractual Incompleteness*

3.1 Introduction

Observed contracts are rarely complete in the Arrow Debreu sense. Parties intentionally sign incomplete agreements, mainly because writing complete formal agreements is costly, especially when a transaction is complex and many unforeseen events may arise. Then, there is a trade-off between these costs and the gains to avoid contractual incompleteness and potential *ex post* opportunism (Crocker and Reynolds [1993], Battigalli and Maggi [2008]). In this paper, we would like to investigate what happens to this trade-off when parties trade repeatedly (with an infinite horizon): Does repeated contracting diminish the fears of hold up in renegotiations, making a less complete (and a less costly) agreement more attrac-

*This chapter is based on a joint work with Claudine Desrieux. A simplified version of this paper was published in *Economics Bulletin* (Desrieux and Beuve [2011b]). We gratefully acknowledge Jean Tirole, Robert Gibbons, Giorgio Zanarone, Bentley MacLeod and participants of the 2010 International School of New Institutional Economics in Berkeley, the 2009 International Conference "Contracts, Procurement, and Public-Private Arrangements" in Paris, the 2009 Congrès de l'Association Française de Sciences Economiques in Nanterre, the 2009 Ecore Conference on Market Evolution and Public Decision in Brussels, the 2009 European Law and Economics Association Conference in Rome and the 2008 International Industrial Organization Conference in Boston for their helpful comments and criticisms.

tive? How does the impact of past interactions determine the willingness to draft complete agreements?

Empirical studies provide ambiguous answers. In the offshore drilling industry, Corts and Singh [2004] find that oil and gas companies are less likely to write complete agreements as the frequency of their interaction with a driller increases. Gulati [1995] studies the governance structures in interfirm alliances and finds that repeated alliances between partners are less likely than other alliances to be organized using formal equity-based contracts. Close interactions between firms over prolonged periods leads to increased trust making details equity-based contracts unnecessary. More recently, Kalnins and Mayer [2004] show that repeated contracting at a U.S. information technology services firm leads on average to less use of fixed price contracts (that are rather considered as *complete* agreements), although the effects of repeated contracting varies across client firms and sometimes leads to more use of fixed-price contracts. However, focusing on the Air Force engine procurement contracts, Crocker and Reynolds [1993] report that contracts become more and more complete over time.

These various empirical results seem to suggest that the degree of contractual incompleteness evolves over time when two partners trade repeatedly, but there is no general rule, as parties may turn to more complete or incomplete agreements. We propose here to explain the evolution of contractual (in)completeness with a model showing that this evolution depends on the ability to sustain relational contracts in a dynamic setting. Relational contracts are informal commitments governing non-contractible actions and sustained by the value of future transactions (Bull [1987]; Baker et al. [2002]). When the discounted payoff stream from commitment to this informal agreement is higher than the discounted payoff stream from deviation, a relational contract is sustainable and allows to avoid *ex post* opportunism. Our model shows that in this situation, there is no need to make formal contracts as complete as possible, so that investment in contractual completeness should be lower. However, such a strategy implies to know whether a relational

contract can be sustained or not, *i.e.* whether the parties pay enough attention to the future of their relationship to be able to commit on informal agreements. The rate at which the parties discount the future payoffs indicates how they value future business: the higher this discount rate, the more they value future business, and then, the more able they are to sustain relational contracts.
In this paper, we explore two scenarii: *(i) symmetric information:* the parties know whether a relational contract is sustainable or not because the information about their discount rates is symmetric, *(ii) asymmetric information:* the parties do not know whether a relational contract can be sustained, because the value of the discount rate is private information.

Our results show that when the information is symmetric, the parties may save on the *ex ante* costs to write a complete contract. On the other hand, when the information about the sustainability of a relational contract is asymmetric, we show that this information can be acquired over time by observing the behavior of the co-contractor. The revelation of information determines the amount of *ex ante* costs spent to make a contract as complete as possible.

To address these issues, we propose to study a buyer/seller relationship in a dynamic framework. The buyer asks the seller to perform a task, and the seller executes the contract according to the buyer's specification. However, the contractual design may reveal to be inappropriate during its execution, and some additional costs are required to perform the tasks. This leads to the renegotiation of the contract, because of its incompleteness, and the seller may hold up the buyer during this renegotiation.
Before signing the initial contract, the buyer may exert some effort (cost) to find out what could go wrong and how to draft the contract accordingly. The more cost are spent *ex ante*, the more complete the contractual design is. This reduces the probability that the contract reveals to be incomplete *ex post*, and then the probability to be held up. The buyer can do this because a contingency is foreseeable (perhaps at a prohibitively high cost), but not necessarily foreseen. It is more

likely to be foreseen if some *ex ante* efforts are made to learn about future states of the world. In our model, the buyer decides the level of *ex ante* contracting costs in completeness (at the first stage of each period) and the renewal (or not) of the contract (at the last stage of each period). As for the seller, he decides to hold up or not in case of renegotiation due to contractual incompleteness. The result shows that the level of *ex ante* contracting costs to complete the formal contract depends on the ability of the seller to sustain a relational contract.

Our paper can be related to the literature on contractual incompleteness.[25] Many papers take contractual incompleteness for granted and assume contractual incompleteness for exogenous reasons: bounded rationality (Williamson [1975, 1985]) or because the cost to make everything verifiable is too high (Hart [1995]). Some other papers try to explain endogenous contractual incompleteness. Parties voluntarily sign incomplete contracts by assessing the cost to write complete agreements and the benefits to avoid *ex post* opportunism. Shavell [1984] shows that when the *ex ante* cost of negotiating breach terms is greater than the benefit, parties prefer to leave the contract incomplete and delegate the damage decision to the court. Anderlini and Felli [1994] provide a theory of contract incompleteness based upon the computational cost of describing an event. Related to this work, Battigalli and Maggi [2002] discuss how contract complexity affect the choice of contract terms - whether they are rigid or flexible.

More recently, some contributions have tried to account for contractual incompleteness by formalizing bounded rationality. For instance, in Tirole [2009], parties have to spend *ex ante* costs to learn about future contingencies.[26] The theoretical framework of our paper is inspired by Tirole [2009]: contractual incompleteness

[25] For a more general description of the literature on incomplete contracts, see Kornhauser and MacLeod [2010].

[26] Another contribution dealing with bounded rationality and contractual incompleteness is Bolton and Faure-Grimaud [2010]. The authors propose a model of equilibrium contracting between two agents who face time costs of deliberating current and future transactions. They show that equilibrium contracts may be incomplete and assign control rights: they may leave some enforceable future transactions unspecified and instead specify which agent has the right to decide these transactions.

is determined by the amount of resources ("transaction costs" in Tirole's paper) that are expended *ex ante* to identify the appropriate contractual design.[27] We derive the same proposition about the over-investment in contractual completeness under a static framework. However, the main concern of Tirole [2009] is to determine the factors (*ex ante* competition, *ex post* bargaining power, contract length) that drive equilibrium transaction costs. He suggests that relational contracting could also be one of these factors (Tirole [2009], p.283) but does not provide the dynamic model that allows to explore such a causality. To our knowledge, our model is the first contribution showing that contractual incompleteness is determined by the sustainability of relational contracts. Only Bernheim and Whinston [1998] have explored the links between incomplete contracts and relational contracts. They regard contractual incompleteness as a cause and not a consequence of relational contracts, since punishment strategies allowing a relational contract to be sustainable can be more easily elaborated when contracts are incomplete. Our contribution is to formally show the reverse causality: incomplete contracts are not a cause but a consequence of relational contracts.

Last, our paper is also related to the literature on relational contracting. This literature investigates the emergence of informal contracting when formal contracting may yield to suboptimal outcomes (Macaulay [1963]; Bull [1987]; Baker et al. [1994, 2002, 2008]). These papers focus on the consequences of the concern for reputation, while some other papers deal with how reputation builds over time (Watson [1999, 2002]; Halac [2011b]). The evolution of agency relationship is also under study in Halac [2011a]: this paper analyzes optimal relational contracts when the value of the outside option of the parties is their private information, which means that the value of the relationship between contracting parties is not commonly known. Information is revealed over time through default of the parties. In our paper, we inspire from this revelation mechanism, by showing how the decision to renege or not allows to learn about the private information of the co-contractor. This determines the level of costs spent to complete the contract

[27] In other words, contractual incompleteness is measured by the probability that the design specified in the contract needs to be altered *ex post*.

at the subsequent periods.

The rest of the paper is organized as follows. Section 2 describes our theoretical framework. In section 3, we describe the result under a static framework. Section 4 describes the dynamic game. In section 5, we show how relational contracting leads to contractual incompleteness in a dynamic framework under symmetric information. Section 6 explores the case for asymmetric information. Section 7 concludes.

3.2 The theoretical framework

3.2.1 Agents and contractual design

We consider an infinite repeated bilateral contractual relationship between a buyer (B, whom we refer as "he") and a seller (S, whom we refer as "she"). The buyer wishes a project or a service, and asks the seller to perform the work according to his specifications, *i.e.* according to the contractual design. The value of the project is K^+ for the buyer and the seller executes the contract at cost c.[28] The contract is a cost-plus contract[29], so that the seller is paid a price $P = c + F$ where F (> 0) is the additional compensation beyond the reimbursement of the cost.

As in Bajari and Tadelis [2001], we focus here on problems of *ex post* adaptations in a context where the level of contractual incompleteness is endogenously determined. More precisely, we consider that both parties share uncertainty about contingencies that may arise once the contract is signed and the production begins.[30] Then, during the execution of the contract, some adaptations may be needed to reach K^+ because the contractual design proved to be inappropriate. In

[28] Both K^+ and c are common knowledge.

[29] The contract could as well be a fixed price contract, allowing the seller to make a profit. We focus on cost-plus contract so that the level of the mark-up is more explicit.

[30] The seller has no private information about the occurrence of unforeseen contingencies that could arise. See Bajari and Tadelis [2001] to justify this concern for *ex post* adaptation in public procurement. An illustration of such *ex post* adaptation can also be found in MacLeod and Chakravarty [2009] about the construction of the Getty museum in Los Angeles.

this situation, the contract is said to be incomplete because some actions to reach K^+ were not foreseen *ex ante*. The parties have then to renegotiate the contract.

3.2.2 Contingencies

Before proposing the contract, B may perform some costly non-observable efforts to learn about future contingencies, which allows him to propose a more or less appropriate contractual design. As in Tirole [2009], these additional costly efforts incurred before the signature of the contract allow the buyer to determine *ex ante* what may go wrong *ex post* and to draft the contract accordingly. Then, those costs determine the level of (in)completeness.
We denote $k(\in [0;1[)$ the intensity of the effort made by the buyer (at each period) to learn about future contingencies.[31] The higher the intensity of the effort, the more complete the proposed contract will be.[32] Then, by investing $k \in [0;1[$:

- **With probability** $\rho(k)$, the proposed design (called design A) is the appropriate design. Then, the contract is considered as "complete", because everything happens as foreseen *ex ante*. The contract delivers utility K^+ for B and costs the seller c to produce ($K^+ > c > 0$). As a consequence, the utility of the buyer is $V = K^+ - P$, and that of the seller is $U = P - c = F$. Hence, the total surplus is $K^+ - c$.

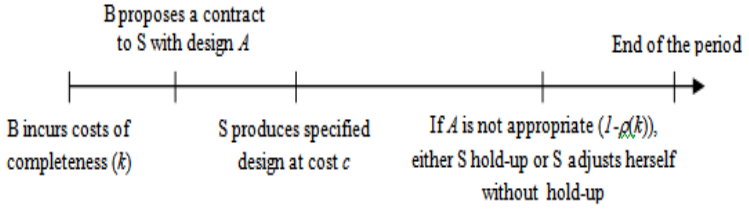
- But, **with probability** $1-\rho(k)$, the design is inappropriate and only delivers K^-, with $K^- = K^+ - \Delta$ where $\Delta > 0$. In this case, we consider the contract as incomplete because unforeseen contingencies prevent from reaching K^+, and parties need to renegotiate their agreement. Indeed, some other, initially unknown, design A' delivers utility K^+ to B. Converting A into A' implies contract's modifications, that cost "a" to B. We assume that these costs are

[31] Since only the buyer may suffer from hold-up in our setting, he is the only party to invest to make the contract more complete.
[32] We speak interchangeably of k as an effort or an investment in contractual completeness.

distributed over $[\underline{a}, \overline{a}]$ with $(0 < \underline{a} < \overline{a} < \Delta)$ according to a probability density function $z(a)$, and the average value of a is denoted $\tilde{a}$. The buyer knows this distribution.[33] Then, net gains from renegotiations are $\Delta - a$.[34] Moreover, the seller can decide to hold-up the buyer during the renegotiation process, *i.e.* she grabs a part h of the net gains of renegotiation. We assume that the seller has an *ex post* bargaining power $\sigma \in [0, 1]$, so that $h = \sigma(\Delta - a)$. As a consequence, the level of hold-up is distributed over $[\underline{h}, \overline{h}]$ (with $0 < \underline{h} < \overline{h} \leq (\Delta - \underline{a})$) according to the same probability distribution as a.

The function $\rho(k)$ is smooth, increasing, concave, and defined on $[0, 1[$ so that $\rho(0) = 0$, $\rho'(0) = 0$, $\rho'(k) > 0$, $\rho''(k) < 0$, $\lim_{k \to 1} \rho(k) = 1$.

Figure 3.1: Timing of the game for one contractual period



3.2.3 First-Best level of investments in contractual completeness

Let us determine here the optimal level of investments in contractual completeness k^* that maximizes the total surplus.

$$k^* = \arg\max_k [\rho(k)(K^+ - c) + (1 - \rho(k))(K^+ - c - \tilde{a}) - k] \Leftrightarrow \rho'(k^*) = \frac{1}{\tilde{a}} \quad (3.1)$$

The optimal investment is that $\tilde{a}\rho'(k^*) = 1$: the marginal benefit of the investment equals its marginal expected cost.

[33] We can assume that the seller also knows this distribution, even if it has no consequence, since she does not bear the cost of these costs of *ex post* adaptation.

[34] We assume that trade is efficient, i.e. $\forall k, a; K^+ - c - (1 - \rho(k))a > 0$.

3.3 The static game

Let us first suppose that B and S meet only once. Using backward induction, we can easily see that whenever *ex post* adaptations are needed, S decides to hold-up B. Then, the expected payoff of B is $E(V^{NE}) = K^+ - P - (1-\rho(k))(\tilde{a}+\tilde{h}) - k$.[35]

$$k^{NE} = \arg\max_k [E(V^{NE})] \Leftrightarrow \rho'(k^{NE}) = \frac{1}{\tilde{a}+\tilde{h}} \tag{3.2}$$

By comparing the first-order conditions (3.1) and (3.2), and because of the concavity of the function $\rho(.)$, $\rho'(k^{NE}) < \rho'(k^*) \Rightarrow k^{NE} > k^*$: B over-invests in contractual completeness compared to the optimal level of investment.

Proposition 1. *Under a static game, the contract signed between a buyer and a seller is too complete compared to the socially efficient level of completeness.*

3.4 The repeated game

When the agents are in a long term relationship and care about reputation, some positive consequences on their behavior can be expected. For instance, Baker et al. [2002, 2008] show that some incentives to invest can be generated by concern for future relationships, and Bull [1987] and Klein [1988] suggest that reputation effects can limit hold-up problems. In our model, we show how future business may also prevent over-investments in contractual completeness, when it is possible, *i.e.* when relational contracts avoiding the hold-up problems can be implemented (subsection 4.2).

Relational contracts are informal commitments between the parties, and are sustained by the value of future relationships. They are sustainable (*i.e.* self-enforced) when the parties prefer to respect their informal agreements rather than renege and end the relationship.

[35] The superscript "NE" stands for "Nash Equilibrium".

To determine whether such relational contracts can be implemented, we first determine the participation and self-enforcement constraints of the buyer (subsection 4.3) and then those of the seller (subsection 4.4).

3.4.1 The dynamic environment

We now consider that the buyer and the seller trade repeatedly. The parties have different discount rates, $\delta_B \in (0,1)$ for the buyer, and $\delta_S \in (0,1)$ for the seller. These discount rates remain the same for all periods.

At each end of a period, the buyer can decide to renew the seller or not. We assume that there is no outside option for the seller if the relationship ends, while the buyer can pursuit the game with another seller but returns to the Nash Equilibrium level of investment in contractual completeness k^{NE}.

$\forall t \in \mathbb{N}^*$, we denote $k_t \in [0;1[$ the intensity of the effort made by the buyer to learn about future contingencies in period t. Since the environment changes over the periods, this effort is specific to each period. Then, at each period t, the design is appropriate with probability $\rho(k_t)$, and inappropriate with probability $1-\rho(k_t)$.

To sum up, at each period of the game, the buyer has to decide the level of effort k_t, while the seller has decide not to hold-up or to hold-up in case of *ex post* adaptations, where $d_t = \{0;1\}$ denotes this decision. The per-period payoff of the buyer is $E(V_t) = K^+ - P - (1-\rho(k_t))(a_t + d_t h_t) - k_t$ and that of the seller is $E(U_t) = P - c + (1-\rho(k_t))(d_t h_t)$.

3.4.2 The relational contract

We assume that B can propose an informal agreement (*i.e.* a relational contract) to S and asks her not to hold-up in the case of unforeseen *ex post* adjustments. This allows him to save on effort k_t. If S cooperates, B promises to renew her with probability 1 at time t+1. Conversely, if S deviates, B threatens to choose another

seller at the next period. If the relational contract is sustainable by both parties, then no hold-up occurs at equilibrium. The level of investment in contractual completeness becomes:

$$k^{RC} = \arg\max_k [E(V^{RC})] = \max_k [K^+ - P - (1 - \rho(k))\tilde{a} - k] \Leftrightarrow \rho'(k^{RC}) = \frac{1}{\tilde{a}} \quad (3.3)$$

In other words, at equilibrium, the level of investment is optimal: $k^{RC} = k^*$. This is a stationary equilibrium: $\forall t \geq 1$, $k_t = k^{RC}$. The expected payoff of the seller is $E(U^{RC}) = P - c = F$ since the seller never holds up. Let us now see whether such a relational contract can be implemented.

3.4.3 The participation and self-enforcement constraints of the buyer

The buyer proposes a relational contract only if his expected payoff under relational contracting is higher than under Nash Equilibrium, *i.e.* if $E(V^{RC}) > E(V^{NE})$:

$$\Leftrightarrow K^+ - P - (1 - \rho(k^{RC}))\tilde{a} - k^{RC} > K^+ - P - (1 - \rho(k^{NE}))(\tilde{a} + \tilde{h}) - k^{NE}$$

$$\Leftrightarrow k^{NE} - k^{RC} + (1 - \rho(k^{NE}))\tilde{h} > (\rho(k^{NE}) - \rho(k^{RC}))\tilde{a} \qquad \text{(PCB)}$$

The left-hand side of (PCB) represents the gains of the buyer thanks to the relational contracts: he saves on investments in contractual completeness ($k^{NE} - k^{RC}$) and on potential hold-up ($(1 - \rho(k^{NE}))\tilde{h}$). The right-hand side of this equation represents the higher cost of contractual modification the buyer is likely to support: because contracts are more incomplete, he will have to finance more frequently the adaptation cost "a". Whenever (PCB) holds, the buyer has better propose a relational contract to the seller than choose to over-invest in contractual completeness. Let us now pinpoint the self-enforcement constraint of the buyer (SEB), *i.e.* the conditions under which he respects his informal commitment. As it is traditional from the literature on relational contracting, we use here the trigger strategy. In case of deviation, the buyer does not renew S and invests the Nash equilibrium

level of investment (with another seller) forever. Then, B respects his informal commitment if:

$$E(V^{RC}) + E(V^{RC})\frac{\delta_B}{1-\delta_B} \geq E(V^{RC}) + E(V^{NE})\frac{\delta_B}{1-\delta_B} \qquad \text{(SEB)}$$

When (PCB) binds so that $E(V^{RC}) \geq E(V^{NE})$, then equation (SEB) holds: the buyer commits to his informal promise.

Lemma 1. *When the participation constraint of the buyer holds, a relational contract threatening not to renew the seller in case of hold-up is sustainable by the buyer and allows him to invest k^*, whatever his discount rate $\delta_B \in (0,1)$.*

3.4.4 The self-enforcement constraint of the seller

The self-enforcement constraint of the seller (SES) implies that her payoff stream is higher under cooperation than deviation (*i.e.* hold-up and no more trade):

$$E(U^{RC}) + \frac{\delta_S}{1-\delta_S}E(U^{RC}) > E(U^{RC}) + h \Leftrightarrow \frac{F\delta_S}{1-\delta_S} > h \Leftrightarrow \frac{h}{F+h} < \delta_S \quad \text{(SES)}$$

Her discount rate has to be high enough for the relational contract to be sustainable.

Definition 1. We define $\overline{\delta} = \frac{\overline{h}}{F+\overline{h}}$ as the discount rate above which the relational contract is sustainable for the seller even for the highest value of hold-up ($\overline{h}$) and $\underline{\delta} = \frac{\underline{h}}{F+\underline{h}}$ as the discount rate below which the relational contract is never sustainable, *i.e.* deviation is more profitable even for $\underline{h}$.

Following definition 1 and (SES), we can distinguish three seller types:

- H when $\delta_S > \overline{\delta}$
- L when $\delta_S < \underline{\delta}$
- M when $\delta_S \in [\underline{\delta}, \overline{\delta}]$

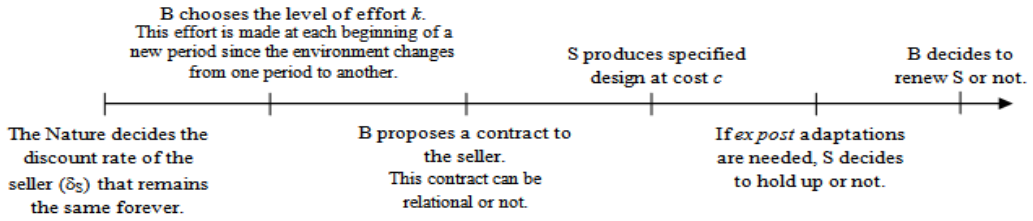
Lemma 2.

- *The type H seller never deviates since her self-enforcement constraint (SES) always holds. The relational contract is sustainable.*
- *The type L seller always deviates, since deviation is preferable for her even when the smallest amount of hold-up occurs. The (SES) never holds, so that no relational contract can be sustained.*
- *There is a level of hold-up* $h_d^M \in [\underline{h}, \overline{h}]$ *above which the type M seller prefers to deviate. Following definition 1 and (SES), we can define* $h_d^M = \frac{\delta_S^M}{1-\delta_S^M} F$. *The (SES) only holds on* $[\underline{h}; h_d^M]$, *which implies that the relational contract can be sustained only for low amounts of hold-up.*

3.4.5 Timing of the game

Under repeated game, the timing is as follows:

Figure 3.2: Timing of one period in the repeated game



3.5 Repeated Games under symmetric information

In this section, we consider that the information about the discount rates of the parties (δ_S and δ_B) is symmetric. We determine how relational contracting may explain the investment in contractual completeness made by the buyer at the beginning of each period. In subsection 5.1., we show that the optimal level of investment in contractual completeness can be reached when the seller is of type H, but that this level of investment is still k^{NE} with type L sellers. In subsection 5.2, we detail how a second-best relational contract can be implemented with some type M sellers, so that the buyer still over-invests in contractual completeness, but less than with type L sellers.

3.5.1 Contractual completeness and the sustainability of relational contracts

From lemma (1) and lemma (2):

- With a type H seller, the relational contract is self-enforced for both the buyer and the seller. The investment in contractual completeness is optimal since $k^{RC} = k^*$.
- With a type L seller, the (SES) never binds. No relational contract can be implemented, and the buyer has to invest k^{NE} if he trades with this seller.
- If the seller is of type M, the self-enforcement constraint only binds up to a value $h_d^M \in [\underline{h}, \overline{h}]$. As a consequence, the relational contract is not sustainable for all the values of h, *i.e.* for all value of a.

Since the relational contract does not allow to prevent the type M seller's opportunism for all the value of a, the optimal level of investment in contractual

incompleteness cannot be reached. However, under some conditions, the buyer may propose a "second-best relational contract" to the type M seller that allows him to save on the investment in contractual completeness (compared to the Nash equilibrium level), even if he still over-invests. Let us detail below such a second-best relational contract.

3.5.2 The second-best relational contract

A type M seller holds up whenever $h \geq h_d^M$. Since $h = \sigma(\Delta - a)$, we denote a^M the level of the modification cost a corresponding to h_d^M, so that $a^M = \Delta - \frac{h_d^M}{\sigma}$. Then, whenever $a \in [\underline{a}, a^M]$, the relational contract is no longer sustainable for the type M seller. However, the buyer may still ask the seller not to hold-up and promises him to get an extra bonus when $a \in [\underline{a}, a^M]$ if no hold-up occurs. This bonus is an *ex ante* predetermined payment that depends on the level of a in case of inappropriate contractual design.[36] We denote $b(a) \geq 0$ this bonus. Under such a second-best relational contract, the payoffs of the buyer and the type M seller are respectively:

$$\begin{aligned} E(V^{SRC}) &= K^+ - P - (1 - \rho(k^{SRC}))(\tilde{a} + [\int_{\underline{a}}^{a^M} b(a)z(a)da]) - k^{SRC} \\ E(U^{SRC}) &= P + (1 - \rho(k^{SRC}))[\int_{\underline{a}}^{a^M} b(a)z(a)da] \end{aligned}$$

Where k^{SRC} denotes the level of investment in contractual completeness when the second-best relational contract holds.

3.5.2.1 The level of investment under the second-best relational contract

Under a second-best relational contract, the payoff of the buyer when he trades with a type M seller is:

$$E(V^{SRC}) = K^+ - P - (1 - \rho(k))[\tilde{a} + (\int_{\underline{a}}^{a^M} b(a)z(a)da)] - k$$

[36] Recall that a is observable by both parties, even if it is non-contractible.

Then, the buyer invests k^{SRC} in contractual completeness such that:

$$k^{SRC} = \arg\max_k [E(V^{SRC})] = \max_k K^+ - P - (1-\rho(k))[\tilde{a} + (\int_{\underline{a}}^{a^M} b(a)z(a)da)] - k$$

$$\Leftrightarrow k^{SRC} \quad \text{such that } \rho'(k^{SRC}) = \frac{1}{\tilde{a} + (\int_{\underline{a}}^{a^M} b(a)z(a)da)}$$

If the second-best relational contract is sustainable, the payoff of the seller is $E(U^{RC}) = P - c + (1-\rho(k^{SRC}))(\int_{\underline{a}}^{a^M} b(a)z(a)da)$. By comparing with (3.1) and (3.2), we obtain $k^{RC} = k^* \leq k^{SRC} \leq k^{NE}$.

3.5.2.2 The sustainability conditions

The participation constraint of the buyer: For the buyer to propose a second-best relational contract, his payoff has to be higher under this informal agreement than under Nash equilibrium. His participation constraint (PCB2) is:

$$E(V^{SRC}) \geq E(V^{NE}) \Rightarrow E(V^{SRC}) - E(V^{NE}) \geq 0 \qquad \text{(PCB2)}$$

The self-enforcement constraint of the buyer: The buyer commits to this second-best relational contract when he has better give the bonus b(a) (when $a \in [\underline{a}, a^M]$) than renege and then invests k^{NE} in the following periods. Then, his self-enforcement constraint (SEB2) is $\forall a \in [\underline{a}; a^M]$:

$$K^+ - P - a - b(a) + \frac{\delta_B}{1-\delta_B}E(V^{SRC}) \geq K^+ - P - a + \frac{\delta_B}{1-\delta_B}E(V^{NE})$$

$$\Leftrightarrow (E(V^{SRC}) - E(V^{NE}))\frac{\delta_B}{1-\delta_B} \geq b(a) \qquad \text{(SEB2)}$$

Let us note that whenever (SEB2) holds, the participation constraint of the buyer (PCB2) binds since:

$$\begin{aligned} \text{(SEB2)} &\Rightarrow E(V^{SRC}) - E(V^{NE}) \geq b(a)\frac{1-\delta_B}{\delta_B} \\ &\Rightarrow E(V^{SRC}) - E(V^{NE}) \geq 0 \Leftrightarrow \text{(PCB2)} \end{aligned}$$

To sum up, the buyer can propose a second-best relational contract to a type M seller. This informal agreement foresees to give an extra bonus $b(a)$ when $a \in [\underline{a}, a^M]$ if the seller does not hold up. The buyer proposes and commits to this informal agreement if the bonus $b(a)$ never exceeds $b^{max} = (E(V^{SRC}) - E(V^{NE}))\frac{\delta_B}{1-\delta_B}$.

The highest bonus he has to give occurs when $a = \underline{a}$, since it implies $h = \bar{h}$.[37]. In other words, a second best relational contract is sustainable for the buyer if $b(\underline{a}) \leq (E(V^{SRC}) - E(V^{NE}))\frac{\delta_B}{1-\delta_B}$.

The self-enforcement constraint of the type M seller (SES2): $\forall a \in [\underline{a}; a^M]$,

$$P - c + b(a) + E(U^{SRC})\frac{\delta_S}{1-\delta_S} \geq P - c + h$$
$$\Leftrightarrow P - c + b(a) + E(U^{SRC})\frac{\delta_S}{1-\delta_S} \geq P - c + \sigma(\Delta - a)$$
$$\Leftrightarrow b(a) \geq \sigma(\Delta - a) - E(U^{SRC})\frac{\delta_S}{1-\delta_S} \quad \text{(SES2)}$$

A type-M seller committs to the second-best relational contract if he gets a minimal extra bonus $b(a) = \sigma(\Delta - a) - E(U^{SRC})\frac{\delta_S}{1-\delta_S}$ whenever $a \in [\underline{a}; a^M]$. To sum up, a second-best relational contract that foresees to give to the seller an extra bonus $b(a)$[38] whenever $a \in [\underline{a}, a^M]$ can be sustained between a buyer and a type M seller if:

$$b(a) = \sigma(\Delta - a) - E(U^{SRC})\frac{\delta_B}{1-\delta_B}$$
$$s.t.\ b(\underline{a}) \leq b^{max} = (E(V^{SRC}) - E(V^{NE}))\frac{\delta_B}{1-\delta_B}$$

[37]Recall that $\forall a$, $h = \sigma(\Delta - a)$

[38]This bonus can be rewritten as $b(a) + \frac{\delta_S}{1-\delta_S}(\int_{\underline{a}}^{a^M} b(a)z(a)da) = \sigma(\Delta - a) - \frac{\delta_S}{1-\delta_S}(P - c)$.

Proposition 2.

- *With a type H seller, the buyer's investment in contractual completeness is at the optimal level k^* since a relational contract threatening not to renew the seller in case of hold-up is sustainable by both parties.*
- *With a type L seller, no relational contract is sustainable and the buyer still over-invests in contractual completeness (k^{NE}) if he trades with the seller.*
- *Under some conditions, a second-best relational contract can be implemented between the buyer and a type M seller. It allows the buyer to invest k^{SRC} so that $k^* < k^{SRC} \leq k^{NE}$.*

3.6 Repeated games under asymmetric Information

In this section, we consider that only the sellers know their discount rates (δ_S) so that the information is asymmetric. For simplicity and to focus on only one particular information asymmetry, we assume that δ_B is known by all the agents. We detail in this section the information structure of the parties (subsection 6.1), the equilibrium concept we use (subsection 6.2), and why there is no separating equilibrium through the choice of contracts (subsection 6.3.). Last, we show how the separation of types may occur over time through the observation of the behavior of the seller (subsection 6.4.).

3.6.1 The information structure

3.6.1.1 Basic assumptions

Let us now assume that the buyer does not know δ_S. However, to simplify our analysis, we do no longer consider continuous types of sellers. Then, the buyer

does not know the seller's type but he knows that there are three possible discount rates for the seller: $\{\delta_H; \delta_M; \delta_L\}$.

- δ_H is such that $\delta_H \geq \bar{\delta}$: if the seller has a discount rate of δ_H, she represents a type H seller, with whom a relational contract allowing to reach the optimal level of investment in contractual completeness is sustainable.

- δ_L is such that $\delta_L \leq \underline{\delta}$: if the seller has a discount rate of δ_L, she represents a type L seller, with whom any relational contract is sustainable and the buyer has to over-invest in contractual completeness (k^{NE}).

- δ_M is such that $\delta_M \in [\underline{\delta}, \bar{\delta}]$: if the seller has a discount rate of δ_M, she represents a type M seller. This type M seller deviates from $h_m \in [\underline{h}, \bar{h}]$. To simplify our analysis, we assume that a second-best relational contract (as described above) can be implemented with this type M seller: the participation and self-enforcement constraints of this type M seller and the buyer are fulfilled.

The buyer also knows the probability density function z. At each period t, the buyer also gets some information from the past plays, and more specifically he knows : (i) his own past investment in contractual completeness, (ii) whether *ex post* adaptations occurred, (iii) the decisions of the seller to hold-up or not. Only the investments in contractual completeness is private information of the buyer. In other words, the set of histories of the buyer (g_t^B) and of the seller (g_t^S) are defined as follows:

- $g_t^B = \{k_0, h_0, d_0, ..., k_{t-1}, h_{t-1}, d_{t-1}\}$

- $g_t^S = \{h_0, d_0, ..., h_{t-1}, d_{t-1}, h_t\}$

3.6.1.2 Beliefs

At the beginning of each period t, the buyer assigns the following probabilities:

- $\alpha_t \in (0,1)$ is the probability that the discount rate of the seller is δ_H.
- $m_t \in (0,1)$ is the probability that her discount rate is δ_M.
- $\ell_t \in (0,1)$ is the probability that her discount rate is δ_L.

As a consequence, at each period t, $\alpha_t + \ell_t + m_t = 1$.

3.6.1.3 Revisions of beliefs

At the end of each period t, the buyer observes whether *ex post* adaptations were needed and he observes d_t, *i.e.* whether the seller held up or not. We denote $r_t^\theta(g_t^S, h_t)$ the probability that the seller with the discount rate δ_θ does not hold up at period t, given the amount of potential hold-up h_t and given the history of play g_t^S. From the previous definitions, $r_t^H = 1$ and $r_t^L = 0$ but $r_t^M \in \{0,1\}$. More precisely, $r_t^M = 0$ when $h \geq h_m$ and $r_t^M = 1$ when $h < h_m$. At the end of each period t, the buyer can revise his beliefs using the Bayes'rule:

- $\alpha_{t+1} = \mu(\alpha_t/d_t) = \frac{\alpha_t}{\alpha_t + (m_t) r_t^M(g_t, h_t)}$. More precisely:
  - If $h \geq h_m$, this implies that $r_t^M = 0$ and $\alpha_{t+1} = 1$.
    This means that if the seller does not hold up for high values ($h > h_m$), the buyer realizes that the seller is of type H since type L and type M sellers would have held up in these conditions (as shown in lemma 2).
  - If $h < h_m$, then $r_t^M = 1$ and $\alpha_{t+1} = \frac{\alpha_t}{\alpha_t + m_t}$. The buyer has observed no hold-up so that the seller is not a type L seller. However, since both

type M and type H sellers do not hold up when $h < h_m$, the buyer cannot distinguish between these two types.

- $\ell_{t+1} = \mu(l_t/d_t) = \frac{\ell_t}{\ell_t + m_t(1 - r_t^M(g_t, h_t))}$
  Then, $\ell_{t+1} = 1$ if $h < h_m$ because $r_t^M = 1$.

  - If $h < h_m$, this implies that $r_t^M = 1$ and $\ell_{t+1} = 1$.
    This means that if the seller holds up for low values ($h < h_m$), the buyer realizes that the seller is of type L since type H and type M sellers would not have held up in these conditions (as shown in lemma 2).
  - If $h > h_m$, then $r_t^M = 0$ and $\ell_{t+1} = \frac{\ell_t}{\ell_t + m_t}$. The buyer has observed hold-up so that the seller is not a type H seller. However, since both type M and type L sellers hold up when $h > h_m$, the buyer cannot distinguish between these two types.

- $m_{t+1} = 1 - \ell_{t+1} - \alpha_{t+1}$

Moreover, we assume that:

- If $\alpha_t = 0$ or $\alpha_t = 1$ at period t, it remains the same for all subsequent histories.
- If $\ell_t = 0$ or $l_t = 1$ at period t, it remains the same for all subsequent histories.
- If $m_t = 0$ or $m_t = 1$ at period t, it remains the same for all subsequent histories.

Under asymmetric information, in period t, the payoff of the buyer is denoted $V(\alpha_t, m_t, \ell_t, k_t)$ since his payoff will depend on his investment in contractual completeness k_t, and his beliefs about the seller's type (inducing the realization of hold-up or not).

3.6.2 Strategies and Equilibrium concept

The solution concept used in this paper is perfect Bayesian equilibrium in pure strategies, and we focus on Pareto-efficient equilibria. A strategy for the buyer is defined as the choice of effort level $k \in (0,1)$ at date t given history g_t^B, so that $s_{B,t} = (g_t^B, k)$. A pure public strategy for the seller of type θ is $s_{S,t}^{\theta} = (r_t^{\theta}(g_t^S, h_t))$, where $r_t^{\theta}(g_t^S, h_t)$ is the probability that the seller of type θ decides not to hold up at date t, given history g_t^S (and then including the observed amount of potential hold-up h_t).

As a consequence, in this paper, a PBE is triple (s_B, s_S, μ) such that:

1. s_B and s_S^{θ} are mutual best responses for all t and sets of histories g_t^B, and g_t^S.
2. $\alpha_{t+1} = \mu(\alpha_t/d_t) = \frac{\alpha_t r_t^H(g_t^S,h_t)}{\alpha_t r_t^H(g_t^S,h_t)+(1-\alpha_t)r_t^M(g_t^S,h_t)} = \frac{\alpha_t}{\alpha_t+(1-\alpha_t)r_t^M(g_t^S,h_t)}$
3. $\ell_{t+1} = \mu(\alpha_t/d_t) = \frac{\ell_t}{\ell_t+(1-r_t^M(g_t^S,h_t))m_t}$

Let us first show that there is no separating equilibrium where the information about the seller's type is revealed through the contract that the seller accepts (subsection (3.6.3)). Since there is no means to determine the type of the seller before entering in the contractual relationship, we next show that the types can only be separated by observing reneging from the informal agreement (subsection (3.6.4)).

3.6.3 The absence of separating equilibrium through the choice of contract

In our dynamic setting, only contract-pooling equilibria exist in pure strategies. The buyer has no means to force the sellers to reveal truthfully their type by

proposing different contracts.

Proposition 3. *Only contract-pooling equilibria exist in pure strategies when the seller's type is private information.*

Proof. If there were a separating equilibrium through the choice of the contract, the buyer would propose different contracts to the seller, and the chosen contract would be different according to the seller's type. If the equilibrium is pooling, the sellers always choose the same contract among the proposals, regardless of type. A separating equilibrium also implies that the payoff streams of each player are maximized subject to participation constraints (no losses for the players) and incentive constraints (each type of seller is not attracted to the contract of the other types of sellers). Let us consider three contracts: C_1 is designed for the type H seller, C_2 for the M type, and C_3 for the L type. For these contracts to be self-enforced by each type of seller, they are designed as follows:

- C_1: The buyer asks the seller not to hold up in case of unforeseen *ex post* adaptation. He informally promises the seller to renew her with probability one at the following period. There is no additional fee proposed to the seller in case of *ex post* adaptation.
- C_2: The buyer proposes the same agreement than in C_1 and also commits to give an additional bonus $b = b^M$ to the seller in case of *ex post* adaptation. The additional bonus b^M solves the self-enforcement constraint of the type M seller.
- C_3: The buyer does not propose any relational contract. There is no commitment on the seller's renewal, so that the contractual relationship is only defined on one period.

From proposition 2, each seller's type has enough incentives to respect its corresponding contract, and no hold up occurs at equilibrium for type M and type H

sellers (and the relationship ends if a party reneges). If there were a separating equilibrium, then:

- By choosing C_1, the seller reveals to be of type H, and the buyer invests k^{RC}. The per-period payoffs of the seller and of the buyer are respectively $E(U^{RC})$ and $E(V^{RC})$.
  By denoting $\mathcal{U}_H^{C_1}$ the payoff stream of the type H seller under C_1, then $\mathcal{U}_H^{C_1} = E(U^{RC}) + \frac{\delta_H}{1-\delta_H} E(U^{RC})$.

- By choosing C_2, the seller reveals to be of type M. The buyer invests k^{SRC}, and the per-period payoffs become $E(U^{SRC})$ and $E(V^{SRC})$.
  By denoting $\mathcal{U}_M^{C_2}$ the payoff stream of the type M seller under C_2, then $\mathcal{U}_M^{C_2} = E(U^{SRC}) + \frac{\delta_M}{1-\delta_M} E(U^{SRC})$.

- By choosing C_3, the seller reveals to be of type L. The buyer invests k^{NE} and the seller gets $E(U^{NE})$, while the buyer's payoff is $E(V^{NE})$.
  The contractual relationship is only defined on one period, so that $\mathcal{U}_L^{C_3} = E(U^{NE})$.

A separating equilibrium exists if each type of seller picks the desired contract and has no incentives to masquerade as another type. The incentive compatibility constraints become:

$$\mathcal{U}_H^{C_1} > U_H^{C_2} \text{ and } \mathcal{U}_H^{C_1} > \mathcal{U}_H^{C_3} \tag{IC1}$$

$$\mathcal{U}_M^{C_2} > \mathcal{U}_M^{C_1} \text{ and } \mathcal{U}_M^{C_2} > \mathcal{U}_M^{C_3} \tag{IC2}$$

$$\mathcal{U}_L^{C_3} > \mathcal{U}_L^{C_1} \text{ and } \mathcal{U}_L^{C_3} > \mathcal{U}_L^{C_2} \tag{IC3}$$

(IC1) means that the type H seller has better choose C_1 than C_2 or C_3, (IC2) shows that the type M seller has better choose C_2 than any other contract, and (IC3) means that the type L prefers C_3 to C_1 and C_2. Let us now show that at least one of the incentive compatibility constraint does not hold. Assume that the type

L seller deviates to C_1. Then, the buyer invests k^{RC} (believing that the seller is of type H), and the type L seller chooses to hold-up whenever *ex post* adaptations occur (as demonstrated in lemma 2). She obtains:

$$\mathcal{U}_L^{C_1} = P - c + (1 - \rho(k^{RC}))\tilde{h} + \rho(k^{RC})\delta_L \mathcal{U}_L^{C_1}$$

$$\mathcal{U}_L^{C_1} = \frac{P - c + (1 - \rho(k^{RC}))\tilde{h}}{1 - \rho(k^{RC})\delta_L}$$

We can now prove that $\mathcal{U}_L^{C_1} > \mathcal{U}_L^{C_3}$, *i.e.* that the type L seller has better mispresent as a type H seller and chooses C_1 rather than C_3. Remember that $\mathcal{U}_L^{C_3}$ represents the payoff of the type L seller when he chooses C_3, and thus gets $E(U^{NE})$ since C_3 is only defined on one period ($\mathcal{U}_L^{C_3} = E(U^{NE}) = F + (1 - \rho(k^{NE}))\tilde{h}$).
Since $k^{NE} > k^{RC}$,

$$F + (1 - \rho(k^{NE}))\tilde{h} < F + (1 - \rho(k^{RC}))\tilde{h}$$

Moreover, $\frac{1}{1-\rho(k^{RC})\delta_L} > 1$, which implies:

$$F + (1 - \rho(k^{NE}))\tilde{h} < F + (1 - \rho(k^{RC}))\tilde{h} < \frac{F + (1 - \rho(k^{RC}))\tilde{h}}{1 - \rho(k^{RC})\delta_L}$$

By transitivity,

$$F + (1 - \rho(k^{NE}))\tilde{h} < \frac{F + (1 - \rho(k^{RC}))\tilde{h}}{1 - \rho(k^{RC})\delta_L}$$
$$\Leftrightarrow \mathcal{U}_L^{C_1} < \mathcal{U}_L^{C_3}$$

Since $\mathcal{U}_L^{C_1} < \mathcal{U}_L^{C_3}$, the type L seller gains from masquerading as a type H seller.
The intuition behind this result is that the choice of the C_1 contract by the seller leads to an investment k^{RC} from the seller, which is a low investment in contractual completeness. The occurrence of hold-up then becomes higher than under C_3, so that the type L seller has better choose C_1 and cheats in case of *ex post* adaptation. In the same way, we can show that a type L seller is always better under C_2 than C_3 since the occurrence of hold-up is higher under C_2 than C_3 (because of the intermediate level in contractual completeness k^{SRC}). Since the type L seller is always better off by masquerading as a type H or a type M seller, (IC3) is always violated, and there is no separating equilibrium through the choice of the contract.

3.6.4 Revelation through reneging

Even if no separating equilibrium can be implemented at the first stage of the period, the buyer may acquire some information at the end of each period and full separation of types can occur over time. The buyer proposes the seller a relational contract, promising to renew her with probability one at period $t+1$ if the seller does not hold-up in case of *ex post* adaptation.
The seller will progressively reveal her type through her behavior, *i.e.* through her decision to cooperate or to renege from the relational contract: in case of *ex post* adaptations, a type L seller always reneges, a type M seller reneges from the amount h_m of hold-up, and a type H seller never reneges.
We first describe how the beliefs of the buyer evolve over time (subsection 6.4.1), and then how much he invests at each period t (subsection 6.4.2).

3.6.4.1 Evolution of the beliefs under asymmetric information

At any period t:

- **If no ex-post adaptation occurs**, the buyer cannot observe whether the seller reneges from her informal commitment or not. Then, he has no additional information about the seller's type. At the following period, he renews him and invests $k_{t+1} = k_t$.
- **If ex-post adaptations occurs**, the buyer can observe the behavior of the seller (*i.e.* whether she commits to her informal promise or not). As shown in subsection 6.1.3, the buyer can then revise his beliefs.

– *If no hold up is observed* The seller is not a type L seller, but can be either a type M or H. By denoting h_t the potential hold up the seller could have made because of this *ex post* adaptation, the beliefs evolve as follows:

  * If $h_t \geq h_m$, then the seller is of type H since he did not hold up for the large amounts of hold up. In other words, $\alpha_{t+1} = 1$ and the game goes back to symmetric information.

  * If $h_t < h_m$, then the seller can be either a type M or a type H seller. The probabilities are revised as follows: $\ell_{t+1} = 0$; $\alpha_{t+1} = \frac{\alpha_t}{\alpha_t + (m_t) r^M(h_t)} = \frac{\alpha_t}{\alpha_t + m_t}$; and $m_{t+1} = 1 - \alpha_{t+1} = \frac{m_t}{\alpha_t + m_t}$.

– *If hold-up is observed*: The seller is either a type L or a type M, but cannot be a type H since hold up was observed. The beliefs of the buyer evolve as follows:

  * If the potential hold up h_t was such that $h_t \geq h_m$, then $\ell_{t+1} = 1$ and the game turns to symmetric information.

  * If $h_t < h_m$, then the seller is a type M or a type L and probabilities are revised as follows:
  $\alpha_{t+1} = 0$; $\ell_{t+1} = \frac{\ell_t}{\ell_t + (1 - r^M(h_t)) m_t} = \frac{\ell_t}{\ell_t + m_t}$, and $m_{t+1} = 1 - \ell_{t+1} = \frac{m_t}{\ell_t + m_t}$.

However, for such a revelation of type to appear over time, the sellers have not to deviate from their types. In the appendix, we show that the incentives compatibility constraints hold (ensuring that there is no seller misrepresents as another type).

3.6.4.2 The investment in contractual completeness at each period t

At each period t, given his beliefs, the buyer maximizes his payoff stream that depends on his beliefs and his investment in contractual completeness.

$$k_t = \arg\max_{k_t}\{\mathcal{V}(\alpha_t, m_t, \ell_t, k_t)\}$$

$$= \arg\max_{k_t} \quad \{V(\alpha_t, m_t, \ell_t, k_t)$$

$$+\delta_B[(\int_{h_m}^{\overline{h}} h \times z(h)dh)[\alpha_t \mathcal{V}(1,0,0,k^{RC}) + (m_t + \ell_t)(\mathcal{V}(0, m_{t+1}, \ell_{t+1}, k_{t+1}))]]$$

$$+\delta_B[(\int_{\underline{h}}^{h_m} h \times z(h)dh)[(\alpha_t + m_t)\mathcal{V}(\alpha_{t+1}, m_{t+1}, 0, k_{t+1}) + \ell_t \mathcal{V}(0,0,1,k^{NE})]]\}$$

subject to $\mathcal{V}(k_t) > \mathcal{V}^{NE}$ (since $\mathcal{V}^{NE}$ is the payoff stream of the buyer when he uses his outside option and always invests k^{NE}.) The first line of this maximization program represents the payoff of the buyer in period t, $V(\alpha_t, m_t, \ell_t, k_t)$, that depends on the investment k_t and the beliefs $(\alpha_t; m_t; \ell_t)$.[39] The second line represents the payoff stream of the buyer at the following period when high values of hold up $(h > h_m)$ occur in period t. If no hold-up occurs (which means that the seller is of type H so that this situation occurs with a probability α_t), the buyer knows that the seller is of type H. The payoff stream becomes $\mathcal{V}(1,0,0,k^{RC})$ since $\alpha_{t+1} = 1$ and the buyer invests k^{RC} forever. However, if hold-up occurs, the buyer cannot distinguish between type M and type L seller, so that he revises his beliefs as described in subsection 6.4.1 and his payoff stream becomes $(\mathcal{V}(0, m_{t+1}, \ell_{t+1}, k_{t+1}))$. The third line describes the payoff stream of the buyer in period $(t+1)$ if low values of hold-up occurs in period t. If the buyer observes hold-up, he revises his beliefs so that $\ell_{t+1} = 1$ and he invests k^{NE} forever. If he does not observe hold-up, he cannot distinguish between type H and type M sellers, so that his payoff stream becomes $\mathcal{V}(\alpha_{t+1}, m_{t+1}, 0, k_{t+1})$.

[39] $V(\alpha_t, m_t, \ell_t, k_t) = K^+ - P - (1-\rho(k))(\tilde{a} + \ell_t \times \tilde{h} + m_t(\int_{h_m}^{\overline{h}} hz(h)dh))$

Since under asymmetric information, the buyer has to take into account the potential hold up that occurs when the seller is of type L (with probability ℓ_t) or of type M (with probability $(\int_{h_m}^{\overline{h}} h \times z(h)dh) \times m_t$), then he invests more in contractual completeness than k^{RC}, i.e. the level of investment when he is certain that the seller is of type H and does not hold-up: $k_t \geq k^{RC}$. Moreover, the previous maximization program shows that whenever *ex post* adaptation occurs with $h > h_m$, and no hold-up is observed, then the buyer realizes that the seller is of type H, and invests k^{RC} afterwards. The level of investment then goes from k_t to k^{RC} which means that this level decreases as the buyer does not need to invest in contractual completeness any more to protect himself from hold-up. This describes the situation where contracts become more incomplete over time (as reported in the empirical studies of Corts and Singh [2004] and Kalnins and Mayer [2004]).
On the other hand, whenever hold-up occurs for low values of h (such that $h \leq h_m$), then the buyer understands that the seller is of type L and invests k^{NE} afterwards. The level of investment in contractual completeness increases from k_t to k^{NE} because the buyer is now certain that the seller always holds up in case of *ex post* adaptation. This describes the situation where contracts become more complete over time (as illustrated in the air force engine sector studied by Crocker and Reynolds [1993]). Quite interestingly, in the empirical analysis of Crocker and Reynolds [1993], the explicative variable "conflicts" (that accounts for the existence of past contractual conflicts between the partners) is positive and significant to explain the high level of contractual completeness. This seems consistent with our theoretical work: when past conflicts have emerged between a seller and a buyer, this may explain why parties look for more complete contracts afterwards.

Proposition 4. *When the information is asymmetric about the discount rate of the seller (i.e. the buyer does not know whether the seller pays enough attention to future business), the level of contractual completeness evolves according to the past behavior of the seller. When the seller never holds up, contracts become more incomplete over time.*

3.7 Conclusion

In this article, we examine what happens to the trade-off between costs and benefits defining contractual completeness, when parties have perspective of future business. We show that under symmetric information about the discount rates of the parties (that account for how they valorize future business), the level of contractual completeness is determined by the ability to sustain a relational contract. Such a contract is an informal agreement between the parties to prevent opportunistic behavior. In our paper, the co-contractor informally commits not to hold up during the execution of the contract and he is renewed at the following period in case of cooperation. When the co-contractor has a high discount rate, the relational contract is sustainable, and there is no need to invest in costly complete agreements, since opportunistic behavior is avoided thanks to the relational contract. However, when the co-contractor has a low discount rate, then he may renege from the informal commitment, and the buyer has better invest in complete formal agreements to prevent opportunism caused by contractual incompleteness. When the information about the discount rate of the co-contractor is asymmetric, the level of contractual completeness evolves over time, and is determined by the past behavior (cooperation or deviation) of the co-contractor. When the seller never holds up, contracts become more incomplete, but when he holds up even for small values, contracts become more complete over time. Then, our results identify a new source of endogenous contractual completeness: the ability of the parties to sustain a relational agreement. Moreover, we show that reputation building helps to understand the evolution towards more and more incomplete formal contracts. Last, our results also suggest that the identity of the parties matters when they contract, so that an identical transaction can entail different contracting costs (in completeness) depending on the contracting parties involved. This may shed a new light on some management practices, and on the choices of contractual partners, when the opportunistic behavior of a partner is feared.

This paper also calls for several extensions. In future works, we would like to explore what happens when parties adopt different strategies in case of reneging from an informal commitment. In our model, we use the trigger strategy so that once a party reneges, she never trusts any more. However, alternative strategies (as "tit-for-tat") could be implemented, and maybe lead to different results. A second extension would be to model multilateral relationships, in which a seller could trade with different buyers and his opportunistic behavior could impact on several transactions (or not), whether the communication between the different buyers is efficient or not. Last, another work would be to give some empirical contents to our propositions and to organize lab experiments, with different treatments making relational contracts more or less sustainable, and to see whether endogenous contractual completeness change in these different contexts.

3.8 Appendix

The incentives compatibility constraints: For the observation of the seller's behavior to allow to separate the types, we have to check that no seller has some interest to masquerade as another type. Let us now demonstrate that:

- a type L seller prefers to hold up whenever *ex post* adaptation occurs than not to hold up to misrepresent as a type M or type H seller *(I1)*

- a type M seller prefers *(i)* to hold up when $h \in [h_m, \bar{h}]$ than to misrepresent as a type H seller, and *(ii)* not to hold up when $h \in [\underline{h}, h_m]$ rather than misrepresent as a type L seller *(I2)*

- a type H seller always chooses not to hold up rather than to misrepresent as a type M or type L seller. *(I3)*

- To show that *(I1)* is true, let us assume that L misrepresents as a type H seller. This strategy induces that L does not hold up when *ex post* adaptation occurs (whatever $h \in [\underline{h}, \bar{h}]$).

  - When the potential hold up is $h \geq h_m$, the buyer then believes that the seller is of type H and invests k^{RC} in contractual completeness. The consequence is that the seller benefits from a higher expected hold up at the following period: the amount of hold up does not change[40] but the probability of occurrence is now higher since *ex post* adaptation occurs with probability $(1 - \rho(k^{RC})) \geq (1 - \rho(k_t))$. The seller L's optimal strategy is then to hold up at the following period as soon as *ex post* adaptation occurs. If no *ex post* adaptation occurs (with probability $\rho(k^{RC})$), she is renewed. Then, when the type L seller misrepresents as

[40] Whatever the investment in contractual completeness, the amount of hold up h is distributed over $[\underline{h}, \bar{h}]$ through the probability density function z.

a type H seller, her payoff stream becomes U_H^L:

$$\begin{aligned} & U_H^L = F + h(1-\rho(k^{RC})) + \delta_L \rho(k^{RC}) U_H^L \\ \Leftrightarrow\ & U_H^L = \frac{F + h(1-\rho(k^{RC}))}{1-\delta_L \rho(k^{RC})} \end{aligned}$$

When *ex post* adaptation occurs, the type L seller has no interest to masquerade as a type H seller whenever her gain by holding up $(F+h)$ is larger than her gain by misrepresenting as a type H seller, *i.e.* when

$$\begin{aligned} & F + h \geq F + \delta_L U_H^L \\ \Leftrightarrow\ & h \geq \delta_L \frac{F + h(1-\rho(k^{RC}))}{1-\rho(k^{RC})\delta_L} \\ \Leftrightarrow\ & h(1-\rho(k^{RC})\delta_L) \geq \delta_L (F + h(1-\rho(k^{RC}))) \\ \Leftrightarrow\ & h > \delta_L (F + h(1-\rho(k^{RC})) + h\rho(k^{RC})) \end{aligned}$$

$$\Leftrightarrow \frac{h}{F+h} \geq \delta_L \tag{3.4}$$

From lemma 2, the discount rate of the type L seller is such that $\delta_L > \frac{h}{F+h}$. Then, (3.4) is always true, then the type L seller has no incentive to misrepresent as a type H seller.

– When *ex post* adaptation occurs and the potential hold up is $h < h_m$, the type L seller still prefers to hold up rather than masquerade as a type M or type H seller. Indeed, given the structure of beliefs, the buyer invests $k_{t+1} < k_t$ when he observes that the seller did not hold up $h \in [\underline{h}, h_m]$ at period t. The seller benefits from a higher expected hold-up in the following period: $(1-\rho(k_{t+1}))h$. The optimal strategy for the buyer is then to hold up whenever *ex post* adaptation occurs. Her expected payoff stream becomes:

$$\begin{aligned} U_L^M &= F + (1-\rho(k_{t+1}))h + U_L^M \delta_L \rho(k_{t+1}) \\ \Leftrightarrow U_L^M &= \frac{F + (1-\rho(k_{t+1}))h}{(1-\delta_L \rho(k_{t+1}))} \end{aligned}$$

The type L seller does not misrepresent as a type M or L (when $h \leq h_m$) if her gain is higher by holding up than by misrepresenting, *i.e.* when:

$$F + h > F + \delta_L U_L^M \tag{3.5}$$

$$(3.5) \Leftrightarrow \frac{h}{h+F} \geq \delta_L$$

Then, the type L seller always prefers to renege when $h < h_m$ than to misrepresent as a type M or type H, and *(I1)* is true.

- Let us now show that a type M seller does not masquerade as a type H or a type L seller.

  – First, a type M seller always prefers to hold up when $h > h_m$ than to misrepresent as a type H seller to benefit from a higher expected hold up in the following period. In case of misrepresentation, given the structure of the beliefs, the payoff stream of the seller becomes:

$$\begin{aligned} U_M^H &= F + (1-\rho(k^{RC}))(\int_{h_m}^{\overline{h}} hz(h)dh) + \delta_M((\rho(k^{RC})) \\ &\quad +(1-\rho(k^{RC}))(\int_{\underline{h}}^{h_m} z(h)dh))U_M^H \\ \Leftrightarrow U_M^H &= \frac{F + (1-\rho(k^{RC}))(\int_{h_m}^{\overline{h}} hz(h)dh)}{1-\delta_M((\rho(k^{RC})) + (1-\rho(k^{RC}))(\int_{\underline{h}}^{h_m} z(h)dh))} \end{aligned}$$

  Then, a type M seller does not masquerade as a type H seller when $h \geq h_m$ if:

$$h > \delta_M U_M^H \Leftrightarrow \frac{h}{F+h} > \delta_M \tag{3.6}$$

  From (SES), (3.6) is true.

  – Second, a type M seller does not misrepresent as a type L, *i.e.* does not hold up when $h \geq h_m$.

  Let us show that her payoff stream is higher when she does not hold up than when she holds up: in case of hold up, she gets $h \in [\underline{h}, h_m]$ and then will no longer be renewed. On the contrary, if she does not hold up, she is renewed, and the buyer invests $k_{t+1} > k_t$. Then, her expected payoff without holding up is

$$\begin{aligned} U_M^M &= F + (1-\rho(k_{t+1}))(\int_{h_m}^{\overline{h}} hz(h)dh) + \delta_M U_M^M(\rho(k_{t+1}) + (1-\rho(k_{t+1}))) \\ &= \frac{F + (1-\rho(k_{t+1}))(\int_{h_m}^{\overline{h}} hz(h)dh)}{1-\delta_M(\rho(k_{t+1}) + (1-\rho(k_{t+1})))} \end{aligned}$$

Then, the type M seller decides not to masquerade as a type L (by holding up when $h < h_m$) if:

$$h < \delta_M U_M^M \Leftrightarrow \delta_M > \frac{h}{h+F} \tag{3.7}$$

From (SES), with $h \in [\underline{h}, h_m]$, (3.7) is always true.

As a consequence, a type M seller never misrepresents as a type H or a type L.

- Last, let us now demonstrate *(I3)*.

  A type H seller has no incentive to masquerade as a type L or a type M seller, *i.e.* to hold up for $h \in [\underline{h}, \bar{h}]$. Indeed, her payoff stream is higher when she does not hold up and is renewed, than when she decides to hold up. When she does not hold up, she gains $E(U^{RC})$ at each period forever, while if she holds up she gets h and then is not renewed. As a consequence, the type H seller prefers not to hold up whenever:

$$h < \frac{\delta_H \times E(U^{RC})}{1-\delta_H} \Leftrightarrow \delta_H \geq \frac{h}{h+F} \tag{3.8}$$

  Then, from (SES), *(I3)* is always true.

  A type H seller has no incentive to misrepresent as a type H or a type M seller. Moreover, a type M seller has never interest to deviate and to misrepresent as a type L. Let us assume that a type M seller chooses to hold up when $h \leq h_m$, then the buyer believes in the next rounds that he is a type L seller and no longer renews him. Instead, if the type M seller does not hold up and

Chapter 4

Relational Contract and Endogenous Contractual Incompleteness. Experimental Evidence*

4.1 Introduction

Many contracts are "deliberately" incomplete in the sense that parties decline to condition performance on available, verifiable measures that could be specified in the contract. Such contractual incompleteness can be explained by a trade-off : the *ex ante* costs of crafting more complete agreements is compared to the *ex post* inefficiencies associated with less exhaustive arrangements. In this paper, we would like to investigate what happens to this trade-off when parties trade repeatedly: Does the perspectives of future repeated interactions diminish the fears of hold up in renegotiations, making a less complete (and a less costly) agreement more

*This chapter is based on a joint work with Claudine Desrieux. We are grateful to Carine Staropoli, Giorgio Zanarone, Bradley Ruffle, Thierry Pénard, David Mascley, Eshien Chong, Anne Yvrande-Billon, Eric Avenel and participants of the 2011 International School of New Instutional Economics in Palo Alto, the 2011 International Conference "Contracts, Procurement, and Public-Private Arrangements" in Paris, the 2011 European Association for Research in Industrial Economics Conference in Stockholm, the 2011 American Law and Economics Association Conference in New York and the 2010 Congrès de l'Association Française de Sciences Economiques for their helpful comments and criticisms. The author also gratefully acknowledge Maxim Frolov for his very precious technical help. Finally, we gratefully acknowledge Pierre Garrouste for his precious advices and his financial support.

attractive? How does the impact of past interactions determine the willingness to draft complete agreements?

According to the relational contract theory, cooperative behavior can be generated by concerns for future relationships and reputation (Bull [1987], Klein [1988] and Baker et al. [2008]). As a consequence, one could expect that relational contract sustained by the value of future transactions will make useless to spend *ex ante* costs to write as complete a formal contract as possible. Nevertheless, there is no empirical work (to our knowledge) that investigates the link between relational contract and contractual incompleteness. In this paper, we propose to fill this gap by analyzing the interplay between relational contracts and the dynamics of endogenous contractual incompleteness. To study whether parties are willing to sign more incomplete contracts when relational contracts are sustainable, we implement an experimental design of infinitely repeated games between identifiable players. In our setting, buyers have to determine the level of contractual completeness they want at the beginning of each period (contractual completeness is determined by a level of *ex ante* investment) while sellers have to decide to cooperate or to hold-up in case of incomplete contract. At the end of each round, players can decide if they want to stop or pursue their relationships and/or to look for new partners in the lab. This game is played under four different treatments in which two determinants of relational contracting vary: the potential duration of the game and the nature of information. Our results show that past interactions are a stronger determinant of the level of investment in contractual completeness than the perspective of future business. Our paper can be related to the literature on endogenous contractual incompleteness. Many theoretical papers have tried to explain why contractual incompleteness can be endogenous (Shavell [1984], Anderlini and Felli [1999], Spier [1992]), however few of them have investigated the links between contractual incompleteness and relational contracting. Bernheim and Whinston [1998] regard contractual incompleteness as a cause of relational contract, since punishment strategies allowing a relational contract to be sustainable can be more easily elaborated when contracts are incomplete. Our contribution is to empiri-

cally explore the reverse causality: instead of thinking contractual incompleteness as a way to allow for relational contract; relational agreements could be the reason for accepting incomplete contract. This implies that relational contract would be a cause and not a consequence of contractual incompleteness. Such an intuition is given in the theoretical model of Tirole [2009] (p.283).

The evolution of contractual incompleteness over time has drawn some attention in the empirical literature. Empirical studies provide various answer about how contractual incompleteness evolves over time. For instance, Corts and Singh [2004] find that oil and gas companies are less likely to write complete agreements as the frequency of their interactions with a driller increases; while Crocker and Reynolds [1993], in their study of air force engine industry, report that contracts become more and more complete over time. Those empirical results (among others) seem to suggest that the degree of contractual incompleteness evolves over time when two partners trade repeatedly, but there is no general rule, as parties may turn to more complete or incomplete agreements. Our methodology based on experimental economics proved to be particularly relevant to study the evolution of contractual incompleteness. This allows us to overcome several limitations of empirical papers testing contractual incompleteness. Compared to the study of Crocker and Reynolds [1993], the experimental approach allows us to observe the entire story of relationships. History between parties start at the first period and the observed behavior cannot be related to unobservable past events. Moreover, the empirical works as that of Crocker and Reynolds [1993] focus on relationships between one buyer and one or two sellers; while, in lab, we can create an environment where buyers and sellers are numerous and identically distributed in the population.

Compared to experimental studies, our paper is closed to Fehr et al. [2000] and Brown et al. [2004]. In their paper, Fehr et al. [2000] study the impact of reciprocity on contractual choices. In their experiment, contractual incompleteness is endogenous since principals have the choice between an explicit contract (incentive contract) and an implicit, less complete, contract (bonus contract). They find that the bonus contract, relying on reciprocal fairness as an enforcement device, is

more often chosen by principals and leads to higher levels of agents' performances. Nevertheless, at each period, players are matched randomly and anonymously so all matches are one shot. As a consequence, Fehr et al. [2000] do not analyze the impact of relational contracting on contractual incompleteness. As for Brown et al. [2004], they examine how the absence of third party enforcement affects the formation of relational contract and market interactions. In their finitely repeated game experiment, they show that, in the absence of third party enforcement, fixed identities allow the emergence of cooperative long-term relationships through contingent contract renewal (i.e. relational contract). Our results are consistent with theirs but we also introduce an additional disciplinary device through the sharing of information about all the sellers' behavior under some treatments. Moreover, we depart from them in our definition of contractual incompleteness. In their study, the presence of third party enforcement corresponds to the complete contract situation and, conversely, the absence of third party enforcement corresponds to the incomplete contract situation. As the presence of this third party depends on the treatment, contractual incompleteness is exogenously determined in their paper. In our study, contractual incompleteness corresponds to the risk to face a situation where the seller will decide the sharing of the surplus on his own, with a possibility to hold-up the buyer. Furthermore, this risk is defined by the level of investment decided by the buyer. As a consequence, our experimental design is the first attempt to study the impact of relational contract on endogenous choice of incomplete contract.

The rest of the paper is organized as follows. Next section provides a very simple theoretical framework to support our view of relational contracts as a factor of endogenous contractual incompleteness. Section 3 describes our experimental design, and section 4 describes the different treatments we study to put our propositions to the test. Section 5 comments our results and section 6 concludes.

4.2 The theoretical framework

In this section, we propose a very simple model to provide some structure on *(i)* why agents decide to cooperate in a relational contract, and (*ii*) how investments in contractual completeness evolve over time in such a situation.[41] We intend this framework to be source of testable implications that we will take to our experimental data in the following sections.

4.2.1 Basic assumptions

Let us consider a repeated and open-ended bilateral contractual relationship between two agents, a buyer (B, whom we refer as "he") and a seller (S, whom we refer as "she"). The buyer wishes a project or a service, and asks the seller to perform the work according to his specifications, *i.e.* according to the contractual design. An illustration could be the public procurement sector, where the buyer (a public authority) asks a contractor to build an infrastructure, following some contractual specifications. As in Bajari and Tadelis [2001], we focus here on problems of *ex post* adaptations in a context where the level of contractual incompleteness is endogenously determined. We consider that both parties share uncertainty about contingencies that may arise once the contract is signed, and the production begins.[42]

When all contingencies are foreseen in the contract, the buyer gets a value U^+ of the project. However, some *ex post* unforeseen contingencies may also occur, in which case the contractual design is inappropriate. Before the beginning of each new period, the buyer can make an *ex ante* non-observable investment, say $I \in [0, 1]$, to determine the level of contractual completeness of the agreement he signs with the seller. The more complete the design is, the lower the prob-

[41] This model is a simplified version of Desrieux and Beuve [2011a], see Chapter 3.

[42] To justify and illustrate this theoretical concern on *ex post* adaptations, the paper of Bajari and Tadelis [2001] (p.388) provides useful information about the public procurement, and show why the procurement problem is mainly about *ex post* adaptations rather than *ex ante* screening.

ability that unforeseen contingencies occur. Then, with probability $\rho(I) \in [0,1]$ ($\rho' > 0, \rho'' < 0$), the contract foresees all the contingencies, and delivers a value U^+ for the buyer. Yet, with probability $1 - \rho(I)$, some unforeseen contingencies occur. In this case, contractual incompleteness opens room for opportunistic behavior and the seller has to decide whether to cooperate or not. If she cooperates, the buyer still gets a value U^+ from the project, but if she decides not to cooperate and to act in her self-interest, the buyer only gets a utility $U^D < U^+$.

At the end of each period, the buyer decides to continue the relationship with the seller, or to stop and to use his outside option. We denote U^P the gain of the buyer when he uses his outside option, with $U^+ > U^P > U^D$. In other words, the buyer has always interest that the seller cooperates in the relationship but prefers to stop than to be cheated. In such a context, the relational contract is the threat of the buyer not to renew the seller if she decides not to cooperate in case of unforeseen contingencies.

The payoff of the seller is C when all contingencies have been foreseen, and when she cooperates under unforeseen contingencies. If she deviates, she gains D.[43] Her expected payoff when she does not trade with the buyer (her outside option) is P, with $D > C > P$.[44]

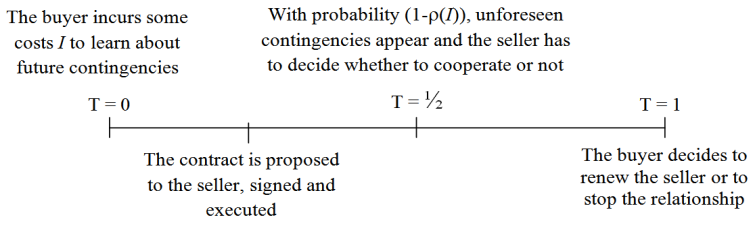
Last, we consider an infinitely repeated game. The buyer discounts his payoffs at rate $\delta_B \in [0,1]$, while the discount rate of the seller is $\delta_S \in [0,1]$. For analytical simplicity, we will consider trigger strategy in this infinitely repeated game: if the seller does not cooperate at any time, then the buyer stops the relationship forever. The timing of the game for one contractual period is presented in Figure 4.1.

We propose to solve the model by backward induction: we determine whether the seller respects or not her informal commitment, and then analyze the level of investment in contractual completeness made by the buyer at the beginning of each period.

[43] The decision of the seller we describe is inspired from Gibbons [1997].

[44] In other words, when unforeseen contingencies occur, the situation is similar to a prisoner's dilemma. In a static framework, by backward induction, the buyer anticipates that the seller will deviate, and there is no trade, since the buyer prefers his outside option U^P rather than U^D.

Figure 4.1: Timing of the game for one contractual period



4.2.2 The seller's decision to cooperate

When unforeseen contingencies occur at date $T = \frac{1}{2}$, the seller has to choose whether to cooperate or not. We determine here the self-enforcement condition of the seller. She cooperates whenever her discounted payoff stream from cooperation is higher than that of deviation, *i.e.* :

$$\frac{C}{1-\delta_S} > D + \frac{P\delta_S}{1-\delta_S} \qquad \text{(SEC)}$$

$$\Leftrightarrow \delta_S > \frac{D-C}{D-P}$$

As traditional in the literature on relational contracting, cooperation is all the more likely to occur than:

Result 1. The outside option (P) is all the lower (*ceteris paribus*).

Result 2. The discount rate of the seller (δ_S) is high (*ceteris paribus*).

4.2.3 The buyer's investment in contractual incompleteness

At the beginning of each new period, in $T = 0$, the buyer chooses his investment in contractual completeness so as to maximize his own payoff. Under symmetric information, the buyer knows whether (SEC) is respected or not, *i.e.* he knows whether the seller will cooperate or not in case of unforeseen events.

- If the seller cooperates, then the buyer expects a gain U^+ in case of *ex post* adaptations. Then, his expected per-period payoff is

$$\rho(I)U^+ + (1-\rho(I))U^+ - I = U^+ - I$$

  Then, the payoff of the buyer is maximized when $I = 0$, which means that the buyer does not invest in contractual completeness. He prefers to leave the contract intentionally incomplete, because the relational contract is sustainable and the seller always cooperates.

- If the seller deviates, then the buyer expects a gain U^D in case of unforeseen events. His payoff becomes:

$$U^+\rho(I) + (1-\rho(I))U^D - I$$

  The buyer chooses the investment level that maximizes his own payoff, *i.e.*:

$$I^B = \arg\max\{U^+\rho(I) + (1-\rho(I))U^D - I\} \Leftrightarrow \rho'(I^B)(U^+ - U^D) = 1$$

  This means that the buyer invests in contractual completeness until the marginal benefit of the investment equals its marginal cost.

In other words, the contract is left intentionally incomplete when the buyer knows that the relational contract is sustainable. Otherwise, the buyer prefers to invest *ex ante* to make a contract more complete, in order to avoid the occurrence of *ex post* adaptations that will lead to the deviation of the seller. While relational contracts are traditionally considered as a solution to contractual completeness, we show here that they can also be viewed as a factor explaining endogenous contractual incompleteness.[45]

Result 3. The contract is left intentionally incomplete when the buyer knows that the relational contract is sustainable.

[45]This result can be related to that of Crocker and Reynolds [1993]: the buyer compares the *ex ante* costs of contractual completeness to *ex post* risk of opportunism. However, we show here that such a risk depends on the sustainability of relational contracts.

4.2.4 Testable implications

This short model above contains several testable predictions. On the one hand, parties are all the more likely to respect a relational contract than the rate at which they discount their future payoffs is high *ceteris paribus* (*Result 1*) and than their outside option is low *ceteris paribus* (*Result 2*). On the other hand, the contract is left intentionally incomplete when parties anticipate that the relational contract governing unforeseen contingencies is sustainable (*Result 3*). To give these results some empirical content, we discuss below each of them.

4.2.4.1 The discount rate

As recalled by Fudenberg and Tirole [1991], there are two interpretations of the discount rate: it represents both the rate of time preference and the probability of continuation of the game.[46] As a consequence, when parties anticipate that the duration of the game is longer, they discount future payoff at a higher rate, all other things being equal. Then, (SEC) is all the more likely to be satisfied, *i.e.* the relational contract is all the more sustainable. Then, we obtain our first testable implication:

Proposition 1. *Cooperation is more sustainable when the duration of the game is longer.*

[46]More formally, $\delta = e^{-r\Delta}$ where r is the rate of time preference and Δ is the length of the period. However, if we add a probability μ of continuation from one period to the next, then with probability $(1-\mu)$ there is no gain, and with probability μ, the gain is discounted at rate $\delta = e^{-r\Delta}$. Then, the expected discounted value of the gain is $\delta' = \mu\delta = \mu e^{-r\Delta}$. Thus, the situation is the same as if $\mu = 1$ and $r' = r - \frac{ln(\Delta)}{\mu}$, hence the dual interpretation of the discount rate.

4.2.4.2 The outside option

In our model, the incentives of the seller to cooperate are all the higher than P (her gain outside the relationship) is low. Several determinants of the outside option can be established. Among them, the level of asset specificity included in the relationship makes the outside option all the lower, because those assets have no more value outside the relationship, and the partner supporting such investments may prefer to stay (even if he has been cheated) than to stop the relationship and to loose his specific investments. In the same way, the market structure is not neutral, since it determines whether alternative partners (outside the initial relationship) may be found in the market or not.

Last, public information also determines the value of the outside option. In the context of multilateral relationships, Greif [2006] and Bernstein [1992] show that the punishment of a cheater is effective only if it can be applied by all the members of the community, so that the outside option of the cheater becomes low. One of the many difficulties of a collective punishment is that the information and communication channels need to be very efficient so that everyone may identify a cheater (Li [2003]; Dixit [2004, 2009]), and may apply the punishment. Then, public information would allow to identify the cheater more easily, and makes the punishment more efficient in case of deviation. As a consequence, the outside option of the cheater in case of reneging is all the lower than the information about his behavior is public. With a different approach, Tadelis [2008] and Frestre and Garrouste [2011] also suggest that individuals are more willing to cooperate when they know that others observe their behavior (*i.e.* in case of public information) because of the player's aversion to being thought of as acting in an inadequate way. In our paper, the goal is not to discriminate between these different explanations but to verify whether public information leads to more cooperation or not.

Then, for a given level of asset specificity and in a given market structure, we propose here to focus on the impact of public information on the willingness to cooperate in a relational contract. When information is public, the level of the

outside option should be all the lower because other potential partners are aware of the non-cooperative behavior of the agent. This would make cooperation all the more sustainable, since the alternative payoff (*i.e.* the outside option) is low:

Proposition 2. *Cooperation is more sustainable when information about the behavior of the participants is public rather than private.*

4.2.4.3 Endogenous contractual incompleteness

Our model shows that parties voluntarily sign incomplete contracts when they know that a relational contract governing unforeseen contingencies is sustainable (*Result 3*). By anticipating the cooperative behavior of the seller, the buyer decide to invest less *ex ante* and to draft a less complete contract. Then, we have the following proposition:

Proposition 3. *Contracts are more incomplete when the relational contract is sustainable.*

As emphasized in previous subsection, the sustainability of the relational contract depend on the incentives for the seller to cooperate in case of unanticipated contingencies. A relational contract is all the more sustainable than the duration of the game is long and information is public. By transitivity, we should observe less investment in contractual completeness in these two situations. Thus, we can break our proposition 3 down into the two following testable implications:

Proposition 3a. *Contracts are more incomplete when the duration of the game is longer.*

Proposition 3b. *Contracts are more incomplete when information about the behavior of the participants is public rather than private.*

However, in many situations, the buyer suffers from asymmetric information about the ability of the seller to respect her informal commitment, so the possibility to use backward induction disappears. He may be ignorant of the value of the outside option (Halac [2011a]) or of the discount rate of the seller (Desrieux and Beuve [2011a]). These recent models of bayesian learning show that when there is no possibility to implement menus of contracts, the buyer has some prior about the ability of the seller to cooperate, and revises his prior over time. Thus, past behavior of the partner delivers some information about the seller, and is the main factor allowing the revision of beliefs. In their theoretical paper, Desrieux and Beuve [2011a] take into account strategic behavior of the seller (*i.e.* their interest to commit temporarily to their informal promise, to cheat later on) and show in details that the more cooperation is observed in past interactions, the more incomplete contracts become. This makes the reduction of completeness more progressive, but cooperative behavior still induce less completeness. Thus, we could expect that the information collected in past interactions allows to influence the level of investment in contractual completeness made by the buyer at the beginning of each new period:

Proposition 4. *Contracts are more incomplete when past experiences are positive (i.e. no hold-up.)*

However, this interplay between past experiences and contractual completeness depends on the information the buyer is able to collect. Whether public or private, the nature of information influences contractual choices of buyers. When there is no public information about the behavior of the sellers, then the buyer can only focus on the information he collects on his own, through past experiences with a given seller. However, when the information about past interactions is public, each buyer can observe the behavior of a seller with all the different buyers. His information comes from his own past experiences and the past experiences of all the other buyers, since he can observe these interactions. Here again, our propo-

sition 4 can be split into the two following last testable implications:

Proposition 4a. *Under private information, the more cooperative the past interactions between the parties are, the more incomplete the contracts chose by the buyer become.*

Proposition 4b. *Under public information, the more cooperative the seller was in all her past interactions, the more incomplete the contracts chose by the buyers for this seller are.*

4.3 Experimental design

The experiment is designed to study the interplay between relational contract and contractual incompleteness. It corresponds to a buyer-seller game where gains will be determined by the decisions of players. In the instructions and during the experiment, we only refer to players A (*i.e.* buyers) and players B (*i.e.* sellers) in order to obtain as a neutral context as possible. Nevertheless, for a better understanding of the results, we will refer in the paper to buyers and sellers.

4.3.1 Subjects

The experiment was conducted in the Experimental Economic Laboratory of Paris at University of Sorbonne. One hundred and ninety-two subjects, predominantly undergraduate students of various fields, participated in the experiment. For each of the next described treatments we conducted four separate sessions, each with one group of twelve different students (every subject only participated in one session). Subjects were randomly assigned to a workstation and received written instructions. Those instructions have also been exposed in lab and subjects answered a control questionnaire before the start of the experiments to ensure they

had a complete understanding of the rules.[47] Finally, all payoffs in the game were in ECUs and at the end of each session, the ECUs earned by each subject were converted into Euros (at the exchange rate of 1 ECU = 0,025 Euros) and paid privately in cash. This exchange rate between ECUs and euros ensured that subjects had significant incentives to try to maximize their earnings.[48]

4.3.2 Matching procedure and identifiable players

In each session, subjects are divided into two groups: six buyers and six sellers. At the beginning of each session, players receive a fixed identification number (from A_1 to A_6 for buyers and from B_1 to B_6 for sellers) for the whole duration of the experiment. As a result, all relationships take place between players that could be identified during all stages. Under these conditions, players are able to engage in long term relationships and buyers are able to condition their choices on the seller's past behavior, so that reputation effects can emerge endogenously (Fehr et al. [2009]).

Furthermore, the matching between players is not random but autonomous. Technically, buyers can propose relationships to any seller and sellers can decide to accept or reject those offers. In the repeated game framework described after, buyers can decide to stop or to propose to pursue their relationships with current partners and to propose new relationship to other sellers at the end of each round. As for sellers, they can decide to accept or reject offers of relationships' renewal and offers of new relationships. Finally, to maintain a minimum level of competitive pressure and allow the threat of relationship termination to be effective, all players are limited to three different relationships per period.

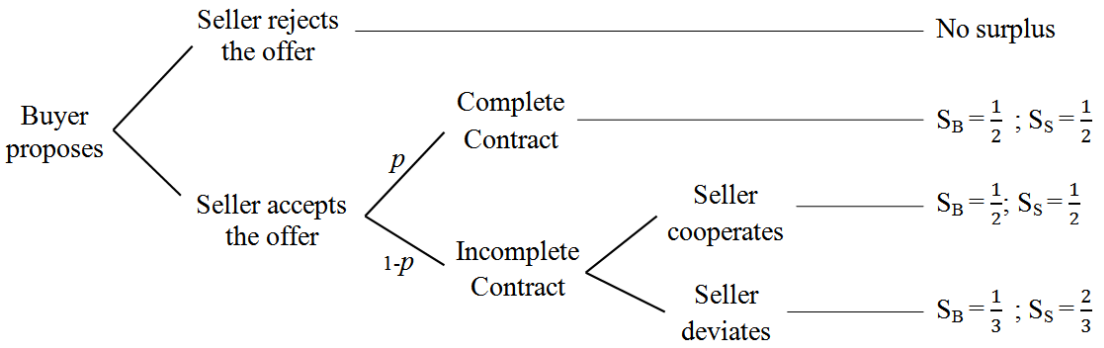
[47] An example of game instructions is provided in appendix 2. The results of the control questionnaire give a mean mark of 9,2/10 for a standard deviation equal to 1,1.

[48] Earnings in ECUs : $m = 583$, $\sigma = 182$. Earnings in Euros : $m = 14{,}6$, $\sigma = 4{,}6$. Duration of the session : between 15 and 30 minutes depending on treatments.

4.3.3 Incomplete contract and cooperation

In our experimental design, the surplus of the relationship is automatically and equitably shared between parties with a probability p; and, with a probability $1-p$ the sharing of the surplus is decided by the seller. According to the theoretical model we provide in section 2, the first case corresponds to a complete contract where contingencies are well foreseen and there is no need for *ex post* adaptation, while the second case corresponds to an incomplete contract where unanticipated contingencies arise and parties have to find a new agreement. This incomplete contract situation opens rooms for opportunistic behavior. Hence the sellers decide if they want to cooperate (*i.e.* to maintain an equitable sharing of the surplus) or to hold-up buyers (*i.e.* to have two-thirds of the surplus and leave one-third to the buyer). Figure 4.2 summarizes those first elements of the experimental design.

Figure 4.2: Matching, contractual completeness and surplus sharing



($S_B = \frac{1}{2}; S_S = \frac{1}{2}$) means that the surplus is shared equally between parties, while ($S_B = \frac{1}{3}; S_S = \frac{2}{3}$) means that the buyer gets one-third and the seller gets two-thirds of the surplus. The seller makes the decision only when contracts are incomplete, so that the game becomes similar to a dictator game in this case.

4.3.4 Additional investment and endogenous contractual incompleteness

The experimental design considers two different types of investment associated with contracting. On the one hand, both players have to bear an initial investment at the beginning of each new relationship (*i.e.* when they first play with a new partner). This initial investment can be compared to specific investment due to the implementation of the relationship. On the other hand, the buyers can decide to periodically incur an additional investment which allows them to minimize the risk of incomplete contract and, *de facto*, the risk to be held up. Such an additional investment could be compared to efforts to make the contract more complete. Contrary to the initial investment, those efforts can be made at the beginning of each new period (*i.e.* whether the partner is new or not).

More precisely, when they start a new relationship, a buyer and a seller both invest 6 ECUs (which is then the amount of initial investment). Thereafter, at the beginning of each round, the buyer can decide to invest 2 ECUs in order to limit the risk of incomplete contract in the current round. If the buyer does not make this additional investment, the probability $1 - p$ to face an incomplete contract is equal to 0.5. This probability falls to 0.25 when the buyer makes the additional investment.[49] Here we can notice that information about additional investment and associated probabilities are known by all players. Nevertheless, during the experiment, the sellers do not know if the buyers decide or not to make this additional investment. As a consequence, the choice of cooperation in case of incomplete contract cannot be analyzed as a reciprocal answer to the trust expressed by the buyers when they choose not to make the additional investment. The explanation of sellers' cooperation have to be found in the relational contract mechanism : cooperation might be reward by offers of relationships' renewal. In other words, the choice to not hold-up made by the seller is not due to the buyer's

[49] All the values assigned to the parameter of the experimental design are discretely determined by the authors. Nevertheless, values are established in order to ensure enough incentives to players and to hold specific conditions described in the subsection 3.5.

choice of contractual completeness (non observable) but relies on the repeated interactions (the buyer can discipline the seller by practicing a contingent renewal policy).

Table 4.1: Buyer's investment and likelihood of incomplete contract

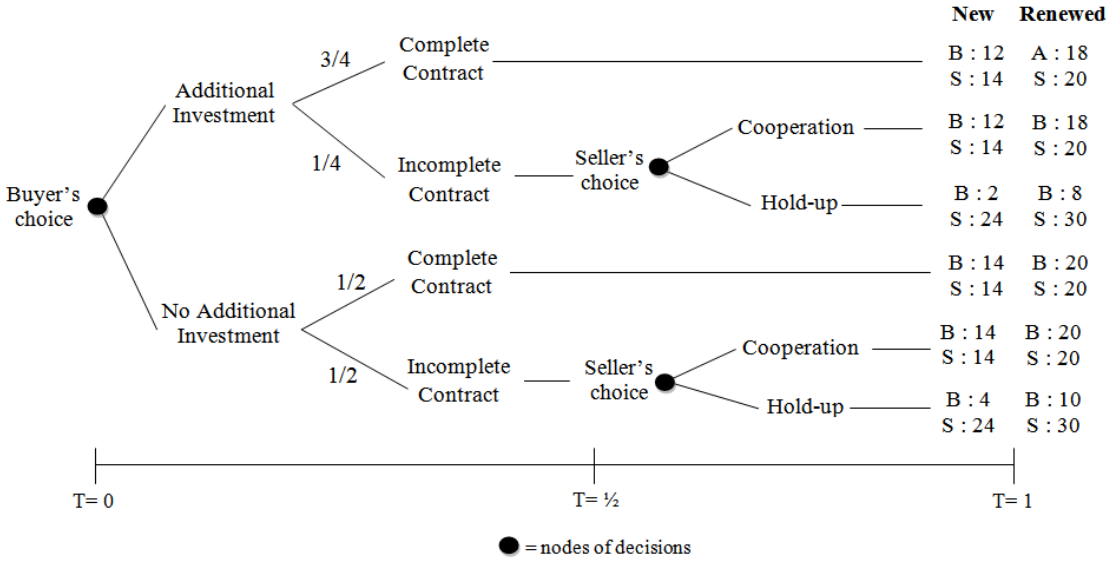
Additional Investment	0 ECU	2 ECUs
Likelihood of complete contract (p)	0,5	0,75
Likelihood of incomplete contract (1-p)	0,5	0,25

4.3.5 Payoffs

At the beginning of the experiment, all players have an initial capital of 0 ECUs. In the end, payoffs of players will be determined by the nature of the relationship (new or renewed) and their actions (additional investment or not of buyers and cooperative or opportunistic behavior of sellers). Figure 4.3 displays the payoffs tree (in ECUs) of players for all different situations. It is important to note that gains associated with the different actions are the same in all treatments. They were specifically designed to fulfill the following conditions:

- It is always profitable to have a relationship for players.
- In one shot-game, it is always profitable for sellers to deviate.
- In one shot-game, it is always profitable for buyers to protect themselves against risk of hold-up by making the additional investment.
- In infinitely repeated games, it is always profitable for buyers to make the additional investment if they know with certainty that sellers will deviate.
- In infinitely repeated games, it is never profitable for buyers to make the additional investment if they know with certainty that sellers will cooperate.

Figure 4.3: Payoffs



4.4 Treatments

In the previous section, we present the experimental design that holds for all treatments. In this section, we now focus on the parameters that will be modified between treatments in order to put to the test our propositions of section 2.

4.4.1 The duration of the game

When they come to the lab, the players are informed that they will play two different games without knowing what those two games will be. They discover them successively.

4.4.1.1 One shot game

The first game is a one shot game where players only interact during one period. There is only one matching procedure and no initial specific investment. According

to the design, buyers decide the level of completeness they want (*i.e.* additional investment) and sellers decide to cooperate or deviate in case of incomplete contract. Afterward, gains are announced to players and the game stops. Once this first game is ended, players receive instructions for the second game.

4.4.1.2 Infinitely repeated games

The second game is a repeated version of the one shot game. Obviously, identification numbers are redistributed among players in a manner that no information could be extracted from the first game. We run experiment in two different infinitely repeated games contexts by using a random continuation rule:

- In long-run repeated game (LR), players interact during at least six periods, thereafter they play successive additional periods with a probability of continuation $\delta = 0{,}8$.

- In short-run repeated game (SR), players interact during at least six periods, thereafter they play successive additional periods with a probability of continuation $\delta = 0{,}2$.

In infinitely repeated games with a continuation probability δ, the expected number of rounds is equal to $1/(1\text{-}\delta)$. Therefore, the expected numbers of rounds in our treatments are equal to 7 for $\delta = 0{,}2$ and 11 when $\delta = 0{,}8$.[50]
According to our propositions 1 and 3a, we expect to observe a higher level of sellers' cooperation and a lower level of buyers' additional investment when the time horizon is longer (*i.e.* when the probability of continuation is equal to 0,8).

[50]The probability of game continuation is common knowledge for all players at the beginning of the experiment.

4.4.2 The nature of information

4.4.2.1 Private information

When information is private, buyers can only observe behavior of sellers they are currently associated with. Nevertheless, they have no possibility to obtain information neither on the behavior of their partners in other relationships nor about other sellers they are not associated with. According to our proposition 4a, we expect to observe less buyers' additional investment in contractual completeness when their sellers cooperated in the previous periods.

4.4.2.2 Public information

When information is public, buyers still have information about sellers they are currently associated with but also about past behavior of all sellers present in the lab. More precisely, at the end of each period, buyers learn the percentage of cooperative versus non cooperative choices of sellers in all their relationships and in all previous periods.[51] As a result, the nature of information could modify the behavior of both players.

According to our proposition 2 and 3b, we expect to observe more sellers' cooperation and less buyers' additional investment in treatments with public information. Furthermore, according to our proposition 4b, reputation (of cooperative behavior) can be used by buyers as a proxy for seller's willingness to cooperate, hence we expect to observe less additional investment on contractual completeness when reputation built during previous periods is high.

[51] As soon as we have an incremental measure of sellers' reputation, we do not distinguish short run reputation (information about the last session) and long-run reputation (information about all sessions). See Keser (2002) for an interesting comparison between the effect of short-run reputation and long-run reputation in trust game.

4.4.3 Summary

Thus we have five different treatments of the experiment. A one shot game treatment (OSG) and four different infinitely repeated game treatments. The second and the third are treatments with a probability of continuation $\delta = 0{,}2$ after the fifth round. However, information is private in the treatment denoted SR (Short Run) and is public in the treatment denoted SRP (Short Run with Public information). The fourth and the fifth are treatments with a game discount $\delta = 0{,}8$ after the fifth round. Similarly, information is private in the treatment denoted LR (Long Run) and is public in the treatment denoted LRP (Long Run with Public information). Table 4.2 summarizes the different treatments.

Table 4.2: Treatments

Name	**OSG**	**SR**	**SRP**	**LR**	**LRP**
Type of the game	One shot game	Infinitely repeated game	Infinitely repeated game	Infinitely repeated game	Infinitely repeated game
Probability of continuation	0	0.2	0.2	0.8	0.8
Nature of information	-	Private	Public	Private	Public

4.5 Results

To test our four propositions described in subsection 2.4, we draw our attention on the determinants of seller's cooperation and the interaction between sustainable relational contract and contractual incompleteness. Nevertheless, before analyzing results coming from descriptive statistics and the econometrical analysis, we have to control if we can compare observations from our different treatments. Consequently, the first question is whether there is enough evidence to reject the proposition that samples of observations of our main variables (*i.e.* *Cooperation* and *Additional Investment*) are generated by the same stochastical process. As suggested by many studies, this is evaluated by using non parametric testing methods

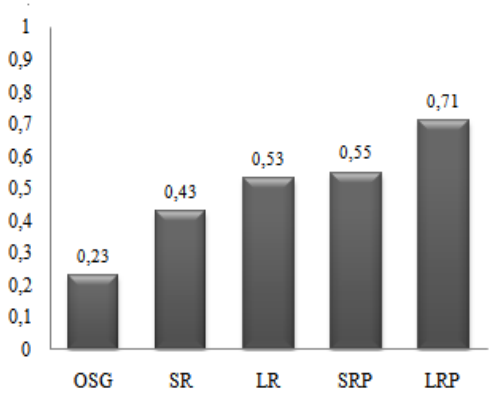
(Hackett 1993). The nonparametric Wilcoxon test reports are presented in Table 4.5 (in Appendix) where "Z" is the Wilcoxon score and "P>Z" is the significance level at which the null proposition of no difference in distribution is rejected. Most of the time, tests reject the null proposition of no difference in distribution of our variables between samples. Particularly, the null proposition is rejected at 1 percent level when we compare short run versus long run treatments on the one hand and private versus public information treatments on the other hand.

4.5.1 Descriptive Statistics

4.5.1.1 The determinants of cooperation

We begin our analysis with some statistics about the frequency of cooperative behavior of sellers[52] in case of incomplete contracts observed in the treatments described in the previous section (see Figure 4.4).

Figure 4.4: *Cooperation* of sellers (frequency by treatments)



All things being equal, we find that the duration of the game leads to higher levels of sellers' cooperation. In fact, cooperation is higher in the LR treatment than in

[52]This frequency means here the percentage of cooperative behavior among all the observed behavior.

the SR treatment (comparison under private information) and sellers also cooperate more often in the LRP than in the SRP treatment (comparison under public information). Thus, in accordance with proposition 1, a longer duration of the game enhances sellers to sustain informal cooperation. It means that the higher probability of continuation makes the cooperation strategy more chosen compared to the deviation one because the opportunity cost associated with a punishment by buyers increases with the likelihood of longer relationship.[53]

Observations are also consistent with our proposition 2 as we observe that sellers are more willing to behave cooperatively when they know that information about their past behavior is made public. Indeed, cooperation is higher in the SRP treatment than in the SR treatment (comparison under short duration) and sellers also cooperate more often in the LRP than in the LR treatment (comparison under long duration). The interpretation of this result is that the risk of deviation to be punished by non renewal becomes higher when it might be extended to all sellers' relationships.[54] It is consistent with the view that many subjects understand the logic of reputational incentives (Fehr et al. [2009]). Taking separately, longer duration and public information are real enhancing factors of cooperation. Moreover, the combination of these two factors (LRP treatment) leads to the highest level of cooperative decisions (71%).

4.5.1.2 Sustainable relational contract and endogenous contractual incompleteness

We pursue our analysis with some statistics about the frequency of additional investments made by buyers[55] (see Figure 4.5). In our experiment, the risk of facing an unforeseen contingency (opening room for sellers' opportunism) decreases

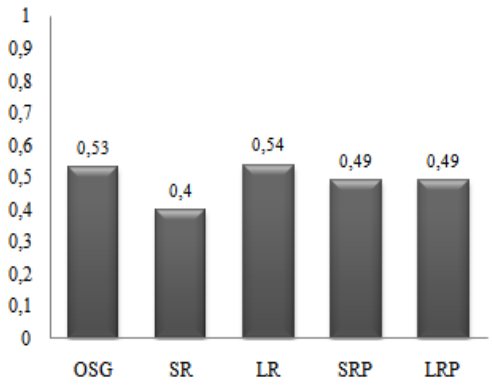
[53]Those observations are consistent with previous findings of experimental studies in different repeated games framework (Murninghan and Roth [1983], Engle-Warnick and Slonim [2006], Duffy and Ochs [2009], Dal Bo [2005]).

[54]Here again, this observation is consistent with previous experiments findings on the positive impact of reputational concerns on cooperative behavior (Fehr et al. [2009], Bolton et al. [2005]).

[55]This frequency means here the percentage of additional investment among all the observed behavior.

with the level of buyer's periodic efforts to complete the contract. In other words, buyers have to invest more (additional investment) in order to lower the risk of incomplete contract in which case sellers make the decision of surplus sharing.

Figure 4.5: *Additional Investment* of Buyers (frequency by treatments)

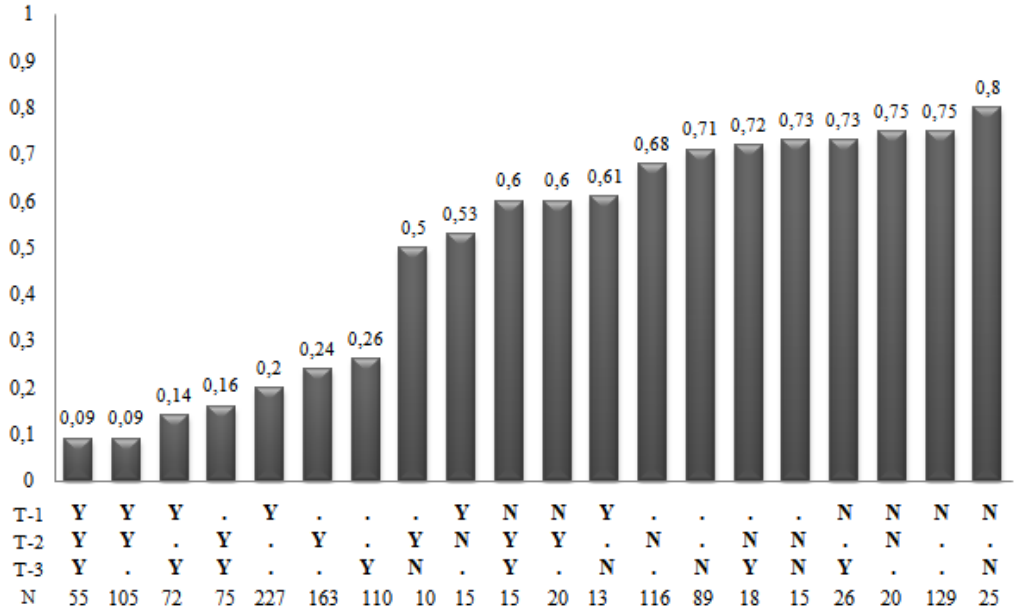


The comparison between SR and LR treatment on the one hand and SRP and LRP treatment on the other hand is not consistent with our proposition 3a. As for proposition 3b, levels of additional investment are equal between SRP and LRP treatment while buyers invest more in contractual completeness in the LR than in the SR treatment. Observations neither provide support for our proposition 3b. Actually, buyers' additional investment are higher in the SRP than in the SR treatment and buyers invest more in contractual completeness in the LR than in the LRP treatments. It indicates that neither longer duration nor public information do not lead to lower level of additional investment. This appears as surprising observations. It seems that buyers do not anticipate the higher incentives of the sellers to cooperate under public information and long game duration, and then do not react accordingly by choosing a lower level of additional investment. In other words, although reputational concerns provide incentives for sellers to behave cooperatively, buyers do not invest less in contractual completeness. As a consequence, both propositions 3a and 3b are rejected and it seems that we

cannot make conclusions about the direct effect of the probability of continuation and the nature of information about behavior of sellers on the level of additional investment chosen by buyers.

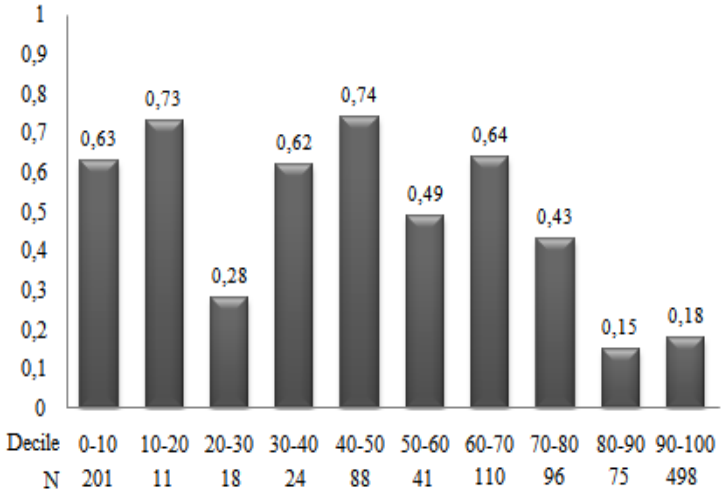
However, in subsection 2.4.3, we recall that under asymmetric information, buyers may learn over time and adapt their behavior. If the perspective of future interactions and public information are not the determinants of endogenous contractual incompleteness, an alternative could be to investigate the link between past experimentations and subsequent choices of buyers in terms of additional investment. Here, our intuition is that the perspective of future business is not sufficient to lower the investment in contractual completeness, yet, reputation building over time could influence this decision. Following this intuition, Figure 4.6 shows the frequency of additional investment of buyers according to the observed behavior of sellers during the last three periods and Figure 4.7 shows the frequency of additional investment of buyers according to the reputation of sellers observed in the last period (*i.e.* frequency of cooperative behavior of sellers ranked by decile) in treatments where information is public.

Figure 4.6: Buyer's *Additional Investment* depending on sellers' past *Cooperation*



The first column means that when the seller cooperated in the last three rounds, only 9% of the buyers make the additional investment. The fifth column means that when the seller cooperated to the previous period (T-1), but the contract was complete during the two anterior periods (T-2 and T-3), then 20% of the buyers make the additional investment.

Figure 4.7: Buyer's *Additional Investment* depending on sellers' *Reputation*
(in SRP and LRP treatments)



The first column means that 201 sellers cooperated in less than 10% of the cases of contractual incompleteness, and 63% of the buyers choose to make additional investments when they interact with those sellers.

Buyers are less likely to invest *ex ante* when sellers were cooperative during previous rounds. The lowest three rates of additional investment (*i.e.* 9%; 9% and 14%) correspond to situations where buyers only observe cooperative behavior during the last three rounds. On the opposite, the highest three rates (*i.e.* 75%; 75% and 80%) correspond to situations where buyers only observe opportunistic behavior during the last three rounds. Moreover, we also observe a gap in buyers' behavior: as soon as there is at least one opportunistic behavior during the last three periods, the *Additional Investment* rate of buyers switches from 26% to 50%. Such an observation indicates that opportunistic behavior of sellers in the past make buyers more wary. This is consistent with (relational contract theory based on) trigger strategy which assume cooperative choices so long as no party has defected from the implicit agreement in past interactions.

A same effect is observed in Figure 4.7 when we look at the impact of sellers' reputation. We find that the lowest rate of *Additional Investment* is reached when sellers are known to be cooperative. For instance, the frequency of additional investment of buyers is equal to 18% when they observed that seller's reputation is higher than 90%. Similarly, a high rate of *Additional Investment* is reached when sellers are known to be opportunistic (the frequency of additional investment of buyers is equal to 63% when they observed that seller's reputation is lower than 10%).

In the end, those descriptive statistics reject the direct impact of reputational concerns on the level of additional investment decided by buyers. Nevertheless, they highlight a strong interaction between past cooperative behavior of sellers and choices of buyers in terms of contractual completeness. Thus, they confirmed our propositions 4a and 4b arguing that the more cooperative the past interactions between the parties are, the more incomplete the contracts proposed by buyer are under private information and that, the more cooperative the seller has been in all her past interaction, the more incomplete the contracts proposed by the buyers to this seller are under public information.

4.5.2 Panel Data Analysis

Our experiment allows us to obtain panel data where panel variables are all the different relationships between buyers and sellers and where time variables are successive rounds. Thus we can also test econometrically our propositions.

4.5.2.1 The determinants of cooperation

Table 4.3 provides the results of logit estimation of sellers' *Cooperation*.[56] For each model, we look at the impact of the *Probability of Continuation* (*PC*) and *Public Information* (*PI*) on the choices of sellers to cooperate or not in case of incomplete contract. We also add a set of control variables which includes the number of previous interactions between the seller and the buyer (*Past Experiences*), the number of ongoing relationships of the seller during the round (*Ongoing Relationships*), the "level" of altruism identified in each particular session (*Altruism*)[57] and a dummy variable which indicates that relationships take place after the round 5 (*Round 6*), *i.e.* when uncertainty of playing next periods starts. Finally, to tackle the issue of potential fixed effects, we include control variables about the age (*Age*), the sex (*Sex*), the status (*Status*) and the discipline (*Discipline*) of each seller and we cluster on sellers' level.

[56] All the variables used in the estimations, their descriptive statistics and the correlation matrix are provided in appendix.

[57] As previously said, participants first play a one shot game without knowing that they will play a repeated game after. Since there is any incentive to cooperate in the one shot game, we use the level of cooperation observed during the one shot game as a measure of the proportion of altruistic players present in the lab.

Table 4.3: Logit analysis of Sellers' *Cooperation*

	Model 1 All sample	Model 2 PI = 0	Model 3 PI = 1	Model 4 PC = 0	Model 5 PC = 1
Probability of Continuation (PC)	0.481**	0.347	0.722**	-	-
	(0.170)	(0.210)	(0.268)	-	-
Public Information (PI)	0.862***	-	-	0.648*	0.817***
	(0.167)	-	-	(0.298)	(0.211)
Past Experiences	0.084**	0.109**	0.026	0.146	0.047
	(0.030)	(0.034)	(0.051)	(0.093)	(0.035)
Ongoing Relationships	0.737***	0.732*	0.807**	0.640*	0.920***
	(0.203)	(0.362)	(0.252)	(0.320)	(0.273)
Altruism	0.007	0.011	0.005	-0.007	0.008*
	(0.004)	(0.007)	(0.005)	(0.013)	(0.004)
Round 6	-1.097***	-1.295***	-0.877*	-2.059***	-0.537
	(0.232)	(0.321)	(0.351)	(0.390)	(0.284)
Control Variables	yes	yes	yes	yes	yes
Constant	-4.112***	-4.624***	-2.054*	-2.916**	-5.029***
	(0.745)	(1.291)	(0.954)	(1.026)	(1.271)
R^2	0.08	0.09	0.06	0.12	0.08
Predict	66.6	63.2	71	69.5	69.5
N	935	456	479	334	601

Level of significance: *:p<0,05 ; **:p<0,01 ; ***:p<0,001

Results of Model 1 confirm the observations coming from descriptive statistics. Coefficients associated with the variables *Probability of Continuation* (prop. 1) and *Public Information* (prop. 2) are positive and significant. It means that cooperative behavior is more likely to emerge in situations where the expected length of the relationship is long and the information about cooperative or uncooperative sellers' past behavior is public.

To gain more insight on the impact of the duration of the game on sellers' cooperation, we split the sample into two subsamples : one with data from private information treatments and the other with data from public information treatments. Hence, we isolate the direct impact of our variable *Probability of Continuation* (Models 2 and 3). Results show that the duration of the game is an enhancing factor of cooperative behavior when information is public. On the contrary, the probability of continuation does not encourage cooperation when the information is private.[58] We use the same method to study the direct effect of public information. Hence, Models 4 and 5 estimate the cooperative choices of sellers in case of incomplete contract on two subsamples (one with data from short run treatment

[58]As we will discuss later, such a result can be explained by the existence of sellers' strategic behavior when information is private.

and the other with data from long run treatment). Results show that public information is always an enhancing factors of cooperation. This result is consistent with previous studies which highlight reputational concerns as a powerful amplifier of cooperative behavior (Fehr et al. [2009]). However, we can notice that this effect is of higher magnitude (and also more significant) when the duration of the game is longer. Moreover, Table 4.3 also show that endgame effect is reduced when we focus on treatment characterized by the higher probability of continuation. Indeed, the variable *Round 6* is not significant in Model 5 while it is always significant in all other specifications.

In the end, our findings indicate that both longer duration and public information enhance cooperation, especially when they are used in the meantime. In the following subsection, we now study the impact sustainable relational contracts have on endogenous contractual incompleteness.

4.5.2.2 Sustainable relational contract and contractual incompleteness

Table 4.4 provides the results of logit estimation of buyers' *Additional Investment*. For each model, we look at the impact of the *Probability of Continuation* (*PC*) and *Public Information* (*PI*) on the choices of buyers to invest in contractual completeness or not at the beginning of each period. Furthermore, according to what we find with the descriptive statistics, we also introduce variables about sellers' past behavior. On the one hand, we have the variable *Lagged.Cooperation* that counts for the number of time the seller decides to cooperate in the past in case of incomplete contract in the relationship with the buyer; on the other hand, the variable *Lagged.Reputation* that counts for the number of time the seller decides to cooperate in the past in case of incomplete contract in all her relationships (information only available in SRP and LRP treatments). The set of control variables we include is the same than previously (*Past Experiences*, *Ongoing Relationships*, *Altruism*, *Round*, *Age*, *Sex*, *Status* and *Discipline*) and only differs from the addition of a new variable about the "level" of risk aversion (*Risk Prone*) identified in

each particular session.[59] Here also, we cluster on buyers' level.

Table 4.4: Logit analysis of Buyers' *Additional Investment*

	Model 1 All sample	Model 2 PI = 0	Model 3 PI = 1	Model 4 PC = 0	Model 5 PC = 1	Model 6 PC = 0 PI = 1	Model 7 PC = 1 PI = 1
Probability of Continuation (PC)	0.612**	1.178***	0.130	-	-	-	-
	(0.198)	(0.253)	(0.297)	-	-	-	-
Public Information (PI)	-0.356	.	.	-0.688	-0.541	.	.
	(0.264)	-	-	(0.518)	(0.335)	-	-
Lagged.CumulCooperation	-0.671***	-0.843***	-0.636***	-1.021***	-0.835***	-0.494*	-0.699***
	(0.110)	(0.134)	(0.134)	(0.197)	(0.111)	(0.242)	(0.160)
Lagged.Reputation	-0.012***	-	-0.019***	-	-	-0.019***	-0.020**
	(0.003)	-	(0.004)	-	-	(0.005)	(0.008)
Past Experiences	0.136**	0.177**	0.170***	0.023	0.179**	-0.073	0.212***
	(0.052)	(0.063)	(0.050)	(0.106)	(0.055)	(0.161)	(0.054)
Ongoing Relationships	0.012	0.281	-0.053	0.480*	-0.321	0.434	-0.408
	(0.172)	(0.235)	(0.262)	(0.238)	(0.200)	(0.341)	(0.329)
Altruism	-0.014**	-0.020*	-0.006	-0.031*	-0.014**	-0.026	-0.004
	(0.005)	(0.009)	(0.005)	(0.016)	(0.005)	(0.019)	(0.007)
Risk Adversity	-0.004	-0.016	0.001	-0.015	-0.002	-0.013	-0.000
	(0.005)	(0.010)	(0.005)	(0.013)	(0.005)	(0.018)	(0.007)
Round 6	0.666***	0.427	0.918**	1.151***	0.707**	1.220*	0.988**
	(0.183)	(0.226)	(0.280)	(0.338)	(0.229)	(0.519)	(0.383)
Control Variables	yes	yes	yes	yes	yes	yes	yes
Constant	0.803	0.972	0.198	0.319	1.533	1.136	1.098
	(0.676)	(0.941)	(1.037)	(1.155)	(1.008)	(2.307)	(1.483)
R^2	0.23	0.23	0.24	0.14	0.23	0.18	0.28
Predict	74.3	72.3	76.8	68.2	75.6	71.2	78.8
N	1963	1046	968	711	1384	340	628

Level of significance: *:p<0,05 ; **:p<0,01 ; ***:p<0,001

Results of Model 1 confirm the surprising results observed through descriptive statistics in the previous subsection. Actually, the coefficient associated with our variable *Probability of Continuation* is positive and significant, meaning that buyers are more prone to pay for contractual completeness when the duration of the game is longer. In the same way, we do not find any significant impact of the nature of information. Here again, we divided the sample in different subsamples in order to study more carefully the direct impact of the duration of the game and the nature of information on buyers' *Additional Investment*. On the one hand, the comparison between Models 4 and 5 confirm that the nature of information, whether public or private, does not directly modify the choice of buyers in terms

[59] As for the variable *Altruism*, participants first play a one shot game without knowing that they will play a repeated game after. Since there is any incentive for sellers to cooperate in the one shot game, buyers have strong incentives to protect themselves as much as they can. Thus, we use the level of no additional investments observed during the one shot game as a measure of the proportion of risk prone players present in the lab

of *Additional Investment*. On the other hand, the comparison between Models 2 and 3 highlights that a longer duration of the game make buyers more willing to invest in completeness but only when information is private.

Hence our propositions 3a and 3b, previously infirmed by descriptive statistics, are also rejected by econometric tests. However, the existence of an indirect effect through cooperative behavior of sellers is clearly observable: past cooperative behavior of sellers promotes less contractual completeness. This effect is highly significant in Model 1 but also in Models 2 to 7 where we successively isolate the impact of the *Probability of Continuation* and the *Public Information*. In all those estimations, the main factor explaining buyers' choices in terms of *Additional Investment* is our variable *Lagged.CumulCooperation*. The negative and significant coefficients associated with this variable indicates that buyers are less likely to invest in contractual completeness when they learn that they are associated with cooperative sellers. Similarly, the coefficients associated with our variable *Lagged.Reputation* are negative and significant. In spite of the fact that the nature of information does not directly influence sellers' behavior in terms of *Additional Investment* (the variable *Public Information* is not significant in Models 4 and 5), we observe that in treatments where information is public, this information is used by buyers to determine the level of contractual completeness they want. Actually, the more the seller appears as cooperative, the less the buyer is prone to invest in completeness. Furthermore, our variable *Lagged.CumulCooperation* is still significant even when we introduce our variable *Lagged.Reputation*. It means that buyers not only take into account their personal interactions with each particular seller but they also care about the behavior of the seller outside of their relationship. We interpret this result by the key role played by past reputation: sellers' reputation helps two different type of buyers in their decisions. On the one hand, it could reinforce or moderate information obtained by buyers through direct interactions; on the other hand, it could be used by buyers who do not know yet the seller as a proxy for the willingness to cooperate. In the end, our results show that less complete contracts are observed in highest cooperative past relationships and with highest reliable

sellers. As a consequence, we can affirm that the sustainability of relational contracts over time encourage buyers to reduce the level of contractual completeness. A learning process is needed to determine the type of seller (*i.e.* her ability to sustain the relational contract).[60]

Finally, to check for robustness, all the results presented in this section are also analyzed without taking into account the first fifth rounds where the probability of continuation is equal to one. Figures 4.9 and 4.10 and Tables 4.8 and 4.9 provided in Appendix show highly similar results.

4.6 Discussion

4.6.1 Strategic behavior

As previously emphasized, an unexpected result appears in Table 4.4 with the positive and significant sign associated with our variable *Probability of Continuation* in case of private information. We consider that the explanation comes from the existence of strategic behavior of sellers. Indeed, although long duration of the game facilitates cooperation, it does not imply that sellers always cooperate. As observed in the data, and as confirmed by informal discussions with participants at the end of experiments, sellers in repeated game are more willing to imagine strategies than to follow a specific behavior.[61] In most of the cases, such strategies take two forms : cooperate most of the time and hold-up occasionally in order to increase their earnings while avoiding the risk of being punished by buyers, or always cooperate at the beginning of the game in order to build reputation of reliability and hold-up more and more frequently when the game was extended periods by periods. Consequently, buyers also have to periodically revise their beliefs and

[60] Such a timing is confirmed by the results of the two stages estimation provided in Table 4.10 in Appendix.

[61] This is also illustrated by the fact that the coefficient of dispersion D ($D = \sigma^2/\mu$; variance-to-mean ratio) of the behavior of sellers in terms of *Cooperation* is clearly higher in treatments where information is private : $D_{SR} = 0.87$; $D_{LR} = 0.90$; $D_{SRP} = 0.65$; $D_{LRP} = 0.65$.

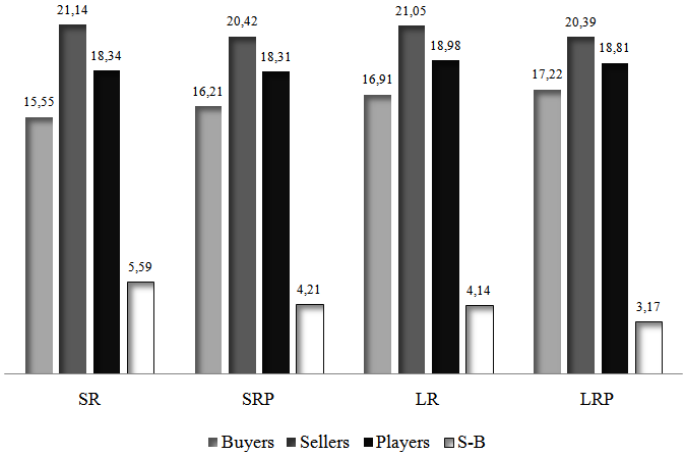
to protect themselves by investing more in contractual completeness. Since those kind of strategies are easier to implement on the long run and when such strategic behavior have lower risk to be broadly discovered, it could explain why, if and only if information is private, we have a positive and significant sign associated with the variable *Probability of Continuation* in the econometric analysis of *Additional Investment* (Model 2, Table 4.4) and why this same variable *Probability of Continuation* does not significantly impact on sellers' cooperation (Model 2, Table 4.3).

4.6.2 Performances

Those strategic behavior of players can also be related to the study of performance. As the primary concern of the paper is to study the interaction between sustainable relational contract and endogenous contractual incompleteness, we do not focus on the performance of the different treatments. Nevertheless, according to theoretical predictions and to the experimental design, we could expect that highest performances will correspond to the LRP treatment. Actually, the more reputational incentives are effective in terms of sellers' cooperation, the more buyers are able to economize on additional investment, so the global performance increases. Observations of data do not reach this legitimate expectation. Figure 4.8 shows the average payoffs of players for each treatment. Despite the fact that the average payoff of buyers is maximized in the LRP treatment, this is not the case nor for sellers neither for "players" (both buyers and sellers). The higher average payoff of sellers corresponds to the SR treatment while the higher average payoff of "players" corresponds to the LR treatment. Here again, the explanation can be found in the existence of strategic behavior of sellers. In short run treatment without public information, sellers try to maximize their gains by cheating every time they can. Following a same reasoning, sellers also develop strategic behavior in long run treatments without public information by cheating occasionally with their different buyers. However, although the LRP treatment does not maximize

the average payoff of "players", it appears as a second best situation and also has the advantage of reducing inequalities in payoff distribution. Figure 4.8 shows that the difference between the average payoff of sellers and buyers is maximized in the SR treatment (5.59 ECUs) but is minimized in the LRP treatment (only 3.17 ECUs).

Figure 4.8: Mean of performances of players (in ECUs)



4.6.3 Outside option

As emphasized in the discussion of our testable implications, incentives provided by the outside option depend on the levels of competitive pressure, specific investments and information sharing. In our experimental design, only the nature of information varies (specific investment is fixed to 6 ECUs and the competitive pressure is always established through a maximum of three authorized relationships per round). As a consequence, the existence of credible outside option in our experiment can be considered as low. Such a statement is confirmed by the few cases of relationships failures we observed in the data (10% of relationships are ended when buyers observe opportunistic behavior). Most of the time, the buyers prefer to increase the level of contractual completeness rather than to start a new relationship. It might be worthwhile to compare our actual results with sessions

including more potential partners and/or with different levels of initial investment to observe the subsequent choices of buyers and sellers. An interesting extension has to be found in Brown et al. [2008]. In this paper, the authors study the performance of relational contract with variations in the market structure: they refer to *high-demand* market when there is more principals than agents and, inversely, to *low-demand* market when there is less principals than agents.

4.6.4 Limitations

Our study leaves other directions open for future extensions. The first concern is about the extent to which the results in this study are robust to changes in the payoffs parameters. In the experiment, the level of payoffs does not vary since we are primarily interested in the enhancing factors of cooperation and their implications on the level of contractual completeness. Nevertheless, one can expect that the level of payoffs may impact on the behavior of buyers and sellers. For instance, a case where the hold-up is high for sellers (i.e. possibility to grab all the surplus) and strongly dangerous for buyers (*i.e.* negative payoffs) may modify their respective behavior in terms of cooperation and investment in contractual completeness. A second concern is that we only focus in this paper on one-side opportunism (only sellers have the possibility to deviate). Obviously, in classical buyer-seller relationship, buyers can also deviate (payment default for instance) and sellers could want to learn their partner's type. Then, an interesting extension will be to enrich the experimental design in order to allow both players to choose between cooperation or deviation in the surplus sharing and to define the level of contractual completeness they want. Such an experiment can provide us with a more satisfactory analysis of the interplay between cooperative relationships and subsequent choices in terms of contractual completeness. Finally, another extension that could be worthwhile to investigate would be to allow players to have more or less profitable relationships (or similarly to specify more or less important payoffs for different relationships). Such a design would help us to observe how the

causality between relational contract and endogenous contractual incompleteness could also be influenced by the profitability of relationships. All those possible extensions are as many alleys for future researches in this exciting topic.

4.7 Conclusion

The primary purpose of this study was to examine the interplay between sustainable relational contract and endogenous contractual incompleteness. The series of experiments shed new lights on this topic. Evidence suggests that reputational concerns - through higher probability of continuation and public information - are enhancing factors of sustainable relational contract but also that the more or less cooperative behavior of sellers has a strong consequence in the subsequent choices made by buyers in terms of contractual completeness. Buyers clearly appear less prone to protect themselves (by investing more in the contractual design) when they are associated with cooperative sellers than uncooperative ones. It means that buyers adapt their investment in contractual completeness according to what they learned in previous periods and they decide themselves to incur lower costs in contractual safeguard mechanisms only when they really observe cooperative behavior. Those results are a step forward on the path to improve our understanding of the dynamics of contractual incompleteness. For instance, it might be used to explain many situations of "lock-in" effect where a firm (or a public authority) prefers to keep its actual partner (or operator) or to choose the same one for a new project despite the presence of other potential and cheaper partners. The learning process allow parties to know each other and to build contractual design accordingly, making the change of partners potentially risky and more expensive than the cost reduction proposed by the alternative option. It also highlights the importance of considering past experiences in the choice of partner and level of safeguard mechanisms foreseen by the contract.

4.8 Appendix

4.8.1 Experimental instructions

*The following instructions were handed out to the participants in the **LRP treatment***

Instructions

You participate in an economic experiment which takes place in a computer room. We inform you that during this experiment it is purely forbidden to have talks. If you follow carefully the instructions, you will make gains and you will be paid in cash at the end of the experiment.
Please note that the following guidelines are applicable to all candidates.
The currency used during the experiment is the ECU (Experimental Currency Unit), and all the transactions will only be denominated in ecus. At the end of this session, your gains will be paid in Euro according to the following exchange rate: 40 ECUs for 1 EURO.

Parts of the experiment

The participants of the experiment are assigned to two different groups:

- Group A: 6 participants: from A_1 to A_6.
- Group B: 6 participants: from B_1 to B_6.

The participants have to assume the role of their group (A or B) and number (from 1 to 6) until the end of the experiment. This way, you can identify the other participants with who you are going to interact throughout the experiment. You start the experiment with 0 ECUs. The experiment is composed of an undetermined number of periods.

The relationship

In order to improve your decision-making and to optimize your understanding of the decisions made by the other participants, there is some information about the relationships' functioning. During this experiment, you are going to make other participants your partners in. These partnerships allow your partner and you to make some profits.

Players A will suggest partnerships to Players B. Players B will have the choice to accept or refuse the partnerships' suggestions made by Players A. You will be able to make at the most three different partnerships by periods. It is also possible that according to the other participants' choices you will have 0 partnerships sometimes.

Investment

When you create a partnership for the first time, both of the participants (A and B) will have to invest 6 ECUs. This investment has to be made only once. This way, if you repeat the partnership during the following period, the two participants will not have to invest 6 ECUs again. Yet, if two participants who were already in a partnership before decide to get into a partnership again, both of them will have to invest again 6 ECUs because they did not repeat the partnership during the following period.

"Situations" and "choices"

When a partnership is created, two types of situations can happen (according to the probabilities given between parentheses) :

- Situation 1 (probability : 50%) : the partnership yields 40 ecus which are automatically split into two equals part. Both participants receive 20 ECUs.
- Situation 2 (probability : 50%) : the partnership yields 40 ecus but in this case, the distribution of the profits depends of the choice of the B participant. B will choose between:
  - Choice 1 : A wins 20 ECUs and B wins 20 ECUs
  - Choice 2 : A wins 10 ECUs and B wins 30 ECUs

Additional Investment

At the beginning of each period, players A can decide to make an additional investment of 2 ECUs in order to change the probabilities assigned to the situations 1 and 2. This additional investment allows players A to obtain the situation 1 with a probability of 75% and the situation 2 with a probability of 25% (to compare with the 50%-50% probability when there is not additional investment) for the current period.

Information

At the end of each period, players A are informed about the choices made by all players B during the past periods. This way, players A can notice the distribution (in percentage) of the choices made by players B between the choice 1 and the 2 during all the past periods.

The sequence of one period

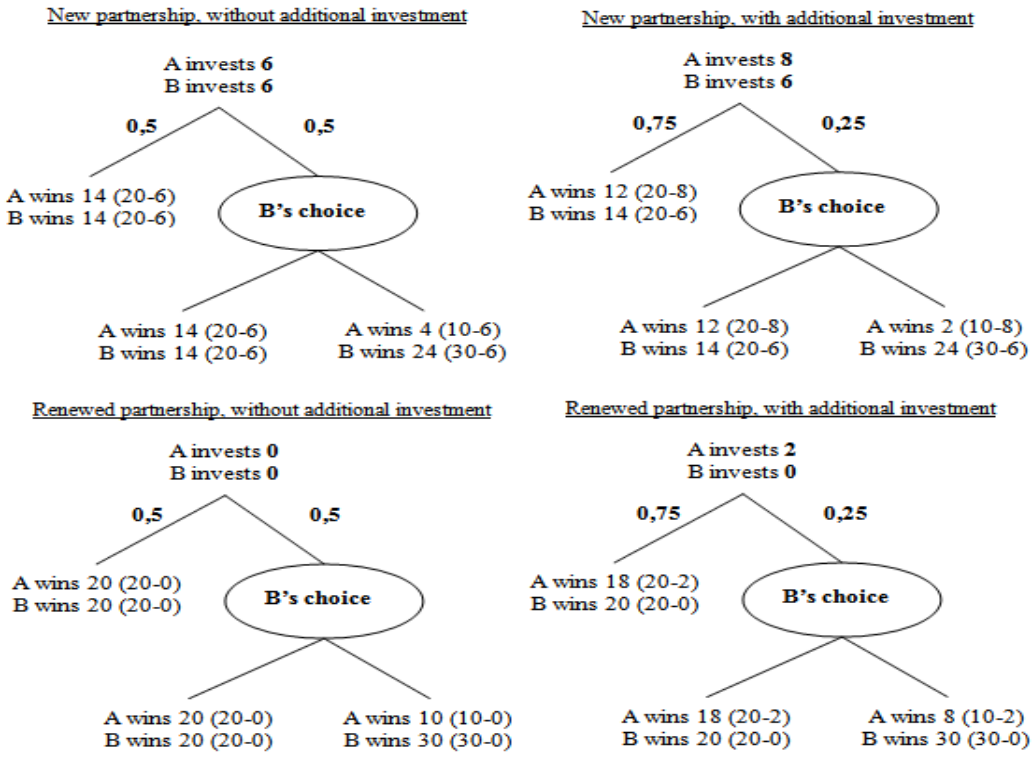
- Step 1. Players A suggest partnerships to players B. (At most 6 propositions)
- Step 2. Players B accept or reject partnership offers from players A. (At most 3 accepted partnerships)
- Step 3. Players A choose at most 3 players B among positive answers.
- Step 4. Players A choose the level of their investment. (Players B do not know the investment level chose by players A)
- Step 5. All participants learn the repartition of their partnerships between situations 1 and 2.
- Step 6. Players B choose surplus sharing in case of situations 2.
- Step 7. All participants learn their gains for the current period, then their cumulative gains for the whole experiment.
- Step 8. Players A learn the choice made by all players B in their partnerships since the beginning of the experiment.
- Step 9. Players A can decide to stop some of their partnerships (or all of them) or to suggest to players B to pursue some of their partnerships (or all of them).
- Step 10. Players B accept or reject partnership's renewals' offers from players A.
- Step 11. Players A can suggest partnerships to players B with who they were not associated within the current period.
- $\rightarrow$ Go back to Step 2.

Length of the experiment

The experiment entails at least 6 periods. After which, the experiment continues period by period with a probability 0,8. In other words, at the end of the sixth period, there are 8 in 10 chances to play an extra seventh round. At the end of this seventh period, there are 8 in 10 chances to play an extra eighth. And so on...

Payoffs

The figure below summarizes gains associated with different situations and actions of players.



4.8.2 Tables and Figures

Table 4.5: Samples, non-parametric test results (Wilcoxon scores)

Variables	Samples	Z	Probability >Z
Cooperation	SR vs SRP	-2.187	0.0287
	SR vs LR	-0.963	0.3358
	SR vs LRP	-5.555	0.0000
	SRP vs LR	1.309	0.1905
	SRP vs LRP	-3.301	0.0010
	LR vs LRP	-5.555	0.0000
	Short Run vs Long Run	**-3.046**	**0.0023**
	Private vs Public information	**-5.021**	**0.0000**
Additional Investment	SR vs SRP	-0.085	0.9321
	SR vs LR	-4.562	0.0000
	SR vs LRP	0.530	0.5959
	SRP vs LR	-4.565	0.0000
	SRP vs LRP	0.630	0.5287
	LR vs LRP	0.530	0.5959
	Short Run vs Long Run	**-2.870**	**0.0041**
	Private vs Public information	**3.966**	**0.0001**

Table 4.6: List of variables and summary statistics

Variable	**Description**	**Obs.**	**Mean**	**St. Dev.**	**Min.**	**Max.**
Cooperation	Dummy variables indicating whether the seller decide to cooperate (1) or not (0).	935	0.58	0.49	0	1
Additional Investment	Dummy variables indicating whether the buyer decide to make an additional investment at the beginning of the round (1) or not (0).	2450	0.44	0.50	0	1
Probability of continuation	Dummy variables indicating whether the probability of continuation is high (1) or low (0).	5400	0.63	0.48	0	1
Public Information	Dummy variables indicating whether the information about sellers' past behavior is public (1) or not (0).	5400	0.51	0.50	0	1
Past Experiences	Number of past interactions between the seller and the buyer during previous rounds.	5400	7.2	3.6	0	19
Ongoing Relationships (Buyer)	Number of ongoing relationships of the buyer in the current round.	5400	2.72	0.57	0	3
Ongoing Relationships (Seller)	Number of ongoing relationships of the seller in the current round.	5400	2.72	0.58	0	3
Reputation	Percentage of cooperative decisions made by each seller in all the previous periods and in all its relationships.	2308	56.75	42.77	0	100
Cumul Cooperation	Percentage of cooperative behavior of seller in all the previous periods of their relationship.	2322	0.53	0.45	0	1
Altruism	Percentage of "altruistic players" identified during the one shot game.	16	21.81	20.94	0	66.6
Risk Prone	Percentage of "risk prone players" identified during the one shot game.	16	56.94	28.18	0	100

Table 4.7: Correlations

	1.	2.	3.	4.	5.
1. *Cooperation*					
2. *Additional Investment*	-0.233				
3. *Probability of Continuation*	0.124	0.067			
4. *Public Information*	0.160	-0.109	0.014		
5. *Cumulative Cooperation*	0.480	-0.255	0.255	0.077	
6. *Reputation*	0.765	-0.288	0.108	0.216	0.527
7. *Past Experiences*	0.050	0.040	0.316	-0.071	0.648
8. *Ongoing Relationships* (Buyers)	0.063	-0.027	0.029	-0.033	0.103
9. *Ongoing Relationships* (Sellers)	0.117	-0.052	0.074	-0.039	0.219
10. *Altruism*	0.089	-0.053	0.269	-0.182	0.264
11. *Risk Prone*	0.081	-0.089	-0.337	0.672	0.001

	6.	7.	8.	9.	10.
7. *Past Experiences*	0.120				
8. *Ongoing Relationships* (Buyers)	0.081	0.147			
9. *Ongoing Relationships* (Sellers)	0.261	0.221	0.094		
10. *Altruism*	0.111	0.397	0.120	0.124	
11. *Risk Prone*	0.154	-0.181	-0.017	-0.059	-0.295

Table 4.8: Logit analysis of Sellers' *Cooperation* - Rounds > 5

	Model 1 All sample	Model 2 PI = 0	Model 3 PI = 1	Model 4 PC = 0	Model 5 PC = 1
Probability of Continuation (PC)	1.281***	2.100*	0.911*	-	-
	(0.389)	(0.960)	(0.448)	-	-
Public Information (PI)	0.919***	-	-	0.865*	0.633*
	(0.241)	-	-	(0.397)	(0.285)
Past Experiences	0.066	0.080*	0.029	0.241	0.057
	(0.034)	(0.037)	(0.062)	(0.174)	(0.038)
Ongoing Relationships	1.438*	3.213	1.116*	-0.599	2.603*
	(0.559)	(2.389)	(0.494)	(1.006)	(1.175)
Altruism	0.007	0.001	0.009	0.002	0.006
	(0.004)	(0.007)	(0.005)	(0.025)	(0.004)
Control Variables	yes	yes	yes	yes	yes
Constant	-9.434***	-15.862	-7.865***	-2.396	-14.137***
	(2.086)	(8.522)	(2.153)	(3.052)	(3.510)
R^2	0.17	0.21	0.13	0.06	0.18
Predict	73.4	77.6	71.3	71.7	74.4
N	447	210	237	99	348

Level of significance: *:p<0,05 ; **:p<0,01 ; ***:p<0,001

Table 4.9: Logit analysis of Buyers' *Additional Investment* - Rounds > 5

	Model 1 All sample	Model 2 PI = 0	Model 3 PI = 1	Model 4 PC = 0	Model 5 PC = 1	Model 6 PC = 0 PI = 1	Model 7 PC = 1 PI = 1
Probability of Continuation (PC)	0.649*	1.504***	0.354	-	-	-	-
	(0.273)	(0.371)	(0.406)	-	-	-	-
Public Information (PI)	-0.203	-	-	-1.406*	-0.339	-	-
	(0.388)	-	-	(0.679)	(0.505)	-	-
Lagged.Cooperation	-0.658***	-0.725***	-0.706***	-0.838**	-0.799***	-0.872*	-0.699***
	(0.114)	(0.127)	(0.146)	(0.264)	(0.108)	(0.440)	(0.168)
Lagged.Reputation	-0.011*	-	-0.013*	-	-	-0.010*	-0.023*
	(0.005)	-	(0.006)	-	-	(0.004)	(0.011)
Past Experiences	0.138**	0.168**	0.147**	-0.043	0.167***	-0.293	0.184**
	(0.048)	(0.061)	(0.053)	(0.167)	(0.050)	(0.207)	(0.057)
Ongoing Relationships	-0.074	0.002	-0.029	0.749*	-0.390	1.222**	-0.499
	(0.266)	(0.540)	(0.327)	(0.358)	(0.333)	(0.449)	(0.374)
Altruism	-0.011	-0.017	-0.006	-0.064**	-0.011	-0.065**	-0.000
	(0.006)	(0.012)	(0.007)	(0.020)	(0.007)	(0.021)	(0.008)
Risk Prone	-0.007	-0.029*	-0.002	-0.036*	-0.006	-0.037	-0.004
	(0.007)	(0.013)	(0.008)	(0.015)	(0.009)	(0.019)	(0.010)
Control Variables	yes	yes	yes	yes	yes	yes	yes
Constant	1.707	3.350	0.429	2.955	2.931*	2.512	2.783
	(0.998)	(1.879)	(1.460)	(1.617)	(1.320)	(2.941)	(2.563)
R^2	0.24	0.3	0.22	0.19	0.26	0.2	0.28
Predict	75.2	77.4	73.7	69.4	76.8	68.8	78.5
N	1144	579	570	258	906	141	429

Level of significance: *:p<0,05 ; **:p<0,01 ; ***:p<0,001

Table 4.10: Two Stage Analysis

	First Stage *Cooperation*	**Second Stage** *Additional Investment*
Cooperation	-	-0.619*
		(0.309)
Probability of Continuation	0.339**	0.116*
	(0.103)	(0.051)
Public Information	0.974***	-0.012
	(0.195)	(0.072)
Lagged.Past Experiences	0.088**	-0.016*
	(0.034)	(0.008)
Lagged.Ongoing Relationships	1.216***	-0.032
	(0.283)	(0.042)
Lagged.ROUND	-1.292***	0.096
	(0.271)	(0.090)
Altruism	0.005	-0.000
	(0.004)	(0.001)
Risk Prone		0.000
		(0.001)
Control Variables	yes	yes
Constant	-5.753***	0.893***
	(1.112)	(0.141)
R^2	0.10	0.22
N	749	749

Level of significance: *:p<0,05 ; **:p<0,01 ; ***:p<0,001

Figure 4.9: Sellers' *Cooperation* (*left*) and buyers' *Additional Investment* (*right*)

Rounds > 5

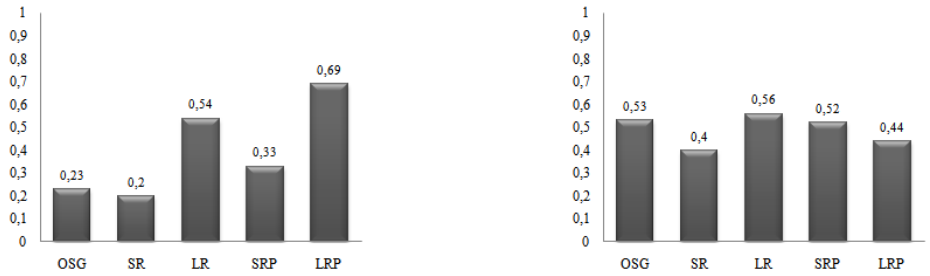
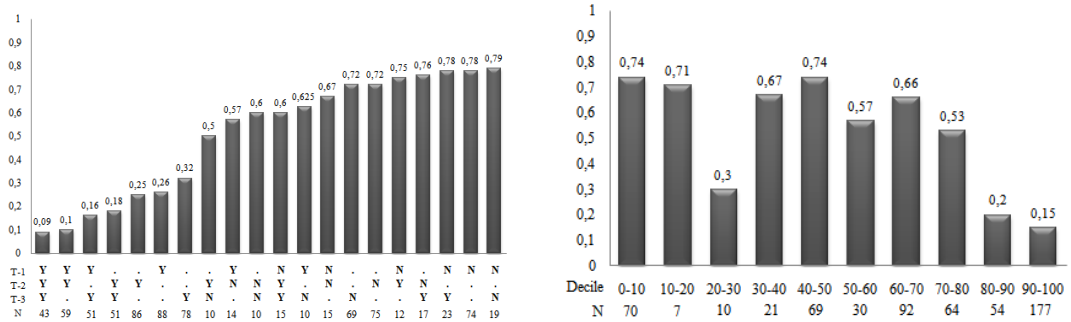


Figure 4.10: Buyer's *Additional Investment* depending on sellers' past *Cooperation* (*left*) and depending on sellers' *Reputation* (in SRP and LRP treatments) (*right*)

Rounds > 5



General Conclusion

In this dissertation, we sought to understand the existing links between cooperative behavior and formal contracts.

The first part allows us to show that this link is not straightforward. In fact, we find that if formal contracts can have a negative impact on *ex post* cooperation when relationships are not particularly strategic, they also appear to be an enhancing factor of cooperative behavior as soon as the intrinsic hazards of a relationship require higher *ex ante* contractual safeguards to secure agreements (*i.e.* particularly strategic relationships). As a result, on the one hand, formal contract can have a pernicious effect on the willingness of firms to implement cooperative behavior; and, on the other, under precise circumstances, formal contracts appear to be a prerequisite for the emergence of *ex post* interfirm cooperation. Consequently, our results suggest that formal contract can strengthen or weaken *ex post* cooperation and that parties have to carefully think about the *ex ante* efforts and costs incurred to frame an appropriate formal contract. In this first part, we also show that cooperation can be analyzed through contractual renegotiations. Such an approach is in contrast to the previous literature that, almost exclusively, analyzes renegotiations through the lens of opportunism. We go beyond existing studies by not only look-

ing at the occurrence of renegotiations but by also paying particular attention to the effects of targeted features of renegotiations. Our innovative results show the existence of a non-linear effect concerning the frequency of renegotiations but also a differentiated impact of contractual adjustments, depending on the dimensions they are concerned with. Our conclusions thus lead us to consider renegotiations as necessary adaptation processes that are punished when they lead to unbalanced results between the parties. Moreover, more than providing empirical results for the theoretically still on-going debate about the opportunism of renegotiations, we also derive some public policy implications. In particular, our results only hold for contractual arrangements which allow a minimum level of public authorities' discretionary power. At a period where the European Union tries to set up a legal framework for public-private partnerships of its member states, we could recommend not to categorically reject the possibility for public authorities to use their discretionary power. At least, we argue in favor or more freedom in the use of relevant information to select operators. Indeed, such a discretion can allow public authorities to use their past experiences and to adapt their efforts to craft contractual agreements efficiently. Obviously, the study of the link between discretionary power and PPPs efficiency requires deeper investigations, noticeably to be able to clearly differentiate discretionary power and potential corruption.

The second part is in line with the first one but goes a step further in the analysis of the links between informal cooperation and formal contract. In fact, we look at how expected cooperation can influence *ex ante* contractual choice and how this link evolves through time in a dynamic setting. This way, we improve the understandings of endogenous contractual incompleteness. Indeed, our results identify a new source of endogenous contractual completeness: the ability of the parties to sustain a relational agreement. Moreover, we show that reputation building helps to understand the evolution towards more and more incomplete formal contracts. Our results suggest that the identity of the parties matters when they contract,

so that an identical transaction can entail different contracting costs (in completeness) depending on the contracting parties involved. This may shed a new light on some management practices, and on the choices of contractual partners, when the opportunistic behavior of a partner is feared. For instance, it might be used to explain many situations of "lock-in" effect where a firm (or a public authority) prefers to keep its actual partner (or operator) or to choose the same one for a new project despite the presence of other potential and cheaper partners. The learning process allow parties to know each other and to build contractual design accordingly, making the change of partners potentially risky and more expensive than the cost reduction proposed by the alternative option. It also highlights the importance of considering past experiences in the choice of partner and level of safeguard mechanisms foreseen by the contract.

Nevertheless, we are confronted with several limits in this dissertation that could be addressed through further investigations that fit into a research agenda.

The first part suffers from the usual limits of empirical studies. In fact, there are problematic weaknesses in our data as for instance the lack of control variables that would permit to cope with more confidence with endogeneity issues. Confronted with institutional (access to data and/or issue of privacy information) and technical (impossibility to extend the database, cross section instead of panel data) issues, some relevant variables are missing and their absence prevent us from inferring causality with certainty. In our dissertation, one could notice that the lack of relevant variables is symmetric between chapters 1 and 2. In chapter 1, we use interesting data about firms' perception but we do not have sufficient variables to take into account other important qualitative dimensions as past experiences, network effects, and so on. For instance, we are not able to determine the existence of prior interactions and the source of reputation parties are relying on. Consequently, we cannot really investigates the evolutionary nature of the link between

contract and cooperation. On the contrary, in chapter 2, we have interesting data about contractual renegotiations but not sufficient qualitative insights such as the perception of parties, the satisfaction of customers, and so on. We also miss important informations such as the number of bidders at each call-for-tenders and their respective bids. Limits in these two empirical papers are also due to the presence of endogeneity issues. We endeavor to tackle the presence of endogeneity in our studies but we suffer, here again, from the absence of relevant variables to instrument perfectly our independent variables. A lot has to be done to enrich our actual databases (in order to improve the relevancy of our results); and also to expand our investigations to other sectors. Future works investigating the dynamic relationship between informal cooperation and specific contractual provisions are still missing to improve our understandings of (efficient) contractual practices.

As for the second part, we face some usual limits associated with theoretical and experimental papers. The chapter 3 provides a dynamic model of relational contracting under asymmetric and imperfect information. As it is well known, the essence of theoretical model is to built a simplified version of the world in order to infer causal link. The aim is to attempt to abstract from complex human behavior in a way that sheds some insight into a particular aspect of that behavior.[62] However, results are limited by the assumptions we made. In this chapter, we try to go beyond some limits of classical model of relational contracting, by noticeably defining different discount rates for parties and by assuming asymmetric information between them about their respective discount rates. Nevertheless, we also made assumptions that are questionable. For instance, we assume that investments in contractual incompleteness have to be periodically incurred while a more realistic assumption would be to consider an incremental function of contractual completeness. Moreover, in our model, we still use what it remains the strongest assumption of relational contract theory, namely the use of "trigger strat-

[62] "You don't need to know the height of Beacon Hill to take a subway across Boston. Tourists use a flat subway map : the model that is just complex enough for the problem at hand." Gabaix and Laibson [2008]

egy" (a cheated buyer will never put again its confidence in any sellers) while it would be more realistic to consider that a cheated buyer can implement sustainable relational agreements with new partners. This is one important challenge that Relational Contract Theory has to take up in future researches. Nevertheless, we built a theoretical framework that can be adapted to new assumptions and that can allow us to lead further investigation on the topic of endogenous contractual incompleteness.

Concerning the experimental economics used in the chapter 4, the classical weaknesses are also due to the simplified environment in which people interact. To control all the dimensions of the environment allow overcoming problems of endogeneity and unobserved variables. Nevertheless, it also reduce the ability to infer results suitable to the real-world complexity. Nevertheless, here again we define an experimental design that can be used as a perfectible framework. There are many possibilities to define new rules and constrains in order to put to the test new theoretical predictions. For instance, some future works have to be done to get our experimental design close to real-world market conditions. Among potential improvements, we can foresee to modify the market structure in order to assess the impact of imperfect competition on the interplay between endogenous contractual incompleteness and sustainable relational contract. Following a same idea, an interesting extension could be to link together the chapters 1 and 4 by introducing some strategic differentiations between relationships (by modifying the surplus associated with different associations in the lab).

To conclude, the discussion conducted throughout this dissertation allows us to say that the role of formal contract in relationships is not straightforward but, on the contrary, strongly depends on the context and the identity of parties. The second main contribution is that contractual completeness has not to be viewed as an ultimate goal to achieve. In fact, we show that reputation of parties allows to save on *ex ante* contracting efforts and also that adaptations through contractual

renegotiations are not necessarily dangerous for the contractual relationship. In spite of the several limits our works are concerned with, we believe that we provide interesting answers and also that the questions we raise are as many alleys for future researches in this exciting topic.

References

Affuso, L. and Newbery, D. (2002). The impact of structural and contractual arrangements on a vertically separated railway. *The Economic and Social Review*, 33(1):83–92.

Akerlof, G. (1970). The market for "lemons": Quality, uncertainty and market mechanism. *The Quarterly Journal of Economics*, 84(3):488–500.

Al Najjar, N. (1995). Incomplete contracts and the governance of complex contractual relationships. *American Economic Review*, 85(2):432–436.

Amaral, M., Saussier, S., and Yvrande-Billon, A. (2008). Auction procedures and competition in public services: The case of urban public transport in france and london. *Utilities Policy*, 17(2):166–175.

Anderlini, L. and Felli, L. (1994). Incomplete written contracts: Undescribable states of nature. *The Quarterly Journal of Economics*, 109(4):1085–1124.

Anderlini, L. and Felli, L. (1999). Incomplete contracts and complexity costs. *Theory and Decision*, 46:23–50.

Arend, R. (2009). Reputation for cooperation: contingent benefits in alliance activity. *Strategic Management Journal*, 30:371–385.

Athias, L. and Nunez, A. (2008). Winner's curse in toll road concessions. *Economics Letters*, 3(101):172–174.

Baffray, L. and Gattet, P. (2009). Gestion des parcs de stationnement, perspectives de marché en 2009, forces en présence et stratégie de croissance. Xerfi Etudes France.

Bajari, P., Houghton, S., and Tadelis, S. (2006). Bidding for incomplete contracts: An empirical analysis. *NBER Working Paper*, w12051.

Bajari, P., MacMillan, R. S., and Tadelis, S. (2003). Auctions versus negotiations in procurement: An empirical analysis. *NBER Working Paper*, w9757.

Bajari, P. and Tadelis, S. (2001). Incentives versus transaction costs: A theory of procurement contracts. *RAND Journal of Economics*, 32(3):387–407.

Baker, G., Gibbons, R., and Murphy, K. J. (2002). Relational contracts and the theory of the firm. *The Quarterly Journal of Economics*, 117(1):39–84.

Baker, G., Gibbons, R., and Murphy, K. J. (2008). Strategic alliances: Bridges between "islands of conscious power". *Journal of the Japanese and International Economies*, 22(2).

Baker, G. P., Gibbons, R., and Murphy, K. J. (1994). Subjective performance measures and optimal incentive contracts. *Quaterly Journal of Economics*, 109(4):1125–1156.

Battigalli, P. and Maggi, G. (2002). Rigidity, discretion, and the costs of writing contracts. *American Economic Review*, 92(4):798–817.

Battigalli, P. and Maggi, G. (2008). Costly contracting in a long-term relationship. *RAND Journal of Economics*, 39(2):352–377.

Bennett, J. and Iossa, E. (2006). Builiding and managing facilities for public services. *Journal of Public Economics*, 90(10-11):2143–2160.

Bernheim, B. and Whinston, M. (1998). Incomplete contracts and strategic ambiguity. *American Economic Review*, 88(4):902–32.

Bernstein, L. (1992). Opting Out of the Legal System : Extralegal Contractual Relations in the Diamond Industry. *Journal of Legal Studies*, 21:115–157.

Beuve, J. and Saussier, S. (2011). Interfirm cooperation and the role of formal contract. *forthcoming in Industrial and Corporate Change*.

Board, S. (2010). Relational contracts and the value of loyalty. Forthcoming in American Economic Review.

Bolton, G., Katok, E., and Ockenfels, A. (2005). Cooperation among strangers with limited information about reputation. *Journal of Public Economics*, 89(8):1457–1468.

Bolton, P. and Dewatripont, M. (2005). *Contract Theory*. MIT Press, Cambridge.

Bolton, P. and Faure-Grimaud, A. (2010). Satisficing contracts. *The Review of Economic Studies*, 77:937–971.

Boycko, M., Shleifer, A., and Vishny, R. W. (1996). A theory of privatization. *Economic Journal*, 106(435):309–319.

Brousseau, E. (2008). Contracts: Bilateral sets of incentives to multi-level governance. In Brousseau, E. and Glachant, J.-M., editors, *New Institutional Economics: A Guidebook*, pages 37–66. Cambridge University Press, Cambridge, UK.

Brown, M., Falk, A., and Fehr, E. (2004). Relational contract and the nature of market interactions. *Econometrica*, 72(4):747–780.

Brown, M., Falk, A., and Fehr, E. (2008). Competition and relational contracts. the role of unemployment as a disciplinary device. IZA Discussion Paper 3345.

Bull, C. (1987). The existence of self-enforcing implicit contracts. *The Quarterly Journal of Economics*, 102(1):147–160.

Calzolari, G. and Spagnolo, G. (2009). Relational contracts and competitive screening. CEPR Discussion Papers 7434, C.E.P.R. Discussion Papers.

Campbell, D. and Fiske, D. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, 56(2):81–105.

Coletto-Labatte, F. (2008). *Le Stationnement Urbain. Opérateurs, Marchés et Concurrence*. Edilivre Collection Universitaire, Paris.

Conner, K. and Prahalad, C. (1996). A resource-based theory of the firm: knowledge versus opportunism. *Organization Science*, 7(5):371–385.

Corts, K. and Singh, J. (2004). The effect of repeated interaction on contract choice: evidence from offshore drilling. *The Journal of Law, Economics, and Organization*, 20(1):230–260.

Crocker, K. J. and Masten, S. E. (1991). Pretia ex machina: Prices and process in long term contracts. *Journal of Law and Economics*, 34(1):64–99.

Crocker, K. J. and Reynolds, K. J. (1993). The efficiency of incomplete contracts: an empirical analysis of Air Force engine procurement. *RAND Journal of Economics*, 24(1):126–146.

Dal Bo, P. (2005). Cooperation under the shadow of the future : experimental evidence from infinitely repeated games. *American Economic Review*, 95(5):1591–1604.

De Brux, J. (2010). The dark and bright side of renegotiation: An application to transport concession contracts. *Utilities Policy*, 18(2):77–85.

Dellarocas, C. (2001). *Reputation mechanisms. Handbook on Economics and Information Systems*. Elsevier Publishing.

Desrieux, C. and Beuve, J. (2011a). Relational contracts and the dynamics of incomplete contracts. *Working paper*.

Desrieux, C. and Beuve, J. (2011b). Relational contracts as a foundation for contractual incompleteness. *Economics Bulletin*, 31(3):2030–2040.

Desrieux, C., Chong, E., and Saussier, S. (2010). Putting all ones eggs in one basket: Relational contracts and the provision of local public services. Working Paper.

Dewatripont, M. (1989). Renegotiation and information revelation over time: The case of optimal labor contracts. *Quaterly Journal of Economics*, 3(104):589–619.

Dixit, A. (2009). Governance institutions and economic activity. *American Economic Review*, 99(1):5–24.

Dixit, A. K. (2004). *Lawlessness and Economics: Alternative Modes of Governance*. Princeton University Press.

Dollinger, M., Golden, P., and Saxton, T. (1997). The effect of reputation on the decision to joint venture. *Strategic Management Journal*, 18(2):127–140.

Dore, R. (1983). Goodwill and the spirit of market capitalism. *The British Journal of Sociology*, 34:459–482.

Duffy, J. and Ochs, J. (2009). Cooperative behavior and the frequency of social interaction. *Games and Economic Behavior*, 66:785–812.

Dyer, J. and Singh, H. (1998). The relational view: cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23:660–679.

Engel, A., Fisher, R., and Galetovic, A. (2009a). Soft budgets and renegotiations in public-private partnerships. Nber working papers, National Bureau of Economic Research, Inc.

Engel, E., Fischer, R., and Galetovic, A. (2009b). Public-private partnerships to revamp u.s. infrastructure. *The Hamilton Project*, pages 1–26.

Engle-Warnick, J. and Slonim, R. (2006). Inferring repeated-game strategies from actions: evidence from trust game experiments. *Economic Theory*, 28(3):603–632.

Estache, A. (2006). Ppi partnerships vs. ppi divorces in ldcs. *Review of Industrial Organization*, 29(1):3–26.

Fehr, E., Brown, M., and Zehnder, C. (2009). On reputation : A microfoundation of contract enforcement and price rigidity. *The Economic Journal*, 119(536):333–353.

Fehr, E., Hart, O., and Zehnder, C. (2010). Contracts as reference points - experimental evidence. Forthcoming in American Economic Review.

Fehr, E., Klein, A., and Schmidt, K. (2000). Endogenous incomplete contract. *Mimeo. Univserity of Zurich*.

Frestre, A. and Garrouste, P. (2011). Big brother is watching you : the respective effects of being observed and sanctioned. *Working paper*.

Fudenberg, D. and Tirole, J. (1991). *Game Theory*, volume 1 of *MIT Press Books*. The MIT Press.

Gabaix, X. and Laibson, D. (2008). The seven properties of good models. In Caplin, A. and Schotter, A., editors, *The Foundations of Positive and Normative Economics : A Handbook*. Oxford University Press.

Gagnepain, P., Ivaldi, M., and Martimort, D. (2010). The cost of contract renegotiation: Evidence from the local public sector. *IDEI Working Paper 637*.

GART (2005). *La passation des DSP en Transport Urbain - Données chiffrées 2005*. Paris.

Gautier, A. and Yvrande Billon, A. (2009). Contract renewal as an incentive device: An application to the french urban public transport sector. *Working Paper*.

Ghoshal, S. and Moran, P. (1996). Bad for practice: a critique of the transaction cost theory. *Academy of Management Review*, 21:13–47.

Gibbons, R. (1992). *Game Theory for Applied Economists*. Princeton University Press.

Gibbons, R. (1997). An introduction to applicable game theory. *Journal of Economic Perspectives*, 11:127–149.

Gibbons, R. (2005). Four formal(izable) theories of the firm. *Journal of Economic Behavior and Organization*, 58(2):202–247.

Gil, R. (2011). The interplay of formal and relational contracts: Evidence from movies. *forthcoming in Journal of Law and Economic Organization*.

Gil, R. and Hartmann, W. (2011). Airing your dirty laundry: Social networks, reputational capital and vertical integration. *Journal of Law and Economic Organization*, 27(2):219–244.

Gil, R. and Marion, J. (2009). The role of repeated interactions, self-enforcing agreements and relational [sub]contracting: Evidence from california highway procurement auctions. Working paper.

Goldberg, V. P. and Erickson, J. R. (1987). Quantity and price adjustment in long-term contracts: A case study of petroleum coke. *Journal of Law & Economics*, 30(2):369–98.

Granovetter, M. (1985). Economic action and social structure: the problem of embeddedness. *American Journal of Sociology*, 91:481–510.

Greif, A. (2006). *Institutions and the Path to the Modern Economy: Lessons from Medieval Trade*. Cambridge University Press.

Grossman, S. J. and Hart, O. (1986). The cost and benefits of ownership: A theory of vertical and lateral intégration. *Journal of Political Economy*, 94(4):691–719.

Guasch, J., Kartacheva, A., and Quesada, L. (2000). Contract renegotiations and concessions in latin america and carribean region: an economic analysis and empirical implications. *World Bank Policy Research Working Paper*.

Guasch, J.-L. (2004). *Granting and Renegotiating Infrastructure Concession: Doing It Right*. The World Bank, Washington DC, USA.

Guasch, J.-L., Laffont, J.-J., and Straub, S. (2006). Renegotiation of concession contracts: A theoretical approach. *Review of Industrial Organization*, 1(29):55–73.

Guasch, J.-L., Laffont, J.-J., and Straub, S. (2007). Concessions of infrastructures in latin america: Government-led renegotiation. *Journal of Applied Econometrics*, 22(7):421–442.

Guasch, J.-L., Laffont, J.-J., and Straub, S. (2008). Renegotiation of concession contracts in latin america. evidence from the water and transport sector. *International Journal of Industrial Organization*, 26:421–442.

Guasch, J.-L. and Straub, S. (2006). Renegotiation of infrastructures concessions: An overview. *Annals of Public and Cooperative Economics*, 4(77):479–493.

Guérin-Schneider, L. and Lorrain, D. (2003). Note de recherche sur une question sensible. les relations puissance publique - firmes dans le secteur de l'eau et de l'assainissement. *Flux*, 2-3(52):35–54.

Gulati, R. (1995). Does familiarity breed trust? the implications of repeated ties for contractual choice in alliances. *Academy of Management Journal*, 38:85–112.

Gulati, R. and Nickerson, J. (2008). Interorganizational trust, governance choice, and exchange performance. *Organization Science*, 19:688–708.

Halac, M. (2011a). Relational contracts and the value of relationships. *American Economic Review*, forthcoming.

Halac, M. (2011b). Relationship building. Working Paper.

Hall, R. (1992). The strategic analysis of intangible resources. *Strategic Management Journal*, 13(2):135–144.

Hall, R. (1993). A framework linking intangible resources and capabilities to sustainable competitive advantage. *Strategic Management Journal*, 14(2):607–618.

Hart, O. (1995). *Firms, Contracts and Financial Structure*. Oxford University Press, Oxford.

Hart, O. and Holmstrom, B. R. (2002). A Theory of firm scope. MIT Department of Economics Working Paper.

Hart, O. and Moore, J. (2008). Contracts as reference points. *The Quarterly Journal of Economics*, 123(1):1–48.

Holmström, B. and Tirole, J. (1989). The theory of the firm. In Schmanlensee, R. and Willig, R., editors, *Handbook of Industrial Organization*, volume I, chapter 2, pages 61–133. Elsevier Science Publisher.

Hoppe, E. and Schmitz, P. (2011). Can contracts solve the hold-up problem? experimental evidence. *Games and Economic Behavior*, 73(1):186–199.

Houston, M. (2003). Alliance partner reputation as a signal to the market: Evidence from bank loan alliances. *Corporate Reputation Review*, 5(4):330–342.

Iossa, E. and Rey, P. (2009). Building reputation for contract renewal: Implications for performance dynamics and contract duration. CEIS Working Paper.

Iossa, E. and Spagnolo, G. (2007). Relational contracts, flexibility and overcontracting in procurement. Working paper.

Kalnins, A. and Mayer, K. (2004). Relationships and hybrid contracts: An analysis of contract choice in information technology. *Journal of Law, Economics, and Organization*, 20(1):207–229.

Klein, B. (1981). The role of market forces in assuring contractual performance. *Journal of Political Economy*, 89(4):615–641.

Klein, B. (1988). Vertical integration as organizational ownership: The fisher body-general motors relationship revisited. *Journal of Law, Economics and and Organization*, 4:199–213.

Klein, B. (1996). Why hold-ups occur: The self-enforcing range of contractual relationships. *Economic Inquiry*, 34:444–463.

Klein, B. (2007). The economic lessons of fisher body-general motors. *International Journal of the Economics of Business*, 14:1–36.

Klein, B., Crawford, R. G., and Alchian, A. A. (1978). Vertical integration, appropriable rents, and the competitive contracting process. *Journal of Law and Economics*, 21(2):297–326.

Kogut, B. (1989). The stability of joint ventures: reciprocity and competitive rivalry. *Journal of Industrial Economics*, 38:183–198.

Kogut, B. and Zander, U. (1996). What firms do? coordination, identity, and learning. *Organization Science*, 7:502–518.

Kornhauser, L. A. and MacLeod, W. B. (2010). Contracts between legal persons. Nber working papers, National Bureau of Economic Research, Inc.

Kumar, N. and Nti, K. (1998). Differential learning and interaction in alliance dynamics: a process and outcome in discrepancy model. *Organization Science*, 9(34):358–367.

Kvaloy, O. and Olsen, T. (2009). Endogenous verifiability and relational contracting. *American Economic Review*, 99(5):2193–2208.

Lafontaine, F. and Raynaud, E. (2002). The role of residual claims and self-enforcement in franchise contracting. In Brousseau, E. and Glachant, J., editors, *The Economics of Contracts: Theories and Applications*, pages 315–336. Cambridge University Press.

Lazzarini, S.G. Poppo, L. and Zenger, T. (2002). The new institutionalism in strategic management. In Ingram, P. and Silverman, B., editors, *The Economics of Contract in Prospect and Retrospect*, pages 275–303. Elsevier Science.

Levin, J. (2003). Relational incentive contracts. *American Economic Review*, 93(3):835–857.

Li, S. (2003). The benefits and costs of relation-based governance: An explanation of the east asian miracle and crisis. *Review of International Economics*, 4(11):651–67.

Lopez-De-Silanes, F. and Chong, A. (2004). Privatization in latin america: What does the evidence say? *Economia*, 4(2):37–111.

Luo, Y. (2002). Contract, cooperation, and performance in international joint ventures. *Strategic Management Journal*, 23(10):903–919.

Macaulay, S. (1963). Non-contractual relations in business. *American Sociological Review*, 28:55–70.

MacLeod, B. and Chakravarty, S. (2009). Optimal contracting in the shadow of the law. *Rand Journal of Economics*, 40(3):533–557.

MacNeil, I. (1978). Contracts: adjustment of long-term economic relations under classical, neoclassical and relational contract law. *Northwestern University Law Review*, 72:854:905.

Masten, S. and Saussier, S. (2002). Econometrics of contracts: An assessment of developments in the empirical literature of contracting. In Brousseau, E. and Glachant, J., editors, *The Economics of Contracts: Theories and Applications*, pages 315–336. Cambridge University Press.

Masten, S. E. and Saussier, S. (2000). Econometrics of contracts: An assessment of developments in the empirical litterature of contracting. *Revue d'Economie Industrielle*, 92:215–237.

Murninghan, J. and Roth, E. (1983). Expecting continued play in prisoner's dilemma games : a test of several models. *Journal of Conflict Resolution*, 27(2):297–300.

Nakamura, A. and Nakamura, M. (1998). Model specification and endogeneity. *Journal of Econometrics*, 83:213–237.

North, D. C. (1990). *Institutions, Institutional Change, and Economic Performance*. Cambridge University Press, Cambridge.

Oxley, J. and Silverman, B. (2008). Inter-firm alliances; a new institutional economics approach. In Brousseau, E. and Glachant, J.-M., editors, *New Institutional Economics: A Guidebook*, pages 209–234. Cambridge University Press, Cambridge, UK.

Parkhe, A. (1993). Strategic alliance structuring: a game theoretic and transaction costs examination of interfirm cooperation. *Academy of Management Journal*, 36:794–829.

Podsakoff, P., MacKenzie, S., Lee, J., and Podsakoff, N. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5):879–903.

Poppo, L. and Zenger, T. (2002). Do formal contracts and relational governance function as substitutes or complements? *Strategic Management Journal*, 23(8):707–725.

Powell, W. (1990). Neither market nor hierarchy: network forms of organization. *Research in Organizational Behavior*, 12:295–336.

Rempel, J., Holmes, J., and Zanna, M. (1985). Trust in close relationships. *Journal of Personality and Social Psychology*, 49:95–112.

Reuer, J. and Arino, A. (2007). Strategic alliance contracts: dimensions and determinants of contractual complexity. *Strategic Management Journal*, 28(3):313–330.

Ring, P. and Van de Ven, A. (1992). Structuring cooperative relationships between organizations. *Strategic Management Journal*, 13(7):483–498.

Ring, P. and Van de Ven, A. (1994). Developmental processes of cooperative interorganizational relationships. *Academy of Management Review*, 19(1):90–118.

Rivers, D. and Vuong, H. (1988). Limited information estimators and exogeneity tests for simultaneous probit models. *Journal of Econometrics*, 39:347–366.

Ryall, M. and Sampson, R. (2003). Do prior alliances influence contract structure? evidence from technology alliance contracts. Working Paper.

Ryall, M. and Sampson, R. (2009). Formal contracts in the presence of relational enforcement mechanisms: Evidence from technology development contracts. *Management Science*, 55(6):906–925.

Saussier, S. (2000). Transaction costs and contractual incompleteness: The case of électricité de France. *Journal of Economic Behavior and Organization*, 42(2):189–206.

Saxton, T. (1997). The effects of partner and relationship characteristics on alliance outcomes. *Academy of Management Journal*, 40(2):443–461.

Schmitz, P. (2006). Information gathering, transaction costs, and the property rights approach. *American Economic Review*, 96(1):422–434.

Scott, R. (2000). The case for formalism in relational contract. *Northwestern University Law Review*, 94:847–862.

Shavell, S. (1984). The design of contracts and remedies for breach. *The Quarterly Journal of Economics*, 99(1):121–48.

Sorensen, J. and Sorenson, O. (1992). Finding the right mix: Organizational learning, plural forms and franchise performance. *Strategic Management Journal*, 22:713–724.

Spier, K. (1992). Incomplete contracts and signalling. *RAND Journal of Economics*, 23(2):432–443.

Sullivan, J. and Peterson, R. (1982). Factors associated with trust in japanese-american joint ventures. *Management international Review*, 22(2):30–40.

Tadelis, S. (2008). The Power of Shame and the Rationality of Trust. *Working Paper*.

Telser, L. (1980). A theory of self-enforcing agreements. *Journal of Business*, 53(1):27–44.

Tirole, J. (2009). Cognition and incomplete contracts. *American Economic Review*, 99(1):265–294.

Uzzi, B. (1996). The sources and consequences of embeddedness for the economic performance of organizations: the network effect. *American Sociological Review*, 61:674–698.

Vanneste, B. and Puranam, P. (2009). Repeated interactions and contractual details: Identifying the learning effect. *Organization Science*, 21(1):186–201.

Watson, J. (1999). Starting small and renegotiation. *Journal of Economic Theory*, 85:52–90.

Watson, J. (2002). Starting small and commitment. *Games and Economic Behavior*, 38:176–199.

White, S. and Siu-Yun, L. (2005). Distinguishing costs of cooperation and control in alliances. *Strategic Management Journal*, 26:913–932.

Williamson, O. E. (1975). *Markets and Hierarchies, Analysis and Antitrust implications: A Study in the Economics of Internal Organization*. Free Press, New York, NY, USA.

Williamson, O. E. (1983). Credible commitments: Using hostages to support exchange. *American Economic Review*, 73(4):519–540.

Williamson, O. E. (1985). *The Economic Institutions of Capitalism*. The Free Press, New York, NY, USA.

Williamson, O. E. (1999). Public and private bureaucracies: A Transaction Cost Economics perspective. *Journal of Law, Economics and Organization*, 15(1):306–342.

Woolridge, J. (2002). *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge.

Wright, M. and Lockett, A. (2003). The structure and management of alliances: Syndication in the venture capital industry. *Journal of Management Studies*, 40(3):2073–2104.

Zanarone, G. and Lo, D. (2011). A theory of bargaining costs and price terms in the absence of specific investments. Working Paper.

Zeng, M. and Chen, X. (1986). Achieving cooperation in multiparty alliances : A social dilemma approach to partnership management. *Academy of Management Review*, 28(4):587–605.

Zupan, M. A. (1989). Cable frenchise renewals: Do incumbent firms behave opportunistically? *RAND Journal of Economics*, 20(4):473–482.

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