

Owner of Holder?

A Critical Study of Property Rights in Public Services

by
CLAUDINE DESRIEUX*

This paper deals with efficient organizational choices for the provision of public services. To better apprehend observed contracts of public–private partnerships (PPPs), we depart from the property rights literature to distinguish between ownership, rights to make residual decisions, and rights to perceive residual benefits. Indeed, such rights can be temporarily transferred to a private firm, even if ownership of the assets remains public. Hence, such a separation makes it possible to analyse the large continuum of contracts from full private to full public management. Our results show that there is always a degree of private involvement that is socially efficient. (JEL: D 23, H 7, H 11, L 33)

1 Introduction

In economic literature, public provision has been traditionally recommended as soon as any market inequity or imperfection was suspected. In recent years, the economic problems that arise when governments own and operate firms that could be managed by the private sector have yet begun to accumulate (WORLD BANK [1995]). Governments then resort to contracting out services and try to identify the opportunities for achieving social goals through private supply by a firm that may operate under a government contract or regulation (SHLEIFER [1998]). In many countries around the world, governments – supported by international institutions – thus recently develop new legal tools, for public and private partners to work together, or initiate programs in this direction, as the 1992 PFI program in the United Kingdom, the 2001 “Legge Obiettivo” in Italy, or the introduction of a new “contrat de partenariat” in France in 2004. Today, most of these countries benefit from a great

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diversity of contracts allowing private firms to be involved in the provision of public services in many different ways.

This trend towards greater “contractualization” of public services is not without raising many issues, both on a pragmatical and theoretical level. This explains why contractual partnerships between public and private sectors have attracted much attention in economic literature. Through the lens of the Agency Theory,¹ some contributions have used ex ante asymmetric information coupled with moral hazard to deal with optimal incentive contracts (LAFFONT AND TIROLE [1986], [1988], [1990a], [1991]), or regulation (LAFFONT AND TIROLE [1990b], MARTIMORT AND SAND-ZANTMAN [2004]). This literature is normative and relies on a complete-contracting environment, which may seem unadapted to fully capture the difference between the public and private provision of services (SAPPINGTON AND STIGLITZ [1987], MALIN AND MARTIMORT [2000]). As summarized by HART, SHLEIFER, AND VISHNY [1997, p. 1128], “from the traditional incentive viewpoint, motivating the contractors and public employees presents the same problem to the politician, even in the presence of moral hazard and adverse selection”. Thus, to fully understand the costs and benefits of contracting-out, the incomplete-contracting perspective proves to be useful. As a consequence, some theoretical and empirical applications of Transaction Costs Economics (TCE), pioneered by WILLIAMSON [1975] and [1985] have been proposed (WILLIAMSON [1999], BAJARI AND TADELIS [2001], MÉNARD AND SAUSSIÉ [2003]). These works refer by analogy to the “make-or-buy” question to explain organizational choices of public services. Yet, in spite of its empirical success, TCE suffers from informal foundations and difficulties of developing into more refined predictions (TADELIS [2002]). This contrasts with the framework developed by GROSSMAN AND HART [1986] later enriched by HART AND MOORE [1990] and HART [1995], that formally models the decision of vertical integration. This theoretical approach (called “GHM approach” hereafter) has also been rightfully used to understand the contracting-out of public services. In this framework, contractual incompleteness is assumed to come from the non-verifiability of investments to a third party. This is precisely the case for many public services, as the quality local public authorities want is often difficult to specify (such as the customer’s relationship, capacity to react to urgency and unforeseen events, researching innovative approaches to perform in excess of the basic standard specified in the initial contract, ...). Difficulties appear especially when the government does not know exactly what it wants from the producer, and then cannot put its wishes into the contract (or a regulation) and enforce it. In this case, contracts prove to be incomplete, as all contingencies cannot be foreseen ex ante.

Moreover, the GHM approach perceives the difference between public and private structures through the allocation of property rights, rather than through the degree of competition per se (HART, SHLEIFER, AND VISHNY [1997]). Indeed, the sharing of property rights conveys residual control rights, which gives the owner control and

¹See LAFFONT AND TIROLE [1993] for a summary of this literature.

bargaining power in situations where contracts do not specify what has to be done. As a consequence, ownership strengthens the owner's incentives to make investments that improve his ex post payoffs.

Among the literature dealing with public services and based on the GHM approach, BOYCKO, SHLEIFER, AND VISHNY [1996] discuss privatization as a strategy available to the reformers to reduce the inefficiency of public firms. Hence, privatization is considered as a reallocation of control rights over employment from politicians to managers and an increase in cash flow ownership of managers and private investors. Still with the incomplete contract theory framework but with a focus on the bundling question, HART [2003] suggests that the choice between PPPs and conventional provision depends on whether it is easier to write contracts on the service provision than on the building provision. The seminal work of HART, SHLEIFER, AND VISHNY [1997] tries to make a clear-cut debate of the organizational forms of public services by proposing a theory of government ownership and contracting based on quality and cost of services under alternative modes of provision. According to them, government ownership is likely to be superior in some very particular cases, i.e. when cost-reducing investments can induce strong negative effects on quality, innovation is relatively unimportant, ex post competition or conditions for consumer choice are not really effective, or reputational mechanisms are weak.

Yet, most of these studies about property rights focus on bipolar cases, either privatization – in which case the residual control rights are given to a private company – or public provision – in which case they are kept by the public authority. It is not possible to account for the great diversity of contracts of public–private partnerships, where private managers can be involved to different degrees.²

To this end, we propose here a model of organizational choices in public services that differs from the previous literature thanks to a refinement of the notion of property rights developed in the GHM approach. Two key features of this approach are hence modified, namely the definition of ownership through residual decision rights and the bundling of decision and payoff rights. The former, i.e. the rights of the owner to make decisions ex post that were not contracted on ex ante, is a clear assumption of the property-rights framework. The latter, which suggests that the owner is also the residual claimant, has finally been admitted. Indeed, following GROSSMAN AND HART [1986], HART AND MOORE [1990, p.1121] distinguish, “between ownership in the sense of possession of the residual control rights over assets and ownership in the sense of entitlement to an asset's (verifiable) profit stream”. HART [1995, p.64] mentions that “residual income and residual control do not have to be bundled together on a one-to-one basis”,³ but highlights that both rights go

²See the World bank glossary for a detailed description of the various types of public–private partnerships that can be observed: <http://ppi.worldbank.org/resources/ppi-glossary.aspx>.

³Profit-sharing agreements can indeed be different from the distribution of property rights: an example is given by joint ventures that can share control 50 : 50 between two parties having different profit shares.

together in many cases.

Departing from this position, we explore the separation of these rights, and consider that an agent is not necessarily the holder of the residual decision and payoff rights over the assets he owns.⁴

Such a distinction in property-rights literature particularly fits with what is commonly observed in contracts of public–private partnerships: assets remain the property of – and are transferred back to – the state at the end of the contract but, the rights to decide over these assets may be transferred to a private manager during the execution of the contract, as well as the right to keep the users’ fees. This describes *concession contracts* for instance. In contrast, *lease contracts* make it possible to transfer payoff rights to a private party that keeps the fees collected from users but decisions about major investments in the infrastructure are made by the public authority who remains owner of the assets at the end of the contract. As for *management contracts*, they transfer the management of a utility to a private operator that is paid a fixed fee for performing these tasks. Unlike the GHM approach, all this shows that ownership is no longer sufficient to attribute full control over all aspects that have not been explicitly given away by contract. To implement new investments, the manager thus needs the agreement of the holder of the decision rights, and the holder of the payoff rights receives residual benefits.

In summary, the originality of our approach compared to the property-rights literature is to separate the right to make residual decisions and the right to receive residual benefits from ownership. However, in accordance with GHM, we assume that renegotiation between the parties can occur to achieve ex post efficiency. This assumption is supported by works demonstrating the importance of renegotiations in public–private contracts (GUASCH, LAFFONT, AND STRAUB [2008]). Consequently, the implementation of innovations requires the agreement of the holder of the decision rights, but this can be reached through renegotiation of the terms of the contract.

This theoretical refinement combining the splitting of property rights and pareto-improving renegotiations due to contractual incompleteness aims to better apprehend observed public–private partnerships. The goal of this paper is then to wonder whether the results obtained in the seminal work of HART, SHLEIFER, AND VISHNY [1997] about public and private provision of public services still apply. In other words, are public services still to be provided in-house when cost-reducing investments inducing strong adverse negative effects on quality and innovation are relatively unimportant?

In the following section of this article, we try to show how the owner’s rights can be dissociated in contracts of public–private partnerships. Section 3 proposes a model of government contracting, where the provider of the service can invest

⁴Such a distinction is also present in BAKER, GIBBONS, AND MURPHY [2008] and GIBBONS [2005] that introduce the notion of “alienable” assets. Yet, their theoretical framework differs from the one presented in this paper on several points, especially because of the absence of renegotiation mentioned in their works.

his time in improving the quality of the service or reducing its cost. As in HART, SHLEIFER, AND VISHNY [1997], the cost reduction has an adverse effect on quality and neither innovation is contractible ex ante. We then show how the distinction between ownership, decision and payoff rights modifies the results obtained by HART, SHLEIFER, AND VISHNY [1997]. Residual control rights, that group these different concepts, appear indeed as insufficient in comprehending the private involvement in public services' management. They suggest the dichotomy of private vs. public ownership, saying nothing about the large continuum of contracts, from full public to full private management, that makes private involvement a much more complex thing than the distinction between the "private" and "public" solution. In contrast to the conclusions of HART, SHLEIFER, AND VISHNY [1997], results also show that there is always a degree of private involvement that makes it possible to out-perform the public provision of services. Section 4 concludes and discusses the results.

2 *Contracts in the Management of Local Public Services*

The growing intervention of private firms in the management of local public services rarely means full privatization. Public-private partnerships refer to contracts, thanks to which a public manager may be called upon to provide one or more functions, such as design, financing, construction, ownership, operation and revenue collection. This leads to the establishment of contracts that are more and more complex, sharing rights and duties differently among public and private parties. To illustrate such a diversity, let us now examine three types of public-private partnerships, namely concession, lease and management contracts.

2.1 *Concession Contracts*

In concession contracts, the private delegate is responsible not only for the operation and maintenance of the public service but also for the construction, renovation and financing of major changes needed to provide the service. In return, the agent is paid directly from the fees paid by users. Such contracts are present in many countries around the world, sometimes under the BOT or BOOT denominations.⁵ According to the World Bank private participation in infrastructure database, between 1990 and 2000, overall 65% of the projects in Latin America and the Caribbean were adjudicated as concessions. Telecommunications accounted for 3%, energy for 54%, water and sanitation for 89%, and transportation for 98% (GUASCH, LAFFONT, AND STRAUB [2008]).

⁵It is still worth noticing that in certain BOT, assets go back to the private firm at the end of the contract, which is not the case in concession contracts.

2.2 Lease Contracts

In such contracts, a private firm leases the assets of a utility from the government and takes on only the responsibility for operating and maintaining them: all major works required are taken on by the local public authority. By collecting and keeping fees from users, the lessor buys the rights to the income stream from the utility's operations (minus the lease payment), as in the previous case. However, leases leave the responsibility of financing and planning investments to the government. If major new investments are needed, the government must raise the financing and coordinate its investment program with the operator's operational and commercial program. The private manager can then decide on the investments for operational tasks, but needs the agreement of the public authority for innovations relative to the infrastructure. Lease contracts are widely used in France and Spain: for example, 56.82% of water production and distribution services are managed in France through these types of contracts, also called "Affermage" (CHONG, HUET, AND SAUSSIER [2005]).

2.3 Management Contracts

Management contracts transfer responsibility for the operation and maintenance of government-owned businesses to the private sector for a certain period of time. Different types of management contracts can be observed, but the simplest consists in paying a private firm a fixed fee for performing managerial tasks. More sophisticated management contracts can introduce greater incentives for efficiency, by defining performance targets and basing remuneration at least in part on their fulfilment. However, it is often difficult to find appropriate indicators, directly connected to the private operator's performance. An example is given in the recent toolkit edited by the World Bank [1997, p.4] concerning the water sector:

"[U]naccounted-for water is a good indicator of a system's efficiency, but it can be hard to measure—especially if metering is inadequate—making it difficult to establish a meaningful base for evaluating the operator's performance. And the operator's ability to reduce unaccounted-for water may depend not only on its efforts to reduce leaks but also on the resources that the government makes available for rehabilitating pipelines. There is often a fine dividing line between operations and maintenance expenditures, for which the private operator is responsible, and capital investment, for which the government is responsible—and both will affect the operator's performance."

For simplicity's sake, management contracts are here considered as contractual arrangements in which private operators perform tasks ordered by a public authority, and are remunerated with a fixed revenue. This means that they do not benefit from the stream of revenue generated by the exploitation of the assets.

These three types of contracts are summarized in Table 1, through the notions of payoff and decision rights. Holding residual payoff rights means that the agent benefits

from the income stream from the utility's operations, and thus from cost reductions whenever innovations allow for them. Holding residual decision rights means that the agreement of the agent is indispensable to implementing new innovations.⁶

Table 1:
Allocations of Residual Decision and Payoff Rights

Contracts	Payoff rights		Decision rights	
	delegating authority	delegated authority	delegating authority	delegated authority
Concession contracts		x		x
Lease contracts		x	x	
Management contracts	x		x	

The following model tries to integrate such separations of the owner's attributes to an incomplete contract theory framework.

3 The Model

3.1 The Framework

As in HART, SHLEIFER, AND VISHNY [1997], a benevolent public authority, denoted G , is here considered, having in charge the provision of a public service, noted F . The manager of the facility or the service is noted M , whether public or private. G can then decide to provide the service in-house, or to contract it out to a private manager. In each case, G and M are able to write a long-term contract specifying some aspects of the good or service to be provided. Although G and M can specify some aspects of the good or service in advance, we suppose some others cannot be specified as all contingencies cannot be anticipated ex ante. The contract thus describes the provision of the service, and its price P_0 , which is the price paid to the private manager in case of private provision, or the wage M received by a public employee in the case of in-house provision.

Moreover, observable but unverifiable investments researching innovative approaches to perform tasks in excess of the basic standards specified in the initial contract can be made, as well as observable but unverifiable cost-reducing investments. We assume that an innovation, if implemented, has an effect both on the social benefits generated by the public service, and on the profits.

The final benefit to society is noted B and costs the manager C to produce. Both variables can be represented by a euro amount. The manager can manipulate

⁶Decision rights can be allocated differently for innovations concerning operational tasks and innovations relative to the infrastructure. The table mentions decision rights for major innovations concerning the assets of infrastructure. Consequences of such a choice will be explained in the following paragraphs.

B and C through prior effort choices. More precisely, M can devote effort to two types of “innovations” relative to the basic good: a cost innovation and a quality innovation. We suppose that a cost innovation leads to a reduction in costs C but is typically accompanied by a reduction in quality. Similarly, a quality innovation leads to an increase in quality, but is typically accompanied by an increase in costs.

Consequently, we write the benefit to society $B = B_0 - b(e) + \beta(i)$, and the cost-reducing innovation is $C = C_0 - c(e)$, where e and i denote respectively effort devoted to the cost innovation and quality innovation; $c(e) \geq 0$ is the reduction in cost corresponding to the cost innovation and $b(e) \geq 0$ is the reduction in quality corresponding to the cost innovation.⁷ $\beta(i)$ represents the level of increase in social benefit due to investments of type i . B_0 represents the initial level of benefit, independent from the investments, and C_0 represents the amount of initial cost independently of the level invested.

Standard assumptions about the convexity, concavity, and monotonicity of b , c , and β are made such as:

$$b(0) = 0, \quad b' \geq 0, \quad b'' \geq 0, \quad c(0) = 0, \quad c'(0) = \infty, \quad c' > 0, \quad c'' < 0, \quad c'(\infty) = 0, \\ \beta(0) = 0, \quad \beta'(0) = \infty, \quad \beta' > 0, \quad \beta'' < 0, \quad \text{and} \quad \beta'(\infty) = 0, \quad c' - b' > 0.$$

The assumptions $c' - b' > 0$ and $\beta' > 0$ say that the quality reduction from a cost innovation does not affect the cost reduction from a cost innovation, and the cost increase from a quality innovation does not offset the quality increase. This is a strong assumption formulated in HART, SHLEIFER, AND VISHNY [1997], as it implies that the net effect of cost-reducing investment is always positive. We then focus on particular types of public services, for which cost-reducing investments may provoke damages on quality that are inferior or equal to the gains they entail. Similarly, we need to keep track of the separate cost and quality components of the cost innovation (c and b), but not of the quality innovation, considered as a net effect.

The investments considered are for the main part human capital investments. In accordance with HART, SHLEIFER, AND VISHNY [1997], we assume consequently that i , e , b , and c are observable to both G and M , but are not verifiable to outsiders and hence cannot be part of an enforceable contract.

As is usual in property-rights models, the parties want to renegotiate the contract at date 1 once they learn the nature of potential quality improvements and cost reductions. We also consider that G and M divide the gains from renegotiation according to a Nash bargaining, i.e. they split the surplus 50 : 50. The parties' default payoffs – that occur in the absence of renegotiation – thus influence final payoffs.⁸

⁷The function b plays a key role in the model, as it measures how much non-contractible quality fails because of a non-contractible cost cut, and hence serves as the variable that critics of privatization focus on.

⁸As in HART, SHLEIFER, AND VISHNY [1997], the public authority does not maximize

Yet, in departure from the property-rights literature, decisions to implement new innovations require here the approval of the holder of the residual decision rights, who is not necessarily the owner of the facility. Indeed, assets involved in the public service are “alienable”, i.e. characterized by the possible separation of ownership, residual decision and payoff rights.

The contract thus specifies the repartition of these rights, i.e. who decides what is not written *ex ante* in the contract, and who receives the payoff generated by the exploitation of the service, and thus benefit from the non-contractible gains linked to cost reduction. (In other words, decision rights are contractible *ex ante* but not decisions themselves. In the same way, payoff rights are thus contractible *ex ante*, even if payoffs themselves cannot be exactly foreseen *ex ante*, as they depend on non-contractible investments). Ownership is then no longer defined in function of residual decision and payoff rights, but as the rights to receive the assets at the end of the contract.

To sum up, the timing of the game is as follows:

$T = 0$: A public authority chooses a contract sharing rights to decide in case of unforeseen events, and rights to benefit from residual benefits.

$T = 1/2$: M chooses efforts e or i devoted to cost reduction or quality innovations.

$T = 1$: If no renegotiation occurs, basic goods are supplied. However, renegotiation will occur to reach the agreement of the holder of the decision rights.

Finally, G and M are supposed to be partially locked into each other once their relationship is under way. Specifically, there is no facility available other than F that can supply society, and there is no other potential customer for the service apart from G . However, M 's labor services may be partially substitutable. We also assume that G and M are risk-neutral, and that there are no wealth constraints.

As implementing innovations does not require the owner's agreement, but that of the holder of the residual decision rights, each contract leads to four different situations:

(A) In this case, the private manager holds both residual payoff and decision rights over maintenance, operation, construction and renovation. Consequently, he benefits from the receipts of the exploitation of the service $c(e)$ without suffering from the adverse effect $b(e)$, and then implements cost-reducing innovations whenever possible. It is yet not in his interest to implement quality innovations without the approval of the public authority, as no payment is foreseen *ex ante* in the contract. He then asks for renegotiation, that occurs under Nash bargaining procedure, and leads to a split 50 : 50 of the gains $\beta(i)$.

(B) In lease contracts, the private operator can decide to implement innovations relative to operational tasks, but not those relative to the infrastructure, as the global surplus during renegotiations: its utility function is given by the welfare of the rest of society, excluding M . If it placed the same weight on M 's utility as on the rest of society, the first-best could be achieved.

public authority holds the residual decision right over these assets. The private manager benefits from cost reduction as holder of the payoff right, and then asks for renegotiation of the contract, whenever cost reduction innovations are feasible, so that to reach the approval of the decision holder. Following Nash bargaining procedure, the net payoff of the cooperation, i.e. $c(e) - b(e)$ is shared 50 : 50, which creates some incentives for the public authority to accept the implementations of new innovations. As for quality innovations, the situation is similar to the previous case: if the manager can ameliorate the quality, he asks for renegotiation to receive one part of the corresponding gains, as no payment is foreseen *ex ante*.

(C) As described in Table 1, in management contracts, the private operator has neither residual decision right nor residual payoff right. He then cannot decide on its own new investments, and is paid a fixed revenue. As a consequence, gains from cost reduction first benefit to the public authority, as it does not change the stream of revenue that is foreseen for the private operator. If the manager has an idea to improve the management of the assets, he then has to ask for renegotiation to be allowed to implement these innovations, and to bargain one part of the gains. Nash bargaining takes place on the whole surplus generated by these innovations, i.e. $\beta(i) + c(e) - b(e)$.

(D) Finally, the public authority can still decide to provide public services in-house, i.e. through a public employee. At first glance, this public manager has no incentive to invest as he does not benefit from the payoffs of new innovations. Yet, as depicted in HART, SHLEIFER, AND VISHNY [1997], he can force the public authority to renegotiate the contract as he can become irreplaceable for some innovations to be implemented. Indeed, if the public manager has an idea about how to reduce costs or increase quality then a fraction of the benefit of this idea requires his participation, but the remainder can be realized without him because some aspects of his ideas become public knowledge (at least within the organization). The public authority can realize a fraction $0 \leq (1 - \lambda) \leq 1$ of the net social gains $-b(e) + c(e) + \beta(i)$ from innovating without the public manager by hiring a different manager and paying him at cost. In the case $\lambda = 1$, the public employee is irreplaceable, and hence can command the same share of the total rents in the negotiation with a private manager.

The perspective of this work is a normative one: optimal levels of investments, i.e. the first-best amount of investments maximizing the total surplus, are first determined, and then incentives reached under each type of the four structures described above are analyzed, to find the most efficient organizational structure.

3.2 *The First Best*

Consider a benchmark situation where e and i are contractible. Their levels are chosen to maximize the total net surplus from their trading relationship, and divide the surplus between them using lump-sum transfers. That is, in the first best, G

and M solve:

$$\max B_0 - b(e) + \beta(i) - C_0 + c(e) - e - i.$$

There is a unique solution (i^*, e^*) characterized by first-order conditions:

$$-b'(e^*) + c'(e^*) = 1 \quad \text{and} \quad \beta'(i^*) = 1.$$

At the social optimum, the marginal social benefit of spending extra effort to reduce costs, measured to take account of marginal quality deterioration, must equal the marginal cost of that extra effort, which equals one. Similarly, the marginal social benefit of spending extra effort to improve quality must equal the marginal cost of that extra effort, which again equals one.

3.3 Equilibriums in Public-Private Arrangements

We examine here the three types of contracts described previously, i.e. concession, lease and management contracts, as well as in-house provision. As usual in the GHM approach, all these equilibriums will be determined in a static framework. Effects of career concerns on incentives to invest are then not taken into account. (An analysis based on repeated games would be probably useful to such an end. However, we can note that the managers – whether public or private – have uncertain horizons in all cases, since the public authority can still decide to select or to nominate another manager in future).

3.3.1 Determination of the Levels of Investments

Concession Contracts. In this case, decision rights are attributed to the private manager, as he decides for the major investments. Furthermore, he directly collects fees on users, which means that he benefits from the receipts of the exploitation of the service $c(e)$ without suffering from the adverse effect $b(e)$. The renegotiation takes place over the quality innovation, as it generates a benefit equals to $\beta(i)$ for the public authority, that is split 50 : 50,⁹ as described in (A).

The payoffs of the parties are thus as follows:

$$UE_1 = B_0 - P_0 + \frac{1}{2}\beta(i_1) - b(e_1)$$

and

$$UM_1 = P_0 - C_0 + c(e_1) + \frac{1}{2}\beta(i_1) - e_1 - i_1.$$

The maximization of the utility function of the manager thus leads to the following levels of investments: e_1 such as $c'(e_1) = 1$ and i_1 such as $1/2 \beta'(i_1) = 1$.

⁹The amount of revenue corresponding to $1/2 \beta(i)$ may come from subsidy attributed to the private operator. Moreover, given the fact that the public authority benefits from extra-powers in many legal frameworks, one could think that the scope of renegotiation could be imposed by the public authority and enlarged to include the adverse effect $b(e)$ it supports. Following HART, SHLEIFER, AND VISHNY [1997], this situation is not represented here but for a discussion on this theme, see DESRIEUX [2006].

In other words, such a structure does not give optimal incentives to the private manager to ameliorate quality of the service through quality investments beyond those specified in the contract. To the contrary, the incentives to invest in cost-reducing investments are over-optimal, as the damages it entails are not taken into account by the holder of the decision rights. These results correspond to the “privatization” case of HART, SHLEIFER, AND VISHNY [1997].

The surplus that thus achieved is:

$$S_1 = UE_1 + UM_1 = B_0 + \beta(i_1) + c(e_1) - b(e_1) - C_0 - e_1 - i_1.$$

Lease Contracts. As described in (B), renegotiation does not only occur on quality innovation, but also on cost-reducing innovation, as the public authority holds decision rights for all types of innovations modifying the infrastructure. Net benefits coming from such a cost-reducing are shared 50/50.

The payoff functions of the parties are thus as follows:

$$UE_2 = B_0 - P_0 + \frac{1}{2}\beta(i_2) + \frac{1}{2}(c(e_2) - b(e_2)),$$

$$UM_2 = P_0 - C_0 + \frac{1}{2}\beta(i_2) + \frac{1}{2}(c(e_2) - b(e_2)) - e_2 - i_2.$$

This structure then gives the following incentives to invest: e_2 such as $1/2 (c'(e_2) - b'(e_2)) = 1$, and i_2 such as $1/2 \beta'(i_2)=1$. Lease contracts thus generate similar under-optimal incentives to invest in quality innovation as in concession contracts, but lower in cost-reducing one, as $1/2 (c'(e) - b'(e)) \leq c'(e)$.

This case could not be explored in HART, SHLEIFER, AND VISHNY [1997], as it implies the separation of decision rights from the ownership.

The surplus that is thus achieved is:

$$S_2 = UE_2 + UM_2 = B_0 - C_0 + \beta(i_2) + c(e_2) - b(e_2).$$

It is yet worth noting that such a situation occurs for innovations relative to the infrastructure, since the public authority holds the decision rights over the corresponding assets. But, as the private manager is responsible for operation and maintenance, he may decide on its own innovations concerning operational tasks. Incentives to invest in this case are then similar to the case of concession contracts, when the private operator holds the decision rights.

Management Contract. As mentioned in (C), renegotiation then occurs on the whole surplus, as the public authority holds decision rights. The sharing of the surplus is then similar to the previous case, but comes from a different situation: not only has the manager no right to decide innovations, but he also has no right to perceive the correlated benefits. Renegotiation is then motivated both to reach the approval of the public authority, and to receive one part of the gains, which was not foreseen ex ante.

The payoffs of the parties are thus as follows:

$$UE_3 = B_0 - P_0 + \frac{1}{2}(\beta(i_3) - b(e_3) + c(e_3)),$$

$$UM_3 = P_0 - C_0 + \frac{1}{2}(\beta(i_3) - b(e_3) + c(e_3)) - e_3 - i_3.$$

As the private manager has the right to decide non-contractible investments, the levels of investments are given by the maximization of its utility: e_3 such as $1/2 (-b'(e_3) + c'(e_3)) = 1$ and i_3 such as $1/2 \beta'(i_3) = 1$.

This means that the incentives to invest in cost reductions are similar to the previous case, but incentives to invest in quality innovations are similar to the previous cases.

The surplus that is thus achieved is:

$$S_3 = UE_3 + UM_3 = B_0 + \beta(i_3) + c(e_3) - b(e_3) - e_3 - i_3 - C_0.$$

3.3.2 Equilibrium under Public Governance

This last case corresponds to the “public ownership” in HART, SHLEIFER, AND VISHNY [1997]: decision rights are transferred to a public manager. At first glance, if his remuneration is not dependent from performance criteria, he has no incentive to implement new innovations. Yet, as mentioned in (D), we assume that there is a fraction λ of the total surplus obtained by the implementation of innovations that cannot be reached without the public manager, as e and i are embodied in its human capital.¹⁰ In the case $\lambda = 1$, the public employee is irreplaceable, and hence can command the same share of the total rents in the negotiation with G as private manager.

The public manager has thus a bargaining power coming from the fact that the public authority cannot do without him, if it wants innovations to be implemented. The renegotiation then takes over the fraction λ of both the cost and quality innovations that the public authority cannot appropriate, i.e. $\lambda(\beta(i) + c(e) - b(e))$. The gains are split 50 : 50, and so the parties' payoffs are:

$$UE_4 = B_0 - P_0 + (1 - \frac{1}{2}\lambda)(\beta(i_4) + c(e_4) - b(e_4)),$$

$$UM_4 = -C_0 + P_0 + \frac{1}{2}\lambda(\beta(i_4) + c(e_4) - b(e_4)) - e_4 - i_4.$$

Incentives to invest are thus dependent from the share that the public manager receives from the realized surplus, such as: $1/2 \lambda(\beta'(i_4)) = 1$ and $1/2 \lambda(c'(e_4) - b'(e_4)) = 1$. As $0 \leq \lambda \leq 1$, incentives are lower than in the other cases.

The surplus that is thus achieved is:

$$S_4 = UE_4 + UM_4 = B_0 + \beta(i_4) + c(e_4) - b(e_4) - C_0.$$

¹⁰If the public manager has an idea about how to reduce costs or increase quality then a fraction of the benefits of this idea requires its participation, but the remainder can be realized without him because some aspects of its ideas become public knowledge.

4 Analysis of the Optimal Ownership Structures

The optimal ownership structure is the one generating the greatest global surplus. To determine it, we now rank the levels of incentives achieved in each type of contract.

4.1 Main Results

Table 2 sums up the different incentives to invest.

Table 2:

Incentives to Invest for Each Type of Innovations and Contracts

Structures	Quality investments	Cost-reducing investments
First-Best	i^* such as $\beta'(i^*) = 1$	e^* such as $c'(e^*) - b'(e^*) = 1$
Concession contract	i_1 such as $\frac{1}{2}\beta'(i_1) = 1$	e_1 such as $c'(e_1) = 1$
Lease contract	i_2 such as $\frac{1}{2}\beta'(i_2) = 1$	e_2 such as $\frac{1}{2}(c'(e_2) - b'(e_2)) = 1$
Management contract	i_3 such as $\frac{1}{2}\beta'(i_3) = 1$	e_3 such as $\frac{1}{2}(c'(e_3) - b'(e_3)) = 1$
Public contract	i_4 such as $\frac{1}{2}\lambda\beta'(i_4) = 1$	e_4 such as $\frac{1}{2}\lambda(c'(e_4) - b'(e_4)) = 1$

By ranking the different incentives to invest, we have:

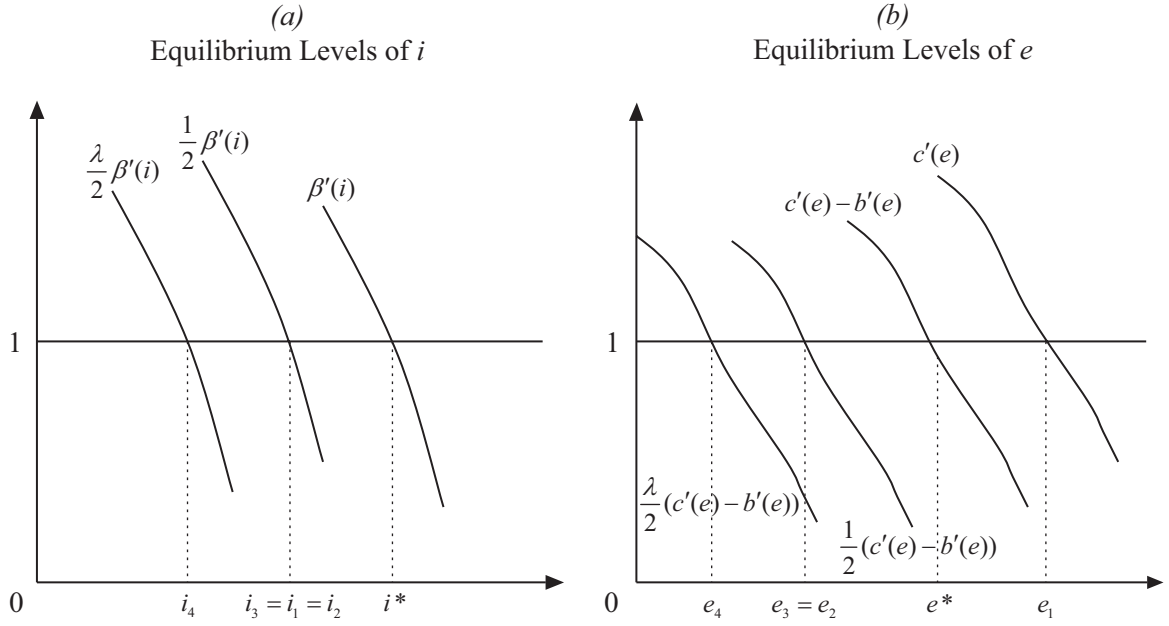
$$i^* > i_2 = i_1 = i_3 \geq i_4 \quad \text{and} \quad e_1 > e^* > e_3 = e_2 \geq e_4.$$

Figure 1 graphically represents this ranking. The following results can be drawn from it.

In accordance with HART, SHLEIFER, AND VISHNY [1997], the private ownership equilibrium, represented here by the concession contract, generates lower incentives to invest in quality investments than the optimal level, but stronger incentives to reduce costs. This result comes mathematically from the first-order conditions and from the concavity of the functions. This translates the ignorance of the adverse effect of cost-reducing investments by the private manager, and the split of the gains from quality innovations.

RESULT 1 $i^* > i_1$ and $e_1 > e^*$.

Figure 1:
Equilibrium Levels under Different Ownership Structures



Lease contracts perform similarly to concession contracts for operational tasks. However, whenever innovations deal with the infrastructure, the private operator has to split the net gains from the cost-reducing innovations with the public authority that holds the decision rights. From previous results, incentives to invest in such innovations appear as lower than the first-best level.

RESULT 2 $i^* > i_2$ and $e^* > e_2$.

Management contracts that attribute decision and payoff rights to the public authority entail under-optimal incentives to invest in both quality and cost-reducing innovations, as renegotiations occur for each type of innovations. First-order conditions gathered in Table 2 and concavity of functions lead to the following result:

RESULT 3 $i^* > i_3$ and $e^* > e_3$.

Public ownership appears as the structure that entails the lowest incentives to invest in both types of innovations. This comes from the splitting of the gains with the public manager and the coefficient λ that makes only the innovations depending on the human capital's manager eligible to the renegotiation. As a consequence, Result 4 can be established:

RESULT 4 $i^* \gg i_4$ and $e^* \gg e_4$.

4.2 Propositions

PROPOSITION 1 *No organizational structure for providing public services makes it possible to reach the first-best levels of incentives. Yet, there is always a type of public-private partnership that outperforms – or at least equals – public provision.*

PROOF The ranking of incentives shows that $i^* > i_2 = i_1 = i_3 \geq i_4$ and $e_1 > e^* > e_3 = e_2 \geq e_4$. In other words, public provision leads to the lowest incentives both in quality and cost-reducing innovations, and is outperformed by contractual tools involving a private partner. These contracts do not reach optimal incentives, but are the closer from the first-best level. The only case in which public provision performs as efficiently as private provision is when $\lambda = 1$, i.e. all innovations are embodied in the human capital of the public manager, which may appear as a very special case.

PROPOSITION 2 *When cost-reducing innovation is relatively unimportant, and quality innovation has a strong impact, private provision is preferable to in-house provision, whatever the type of contract that is concluded with the private party.*

PROOF Suppose that the function $b(e)$ is replaced by $\theta b(e)$, where $\theta > 0$, and $c(e)$ is replaced by $\phi c(e)$, where $\phi > 0$. Then for θ and ϕ sufficiently small, net gains from cost reductions converge to zero, and the total surplus is determined by gains from quality innovations. Contracts that lead to the greater level of incentives in quality are those involving a private partner, i.e. concession, management or lease contracts. Yet, when $\lambda = 1$, public solution performs similarly.

PROPOSITION 3 *When cost-reducing innovation has an important positive impact (i.e. entails a weak adverse effect or generates strong cost reductions), concession contracts are superior to other organizational structures.*

PROOF Suppose that the function $b(e)$ is replaced by $\theta b(e)$, where $\theta > 0$. Then for θ sufficiently small, concession contracts are preferable to other organizational structures to provide services.

Indeed, as $\theta \rightarrow 0$, the damage to quality from cost reduction disappears. Under these conditions, concession contracts lead to the efficient choice of e (since $c'(e) \approx c'(e) - b'(e)$).

Such a conclusion is valid, whatever the importance of quality gains in the total surplus, as concession contracts lead to the same level of quality investments as management or lease contracts. This level is under-optimal but higher than the level reached under public provision.

PROPOSITION 4 *When cost-reducing innovation has a weak positive impact (i.e. entails a relatively strong adverse effect), management or lease contracts are superior to other organizational structures.*

PROOF Suppose that $b'(e) \equiv c'(e) - \sigma$, where $\sigma > 0$. If $\sigma \rightarrow 0$ the social gains from cost reduction, $-b(e) + c(e)$, converge to zero: the quality damage fully offset the cost savings.¹¹

Then, for σ sufficiently small, $(c'(e) - b'(e)) \rightarrow 0$, and $e^* \rightarrow e_2 = e_3 \leq e_4$. It is yet to be noted that Proposition 4 is valid for innovations relative to the infrastructure: indeed, lease contracts perform as management contracts for those innovations, but lead to incentives similar to the concession contracts for operational tasks. Finally, here again, in the very special case where $\lambda = 1$, then $e_3 = e_2 = e_4$ and management or lease contracts are as efficient as public provision.

PROPOSITION 5 *When $0 \leq b'(e) \leq 1/4 c'(e)$, i.e. the adverse effect from cost reduction is relatively small, concession contracts are preferable to the other organizational structure, whereas if $b'(e) \geq 1/4 c'(e)$, lease or management contracts (or in-house provision if $\lambda = 1$) are more efficient.*

PROOF Proposition 5 allows to characterize more precisely the trade-off between the various types of public-private partnerships. First, quality innovations do not matter, as all contracts involving a private partner reach the same level of incentives in these types of innovations. Then, only the incentives of cost-reducing innovations allow to discriminate the various contracts. If $0 \leq b'(e) \leq 1/4 c'(e)$, then $3/4 c'(e) \leq c'(e) - b'(e) \leq c'(e)$, and e^* converges to e_1 rather than e_2 or e_3 .¹² Suppose now that $1/4 c'(e) \leq b'(e)$, then $c'(e) - b'(e) \leq 3/4 c'(e)$. This means that $(c'(e) - b'(e))$ is closer from $1/2 (c'(e) - b'(e))$ than $c'(e)$ and e^* converges to e_2 or e_3 rather than e_1 because of the concavity of functions. Public provision appears as an equivalent solution in this case, when $\lambda = 1$.

Before concluding, we now discuss our results compared to HART, SHLEIFER, AND VISHNY [1997] and the applications they mention.

4.3 Applications

Whereas HART, SHLEIFER, AND VISHNY [1997] conclude the preference of public provision in some cases (i.e. when cost-reducing investments can induce strong negative effects on quality, innovation is relatively unimportant, ex post competition or conditions for consumer choice are not really effective, or reputational mechanisms are weak), our model rejects such a conclusion. Indeed, results show that there is always a type of private involvement that outperforms public provision. How should such a result be dealt with when remembering the examples illustrating HART, SHLEIFER, AND VISHNY [1997]?

¹¹A strong adverse effect of cost-reducing investments entail a weak total net surplus of cost-reducing investments, as in each case, $c' - b' > 0$.

¹²Indeed, in such a case, $3/8 c'(e) \leq 1/2 (c'(e) - b'(e)) \leq 1/2 c'(e) \leq 3/4 c'(e) \leq c'(e) - b'(e) \leq c'(e)$, which implies that $e^* \rightarrow e_1$.

In this article, garbage collection is described as a service for which the damage to quality from the various types of investments is low. The authors conclude that privatization is preferable, which is confirmed by several empirical studies, such as DONAHUE [1989]. Our model is in accordance with private involvement, and even specifies what type of contract is the most appropriate according to the importance of quality innovations.

According to HART, SHLEIFER, AND VISHNY [1997, p.1156], the management of schools appears undetermined on a static level: “the damage to cutting costs may be large ($b(e)$), but innovation is probably important, and the incentives of public employed teachers are weak”. The authors then refer to the dynamic analysis to prove that private provision is better. Thanks to ex post competition, damages on quality can be evaluated by consumers and private managers cannot sacrifice this quality. The value of our model is to reject the public provision in the first step of the analysis, without the need for introducing new arguments about dynamics.

Let us now turn to the main example analyzed in HART, SHLEIFER, AND VISHNY [1997]: the management of prisons. As the quality of personnel and the use of force are not totally contractible and can lead to strong damages on social welfare, public provision is then justified. This seems all the more convincing as statistics show that only 3% of the prisons are privately managed. Another relevant example of public provision is given by the police and the armed forces. Privatization would attribute considerable powers to private managers, and risks holding-up the government or society. In an extreme case, nobody can think of privatizing nuclear weapons. Yet, these arguments show how strong the damages on quality cost-reducing investments can be, as it may affect the safety of society and people’s lives. Such examples can then be considered as being outside the scope of both models: indeed, one of the assumption mentioned in the framework of the model is $c'(e) - b'(e) > 0$, which entails that in HART, SHLEIFER, AND VISHNY [1997] as well as in our model, we only deal with public services whose marginal gains from cost-reducing investments are greater than the marginal damages they can entail. The damages described in the previous examples are so strong that they are probably beyond the scope of our models. Hence, public provision observed in prisons and in the armed forces does not seem to discredit our results.

5 Conclusion and Discussion

LAFFONT AND TIROLE [1993] argue that private involvement in the management of public services leads to both lower costs and quality. In contrast, HART, SHLEIFER, AND VISHNY [1997] demonstrate that in some cases, it can induce both lower costs and higher quality. Our model confirms this result, but goes further by showing that there is always a degree of private involvement that is socially efficient. Private involvement can then be justified for certain public services that fit the assumptions we postulate, especially regarding damages to quality linked to cost-reducing investments.

Today, contractual tools allow public authorities to cede, for a defined period, their rights to make decisions over the assets in unforeseen contingencies, and rights to benefit from the revenue generated by the use of these assets. This does not signify ceding the ownership of the assets since they go back to the State at the end of the contract. The previous model has therefore tried to integrate such characteristics through a refinement of the GHM approach, in which ownership no longer represents the vector of residual decision and payoff rights.

With such a methodology, the efficiency of the mixed organizational structure between full public and full private management can be evaluated, which makes it possible to take the analysis further than the bipolar case presented in HART, SHLEIFER, AND VISHNY [1997]. Their conclusion, according to which public provision is preferable when adverse effects of cost reduction are strong, is then contradicted by our results: public provision does not appear as efficient for the management of public services, in which the marginal gain of cost reduction is superior to the marginal adverse effect that is generated. Indeed, contracts mixing public and private partners allow local authorities to authorize or reject the implementations of investments, even if private managers benefit from payoffs derived from the use of the assets. Before choosing investments in cost reduction, the private manager must reach an agreement with the public party that holds the residual right to decide on new investments. As a consequence, adverse effects of cost reduction are taken into account, and this allows for the preservation of certain deteriorations in social benefits. Incentives to invest both in quality and cost-reducing innovations then generally prove to be more efficient when a private manager is involved in the use of a public service than under in-house provision.

Yet, our analysis must be nuanced for several reasons. First, as in HART, SHLEIFER, AND VISHNY [1997], we implicitly postulate that public authorities defend the public interest, and that there is no corruption or patronage. If we assume such behaviour, this means that public authorities become interested in their own income, including bribes. As BOYCKO, SHLEIFER, AND VISHNY [1996] or SHLEIFER [1998] demonstrate, the effects on the optimal organizational structure are then ambiguous: a corrupt government is less able to privatize, regulate or contract in public interest, but is also less able to run firms in the public interest.

Second, ex post competition between the suppliers of the good is not taken into account in the model. This is a strong assumption to the extent that it may modify the incentives of a private operator to invest in quality innovations, as it gets a lower price for any quality shortfall resulting from a cost reduction and a higher price for any quality improvement. Private firms enrolled in concession or PFI contracts are then likely to develop first-best incentives to invest in quality, as is the case in lease contracts. Private involvement then out-performs public provision, whatever characteristics the public service may have.

Finally, our model is based on a formal and contractual vision of public-private partnerships. This analysis thus leads to conclude that the choice of the optimal contractual tool is dependent on the levels and the nature of the non-contractible

investments that are at stake in the local public services. Yet, it is worth mentioning that PPPs are also public–private relationships, and that extra-contractual elements are likely to play a role during the execution of contracts (MACAULAY [1963]). PPPs are indeed often long-term contracts and involve continuing interactions between parties, which also may be linked through other different contracts. Recent economic literature on contracting has thus emphasized the role of informal aspects, through the notion of “relational contracts” (BAKER, GIBBONS, AND MURPHY [2002], GIBBONS [2005]). They include certain elements that are observable for the parties but non-verifiable, and hence non-enforceable by the courts. Their respect then depends on the parties’ self interest or concern for reputation. Parties may also engage informally to a certain use of the decision rights and implementation of investments, corresponding to a common vision of public services. Such elements may also help to explain why different organizational choices are sometimes observed between apparently similar countries, and why public provision may persist in spite of this theoretical lower performance. We defer such analysis to future work.

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Claudine Desrieux
 ADIS-University of Paris XI
 54 Bd Desgranges, 92235 Sceaux Cedex
 E-mail: claudine.desrieux@free.fr