

Owner of Holder? A critical study of property rights in public services

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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 ex post 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 allows 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: D23, H7, H11, L33)

1 Introduction

Public provision has been traditionally recommended in the economic literature 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 has yet begun to accumulate [World bank, Bureaucrats in Business,1995]. Governments then turn to the contracting out of services and try to identify the opportunities for achieving social goals through private supply by a firm that may

*I thank Elisabetta Iossa, Oliver Hart, Claude Ménard, Yannick Perez, Stéphane Saussier and participants at the IDEI-Veolia conference on public service and management, at the Spring Meeting of Young Economists (SMYE), and EARIE colloquium for helpful comments at an early stage of this work.

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. Most of these countries thus benefit today from a great diversity of contracts allowing private firms to be involved in the provision of public services in many different ways.

This trend towards more “contractualization” of public services is not without raising many issues, both on a pragmatical and theoretical level. Difficulties appear especially when the government does not know exactly what it wants the producer to make, and then cannot put its wishes into the contract (or a regulation) and enforce it. In this case, contracts are considered as incomplete, as all contingencies cannot be foreseen *ex ante*. Such a situation has lead to fruitful theoretical analyzes, especially in the incomplete contract theory framework, proposed by GROSSMAN AND HART [1986], or HART [1995]¹. This approach (called “GHM” approach hereafter) allows indeed to evaluate rigorously the costs and benefits of privatization. Contractual incompleteness is assumed to come from non verifiability of investments to a third party. This is indeed not hard to motivate for public services once it is recognized that the quality local public authorities want is often difficult to specify (such as 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, ...). The sharing of property rights conveys residual control rights, that gives the owner control and 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. The difference between public and private structures thus concerns the allocation of property rights, rather than the degree of competition *per se* (HART, SHLEIFER AND VISHNY [1997]).

Among the articles dealing with public services and based on this framework, BOYCKO, SHLEIFER, AND VISHNY [1996] discusses privatization as a

¹We intentionally focus here on literature inspired by this framework, even if we have to note that other contributions on PPPs’efficiency come from other frameworks, such as agency theory for instance (LAFFONT [2000], LEVIN AND TADELIS [2004]) or empirical studies (LOPEZ, SHLEIFER AND VISHNY [1997]).

strategy available to the reformers to reduce inefficiency of public firms. Privatization is here considered as a reallocation of control rights over employment from politicians to managers and the increase in cash flow ownership of managers and private investors. Still with the incomplete contract theory framework but focusing on the bundling question, HART [2003] suggests that the choice between PPPs and conventional provision turns on whether it is easier to write contracts on service provision than on building provision. Trying to clear-cut the debate about the organizational forms of public services, the seminal work of HART, SHLEIFER, AND VISHNY [1997] (HSV [1997] hereafter) proposes 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. This does not allow to account for the great diversity of contracts of public-private partnerships². The model we propose here is then a contribution to the study of organizational choices in public services but differs from this previous literature by introducing a more detailed version of property rights than in the “GHM” approach. To this end, we mix this theoretical framework with some elements of the work of BAKER, GIBBONS, AND MURPHY [2004, 2005] (BGM [2004,2005] hereafter) about the theories of the firm. We break the notion of residual control rights and consider assets as “alienable”, which means that the owner of an asset does not hold automatically the decision rights nor the payoff rights over this asset. In other words, and in accordance with what is commonly observed in contracts of public-private partnerships, assets may remain 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

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](http://ppi.worldbank.org/resources/ppi-glossary.aspx)

concession contracts for instance. In contrast, *lease contracts* allow to transfer payoff rights to a private party that keeps fees collected from users but decisions about major investments are made by the public authority that remains owner of the assets at the end of the contract. As for *Private Finance Initiative* projects (PFI), they allow to public authorities to remunerate a private manager, but transfer the rights to decide about design, operation and maintenance to a private operator. Contrary to 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 payoff rights.

This detailed vision of the rights linked to ownership comes from BGM [2004,2005], yet, in departure from them, we assume that renegotiation between parties can occur to achieve ex post efficiency. Whereas interfirm contracts analyzed by BGM [04] allow no time to recontract on either decision rights or payoff rights once the contract is signed and decision have to be made, we consider here that public-private partnerships are long-term contracts that allow parties to renegotiate before decisions are made. This assumption is supported by works demonstrating the importance of renegotiations in public-private contracts (GUASCH, LAFFONT, AND STRAUB [2003]). The implementation of innovations then needs the agreement of the holder of the decision rights, but this can be reached through renegotiation of the terms of the contract.

To sum up, the originality of our approach comes from the combination of alienable assets from BGM [04,05] and pareto-improving renegotiations due to contractual incompleteness from GHM. Such a mix intends to better apprehend observed public-private partnerships. Thanks to this new methodological approach, the goal of this paper is 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 if we separate the owner's attributes as observed in contracts of public-private partnerships. In other words, in a static framework, are public services still to be provided in-house when cost-reducing investments induce strong adverse negative on quality and innovation is relatively unimportant?

In the following section of this article, we try to show how the owner's rights can be allocated in contracts of public-private partnerships. Section III proposes a model of government contracting, where the provider of the

service can invest his time to improve the quality of the service or to reduce its cost. As in HSV [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 results obtained by HART, SHLEIFER AND VISHNY [1997]. Indeed, residual control rights, that convey rights to decide and to keep benefits, does not apprehend precisely private involvement in public services' management. It does not allow to go further than the dichotomy private vs. public ownership, saying no word 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 solution" and the "public" one. Results also show that, contrary to the conclusions of HSV [1997] there is always a degree of private involvement that allows to outperform public provision of services. Section IV 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 more and more complex contracts, sharing differently rights and duties among public and private parties. To illustrate such a diversity, let's now examine three types of public-private partnerships, namely concession contracts, lease contracts and Private Finance Initiative (PFI).

2.1 Concession contracts

In concession contracts, the private delegate is responsible not only for 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. 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. It was

3% for telecommunications, 54% for energy, 89% for water and sanitation, and 98% for transportation (GUASCH, LAFFONT, AND STRAUB [2006]).

2.2 *Lease contracts*

In this organizational structure, the leasee directly receives all means required to provide the contracted service. The leasee is responsible for maintaining the equipment or infrastructures, whereas the local authority takes on all major works required. As it also finances these major works, we consider that the public authority holds the decision rights. The leasee has full operational responsibility and holds the payoff rights, as he is paid from the fees received from users. 56,82% of water production and distribution services are managed in France through these types of contracts called “Affermage” (CHONG, HUET AND SAUSSIÉ [2005]).

2.3 *Private Finance Initiative*

Under the most common form of PFI, the private sector designs, builds, finances and operates (DBFO) facilities. The public sector pays the PFI contractor a stream of committed revenue payments for the use of the facilities over the contract period. Once the contract has expired, ownership of the asset either remains with the private sector contractor, or is returned to the public sector, depending on the terms of the original contract. We thus consider that the private party does not hold the payoff rights, as his revenue comes from the public authority and not from the collected fees, but holds decision rights, as the private sector builds most public facilities and carries out the design, financing and operation of public services. PFI projects are particularly successful in Great Britain, where they have ranged from small projects, such as the £100,000 Littlehampton Community School ITC facilities project in West Sussex, to Europe’s largest construction project, the £4 billion deal for the Channel Tunnel Rail Link (CTRL).³ By October 2005, agreements for about 700 PFI projects had been signed by central and local government across a wide range of sectors. Using Partnerships UK’s project database, around 450 of these projects were identified as operational (i.e. the

³Source: The Private Finance Initiative, research paper 01/117, 18 December 2001, economic policy and statistics, section House of commons library, Grahame Allen, [http : //www.oldham.gov.uk/pfi_initiative.pdf](http://www.oldham.gov.uk/pfi_initiative.pdf)

construction phase completed and services being delivered) as at the end of March 2005.⁴

The following table sums up the various distributions of rights and attributions among these three types of public-private partnerships.

Table 1: *Characteristics of contracts of public-private partnerships*

	Concession contracts		Lease contracts		PFI	
	DA	PO	DA	PO	DA	PO
Infrastructure financing		X	X			X
Runing coasts		X		X		X
Fees collected from uses		X		X	X	
Personal management		X		X		X
Maintenance		X		X		X
Major Investments		X	X			X

DA: Delegating authority

PO: Private operator

These three different types of contracts thus share differently rights to decide and to collect payoff of the assets. The model that follows tries to integer such separations of the owner's attributes.

3 The model

3.1 The framework

We consider a public authority, denoted G, 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 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

⁴Source: Report on operational PFI projects by partnerships UK, march 2006, [http : //www.partnershipsuk.org.uk/Information/pdf/Operational_PFI_PUK_report20060322.pdf](http://www.partnershipsuk.org.uk/Information/pdf/Operational_PFI_PUK_report20060322.pdf)

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

The benefit to society is noted B and costs the manager C to produce. Both variables can be represented by a dollar amount. 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.⁵ $\beta(i)$ 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: $b(0) = 0, b' \geq 0, b'' \geq 0, c(0) = 0, c'(0) = \infty, c' > 0, c'' < 0, c'(\infty) = 0, \beta(0) = 0, \beta'(0) = \infty, \beta' > 0, \beta'' < 0$ et $\beta'(\infty) = 0, c' - b' > 0$.

The assumption $c' - b' > 0$ 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 hypothesis formulated in HSV [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 invest-

⁵The function b plays a key role in the model, as it measures how much noncontractible quality fails because of a noncontractible cost cut, and hence serves as the variable that critics of privatization focus on.

ments. 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. The contract then only specifies which party has the right to decide for unforeseen investments and to benefit from the exploitation receipts.

More precisely, by having to decide how to manage F , the public authority has to choose between a variety of contractual tools, involving private partners at various degrees. In departure from property-rights literature, we consider here that assets involved in the public service are alienable, *i.e.* characterized by the possible separation of ownership, decision and payoff rights. In other words, the owner is not necessarily the decision-maker or does not always receive payoffs linked to these assets. This allows to involve private manager through contractual tools in very different ways.

Ownership, decision rights and payoff rights are thus shared *ex ante* between public and private partners through a contract. We assume here that decisions mainly concern the observable but unverifiable investments described above. Decisions are thus non contractible *ex ante*, but the contract specifies which party has the right to decide the implementation and the financing of such investments during the execution of the contract, in case unforeseen innovations appear.⁶ In the same way, the contract mentions which partner receives the payoff generated by the exploitation of the service, and thus benefit from the gains of the non-contractible investments. When payoff rights are attributed to the public authority, it receives the receipts linked to the exploitation of the service (and benefits from eventual cost reductions), and the private manager is remunerated by the public authority, by a fix amount of money. In contrast, when the payoff rights are attributed to the private company, it directly collects fees on users, and then directly benefits from cost-reducing investments. 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.

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

⁶In other words, decision rights are contractible *ex ante* but not decisions themselves.

substitutable. We also assume that G and M are risk-neutral, and that there are no wealth constraints.

Contrary to BGM (2004, 2005), the parties may renegotiate the contract at date 1 once they learn the nature of potential quality improvements and cost reductions. We assume that the distribution of decision rights ex ante allows to save renegotiation costs for minor decisions, yet, for major decisions as the implementations of innovations, the costs of renegotiation appears as insignificant, and renegotiation occurs. As in traditional incomplete contract theory framework, we consider here 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.⁷

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= $\frac{1}{2}$: 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.

In departure from HART, SHLEIFER AND VISHNY[1997], implementing innovations does not require the owner's agreement, but that of the holder of the decision rights. Thus, each contract leads to four different situations:

(A) In case of concession contracts, ownership may remain public, but investments need the private manager's approval, as he has the decision rights over the assets. Yet, it is not in his interest to introduce unforeseen quality innovations without the approval of the public authority, for no payment will be forthcoming for an uncontracted-for quality improvement, unless a new contract is written. Yet, as for uncontractible cost-reducing investments, he

⁷This is an important distinction compared to BGM [04,05], where the parties choose an allocation of decision rights and payoff rights, and then, the state of the world (s) is revealed, after which the parties make decisions and payoffs are realized. The revelation of s are assumed to be fleeting, in the sense that decisions must be made immediately after the state is revealed: there is in this case no time to recontract on either decision rights or payoff rights between the time that s is revealed and decisions must be made.

can decide their implementations without the public authority's approval, as he holds the decision rights.

(B) In lease contracts, the public authority holds the decision rights, and can decide the implementation of quality and cost-reducing innovations on its own. Payoff rights are attributed to a private manager that thus benefit from cost-reducing investments without suffering from its adverse effect. Yet, the public authority has first no incentives to invest in cost-reducing investments, as it supports only the damages linked to them. For such investments to be implemented, the private manager has to renegotiate the contract and split 50:50 its gains. If the net gains are positive for the public authority, it implements such innovations.

(C) As for PFI, decision rights are transferred to the private manager, as described previously in the first section. Yet, the public authority holds the payoff rights, and thus benefit from the residual payoffs, in case of unforeseen innovations. For the private manager to implement innovations, renegotiation occurs and net total gains of the public authority are split 50:50.⁸

(D) Finally, in case of public provision, payoff rights are kept by the public authority, but decision rights are transferred to a public manager. At first glance, he has no incentive to invest as he does not benefit from the payoffs of new innovations. Yet, as depicted in HSV [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.

We first determine the optimal levels of investments, *i.e.* the first-best amount of investments maximizing the total surplus. We then analyze each different decision process to try to see in which case the best incentives are

⁸Even if the private manager is remunerated by the public authority, PFI contracts mention that this revenue can entail some variable parts linked to the performance. This justifies the remuneration linked to the net total surplus.

reached.

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:

$$\text{Max} B_0 - b(e) + \beta(i) - C_0 + c(e) - e - i$$

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

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

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*

3.3.1 *The sharing of decision and payoff rights*

We examine here four types of contracts, *i.e.* concession contracts, lease contracts, PFI contract, and public contracts. Each of them gives different attributes to public and private manager. We call “decision rights” the right to decide the implementation of investments that were not foreseen *ex ante*; and “payoff rights” the right to benefit from the receipts of the assets by collecting directly the revenue.

From what has been exposed in the first part, contracts of PPPs can then be summarized in the following table:

3.3.2 *Determination of the levels of investments*

Following the sharing of the decision and payoff rights formulated in the chosen contract, the utility function of each agent can be determined. As the holder of the decision rights decides the amounts of investments that were not foreseen *ex ante*, the maximization of its utility function allows to know the levels of investments that are reached.

Table 2: Allocations of decision and payoff rights

Contracts		The private manager	The public authority
Concession contracts	Decisions rights	X	
	Payoff Rights	X	
Lease contracts	Decisions rights		X
	Payoff Rights	X	
Private Finance Initiative	Decisions rights	X	
	Payoff rights		X

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 50:50⁹, as described in (A).

The payoffs of the parties are thus as follows:

- $UE_1 = B_0 + 1/2\beta(i_1) - b(e_1)$
- $UM_1 = -C_0 + c(e_1) + 1/2\beta(i_1) - e_1 - i_1$

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 $1/2\beta'(i_1) = 1$.

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

⁹Even if the private manager directly collects fees on users, the amount of revenue corresponding to $1/2\beta(i)$ may come from subsidy attributed to the private operator. Moreover, because of extra-powers accorded to the public authority in many legal frameworks, renegotiation seems necessarily to be accepted by the private manager.

entails are not taken into account by the holder of the decision rights. These results correspond to the “privatization” case of HSV [1997].

The surplus that is thus achieved is:

$$S_1 = UE_1 + UM_1 = B0 + \beta(i_1) + c(e_1) - b(e_1) - C0 - e_1 - i_1.$$

Lease contracts

As described in (B), renegotiation does not occur on quality innovation, but on cost-reducing innovation. Benefits coming from such a cost-reducing are shared 50/50.¹⁰

The payoff functions of the parties are thus as follows:

- $UE_2 = B0 - C0 + \beta(i) - b(e_2) + 1/2c(e_2) - e_2 - i_2$
- $UM_2 = 1/2c(e_2)$

This structure then gives the following incentives to invest:

e_2 such as $1/2c'(e_2) - b'(e_2) = 1$, if $1/2c'(e_2) - b'(e_2) > 0$, else $e_2 = 0$ ¹¹

i_2 such as $\beta'(i_2) = 1$

Lease contracts thus generate greater incentives to invest in quality innovation, but lower in cost-reducing one. If $1/2c'(e_2) - b'(e_2) < 0$, no cost-reducing investment is implemented. In other words, only cost-reducing innovations with low adverse effect are implemented. This case could not be explored in HSV [1997], as it implies the separation of decision rights from the ownership.

The surplus that is thus achieved is:

$$S_2 = UE_2 + UM_2 = B0 - C0 + \beta(i_2) + c(e_2) - b(e_2)$$

Private Finance Initiative

As mentioned in (C), renegotiation then occurs on quality investments: for

¹⁰Even if investments are not verifiable, we assume that the private manager cannot implement cost-reducing innovation on its own, because of financial constraints. He thus needs the approval of the holder of the decision rights, but also its financial resources.

¹¹In the framework of the model, $c'-b'>0$ is assumed. For $1/2c'(e_2) - b'(e_2) = 1$ to be implemented, a stronger assumption is necessary: $1/2c'(e_2) - b'(e_2) > 0$. If it is not the case, none innovation is implemented as the decision holder has more damages than gains.

such innovations to be implemented, the public authority, that does not hold decision rights, has to split its gains with the public authority.¹²

The payoffs of the parties are thus as follows, where R represents the initial level of revenue attributed by the public authority to the private party:

- $UE_3 = B_0 + C_0 + \frac{1}{2} (\beta(i_3) - b(e_3) + c(e_3))$
- $UM_3 = R + \frac{1}{2} (\beta(i_3) - b(e_3) + c(e_3)) - e_3 - i_3$

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 $\frac{1}{2}(-b'(e_3) + c'(e_3)) = 1$ and i_3 such as $\frac{1}{2} \beta'(i_3) = 1$

This organizational structure generates lower incentives to invest in quality-improving innovations than in lease contracts, but stronger in cost-reducing investments, even if still under-optimal.

The surplus that is thus achieved is:

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

3.3.3 Equilibrium under spot public governance

In this case, decision rights are transferred to a public manager that also receive the financial resources to implement innovations if needed. 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.¹³ 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,

¹²Such a splitting may come from a rent paid to the public party, to have the right to exploit the public infrastructure. The public authority agrees to made cost-reducing investments, if the rent increases.

¹³If 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.

Table 3: 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 contracts	i_1 such as $\frac{1}{2}\beta'(i_1) = 1$	e_1 such as $c'(e_1) = 1$
Lease contracts	i_2 such as $\beta'(i_2) = 1$	e_2 such as $\frac{1}{2}c'(e_2) - b'(e_2) = 1$
Private Finance Initiative	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 $\frac{1}{2}\lambda (c'(e_4) - b'(e_4)) = 1$

i.e. $\lambda(\beta(i) + c(e) - b(e))$. The gains are split 50:50, and so the parties' payoffs are:

- $UE_4 = B0 + (1 - \frac{1}{2}\lambda)(\beta(i_4) + c(e_4) - b(e_4))$
- $UM_4 = C0 + \frac{1}{2}\lambda(\beta(i_4) + c(e_4) - b(e_4)) - e_4 - i_4$

Incentives to invest are thus dependent from the share that the public manager receives from the realized surplus, such as: $\frac{1}{2}\lambda(\beta'(i_4)) = 1$ and $\frac{1}{2}\lambda(c'(e_4) - b'(e_4)) = 1$.

The surplus that is thus achieved is:

$$S_4 = UE_4 + UM_4 = B0 + \beta(i_4) + c(e_4) - b(e_4) - C0.$$

4 Analysis of the optimal ownership structures

4.1 Main Results

Each structure develops different incentives to invest that can be summed up in the following table:

By ranking the different incentives to invest, we have:

$$i^* = i_2 \geq i_1 = i_3 > i_4$$

and if $(1 - \lambda)c'(e) > b'(e)$ and $\frac{1}{2}c'(e) - b'(e) > 0$,¹⁴

$$e_1 > e^* \geq e_3 \geq e_2 \geq e_4$$

else,

$$e_1 > e^* \geq e_3 \geq e_4 \geq e_2$$

In the first case, *i.e.* the marginal adverse effect of cost-reducing innovation is rather low or the public manager has few bargaining power, the various incentives to invest can be graphically represented as follows:

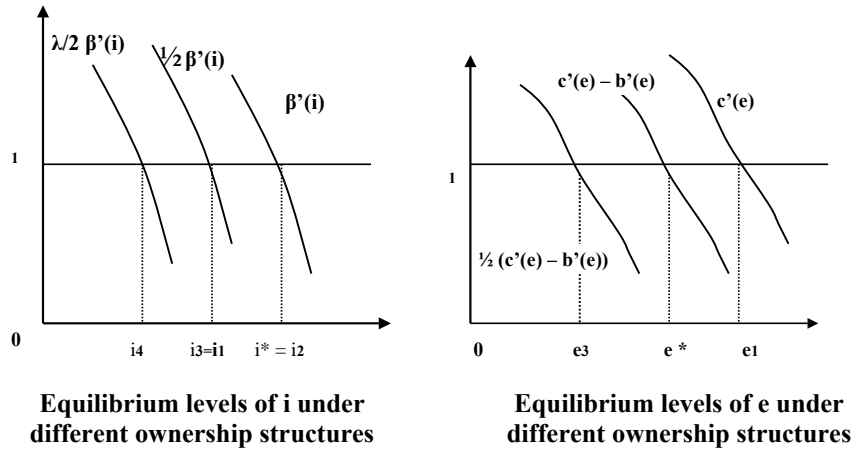


Figure 1: Levels of investments

- In accordance with HSV [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.

¹⁴Indeed, if $\frac{1}{2}c'(e) - b'(e) < 0$, then $e_2=0$, and $e_4 > e_2$, else the inequality holds if $(1 - \lambda)c'(e) > b'(e)$

Result 1: $i^* \geq i_1$ and $e_1 > e^*$

- Whereas in HSV [1997], no ownership structure allows to reach optimal incentives to invest in quality innovations, lease contracts appear here as structures generating first-best levels of quality innovations. Yet, as the private operator has to split the gains from the cost-reducing innovations with the public authority that holds the decision rights, the incentives to invest in such innovations are lower than the first-best level, and even the lowest in case the adverse effect of cost-reducing innovation is high or the public manager has strong bargaining power.

Result 2: $i^* = i_2$ and $e^* \gg e_2$

- PFI contracts that attribute decision rights to the private manager, and payoff rights to the public authority entail under-optimal incentives to invest in both quality and cost-reducing innovations, as the public authority has to share its gains to convince the private manager to implement innovations.

Result 3: $i^* \geq i_3$ and $e^* \geq e_3$

- 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.

Result 4: $i^* \gg i_4$ and $e^* \gg e_4$

4.2 Interpretations

PROPOSITION 1 : *When quality innovation is relatively unimportant, and cost-reducing innovation has an important positive impact (i.e. entails weak adverse effect or generate 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 $\theta > 0$. Suppose that the function $\beta(i)$ is replaced by $\tau\beta(i)$, where $\tau > 0$. Then for θ and τ sufficiently small, concession contracts are preferable to other organizational structures to provide services.

Indeed, as $\tau \rightarrow 0$, quality innovations converge to zero and do not determine the total surplus. Thus, only the choice of e matters. 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 $c'(e) \approx c'(e) - b'(e)$).

PROPOSITION 2 : When quality innovation is relatively unimportant, and cost-reducing innovation has a weak positive impact, i.e. entails strong adverse effect or generate weak cost reductions), PFI contracts are superior to other organizational structures.

PROOF :

Suppose that $b(e) \equiv c(e) - \sigma$, where $\sigma > 0$. Suppose that the function $\beta(i)$ is replaced by $\tau\beta(i)$, where $\tau > 0$. Then, for τ and σ sufficiently small, PFI contracts are the most appropriate organizational structure. Indeed, as in the previous case, when $\tau \rightarrow 0$, quality innovations converge to zero and do not determine the total surplus. Thus, only the choice of e matters, *i.e.* e_1 or e_3 as $e_1 > e^* > e_3$.

Yet, as $\sigma \rightarrow 0$ the social gains from cost reduction, $-b(e) + c(e)$, converge to zero: the quality damage fully offset the cost savings.¹⁵ The organizational form that is chosen is the one for which the incentives to reduce costs are weaker, *i.e.* e_3 .

PROPOSITION 3 : When cost-reducing innovation is relatively unimportant, and quality innovation has a strong positive impact, lease contracts are superior to other organizational structures.

PROOF

Suppose now 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, *lease contracts* are preferable to other organizational structures. Indeed, only the choice of i matters as the net impact of the surplus linked to the cost-reducing investments tends to zero, and as $i^* = i_2$, lease contracts lead to the first-best incentives.

PROPOSITION 4 : When quality and cost-reducing innovations are both equally important in the determination of the total surplus, the preferable organizational form is undetermined between lease and concession contracts.

¹⁵A strong adverse effect of cost-reducing investments entail a weak total net surplus of cost-reducing investments, as in each case, $c' - b' > 0$

PROOF

Suppose that the function $b(e)$ is replaced by $\theta b(e)$, where $\theta > 0$. Then for θ sufficiently small, cost-reducing innovations entail more gains than damages, and are thus to be encouraged.

Suppose that the function $\beta(i)$ is replaced by $\tau\beta(i)$, where $\tau > 0$. If τ does not converge to zero as in the first proposition, quality innovation matters.

Concession contracts entail appropriate incentives to invest in cost-reducing investments, as $e_1 > e^* > e_3$, but insufficient incentives in quality innovations, as $i^* = i_2 \geq i_1$. In contrast, lease contract may entail first-best incentives to invest in quality innovations, as $i^* = i_2$, but insufficient incentives to invest in cost-reducing ones, as $e^* \gg e_2$. No organizational structure allows to reach appropriate incentives in both types of innovations. The trade-off depends on the relative weight of τ and θ : the greater θ and τ are, the more important quality investments are and lease contracts are all the more preferable. The lower τ and θ are, the less determinant quality is and the more important cost reductions are, consequently concession contracts appear as more appropriate.

The following table summarizes the characteristics of the local public services associated with each contract:

	Strong total net effect of cost-reducing innovations ($b' \rightarrow 0$)	Weak total net effect of cost-reducing innovations ($c'-b' \rightarrow 0$)
Strong opportunities for quality innovations	Undetermined between Concession and lease contracts	Lease contracts
Weak opportunities for quality innovations	Concession contracts	PFI

Figure 2: Optimal contracts in function of the characteristics of the local public service

Before concluding, we now discuss our results compared to HSV [1997]

and the applications they mention.

4.3 Applications

Whereas HSV [1997] conclude to 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 conclusion. Without including some dynamic elements, there is always a type of private involvement that outperforms public provision. How to deal with such a result when remembering the examples illustrating HSV [1997]?

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 precise what type of contract is the best appropriate according to the importance of quality innovations.

According to HSV [1997], 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 on the first step of the analysis, without introducing new arguments about dynamics.

Let’s now turn to the main example analyzed in HSV [1997]: the management of prisons. As quality of personnel and 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. A privatization would attribute private managers enormous powers, and risks to hold up the government or society. As an extreme case, nobody can think of privatizing nuclear weapons. Yet, these arguments rather show how strong the damages on quality cost-reducing investments can entail, as it may affect the safety of society and lives of people. Such examples can then be considered as

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 HSV [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. Public provision observed in prisons and in the armed forces then 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 lead to both lower costs and quality. In contrast, HSV [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 allows to outperform public provision of services. Without introducing dynamic elements in the model, private involvement in public services can then be justified to the extent that they fit the assumptions we postulate, especially as for damages on quality linked to cost-reducing investments.

By decomposing the notion of residual control rights, the previous model has indeed tried to account for various existing types of public-private partnerships. With such a methodology, we thus have a more precise approach of the existing contracts of public-private partnerships, compared to previous studies where privatization and public management are perceived as a bipolar case (HART, SHLEIFER AND VISHNY [1997]). Using a similar framework, this allows to reject their result, to the extent that public provision does not appear as efficient under the restrictive conditions they establish. Indeed, a small deterioration of quality from cost reduction is no longer sufficient to recommend “privatization”, as the importance of quality innovation in the total surplus matters. Concession contracts are thus preferable in case of small deterioration of quality from cost reduction *and* the potential for quality innovations are relatively small. When quality innovations outweigh cost-reducing innovations in the total surplus, the result of HSV [1997] in case of small adverse effect of cost-reducing investments is no longer valid: a mixed structure between public and private is preferable to concession contracts. Furthermore, contrary to HSV [1997], when the adverse effect of cost reduction on quality is large, even if λ is strong (and public managers have strong

incentives to invest), it is not enough for public provision to be recommended. If quality innovations are unimportant, PFI contracts are preferable, else and if the choice of e does not matter, lease contracts that generate strong quality incentives may be superior.

Yet, our analysis needs to be nuanced for several reasons.

First, as in HSV [1997], we implicitly postulate that public authorities defend the general interest, and that there is no corruption nor patronage. If we assume such behavior, 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 it is the case in lease contracts. Private involvement then outperforms 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 from the levels and nature of the non contractible investments that are at stake in 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, that also may be linked through different other contracts. Recent economic literature on contracting has thus emphasized the role of informal aspects, through the notion of “relational contracts” (BGM [2002, 2004, 2005]). They include some elements that are observable for the parties but non verifiable, and hence non enforceable by courts. Their respect then depends from the parties’ self interest or concern for reputation. Parties may also engage informally to a certain use of the decision rights and investments’ implementations, corresponding to a common vision of public services. Such elements may also help to explain

why so 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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