Regulation by Negotiation: the Private Benefit Bias

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Abstract

This paper analyses the role of non-pecuniary private benefits of managers in an incomplete contract approach to the regulation of utilities. Private benefits may take various forms: excessive job security, perks, empire building feelings, overstaffing. Model describes the relationship between a government and the manager of a firm which produces a public good, under private or public ownership. The firm’s production is characterized by its quantity and its flexibility, the latter corresponding to adaptability to changes in consumers’ tastes or to new technologies. A larger output quantity entails larger private benefits to the manager, while increasing flexibility runs counter to the managers’ private benefits. The manager decides upon non-verifiable investment in human and non-human capital so as to facilitate an increase in the output quantity (capacity investment) or to improve the firm’s flexibility (investment in organizational adaptability). We compare the effects of the ownership regime on the manager’s incentives to invest and on the aggregate welfare. The private firm invests in capacity and organizational flexibility because the government holds up a part of the gains through ex post renegotiation of the manager–government initial contract. Our analysis also highlights a fundamental bias in the investment behavior of the state–owned firm: the manager of such a firm only invests in capacity (he may even invest more than under private ownership) but he never invests in organizational adaptability. The model shows that an increase in the government’s bargaining power exacerbates the hold up problem when the firm is privately owned, but that this result may be reversed for capacity investment under public ownership. Finally, we show that the superiority of private or public ownership depends simultaneously on three factors: the bargaining powers of the manager and of the government, the degree of specificity of investments and the relative weight of quantity and flexibility concerns in the social welfare.
1 Introduction

A common argument in favor of privatization of public utilities is that state-owned regulated firms tend to resist changes that hurt their employees. In other words, private ownership is likely to be more favorable to flexibility. Privately owned enterprises are more responsive to changes in consumers’ tastes and technologies that require organizational adaptability. Conversely, at least during some periods of history, success of nationalized firms has been more convincing in activities where top priority was given to the growth of productive capacity. More generally, the records of state owned firms is most convincing where their development could go hand in hand with extensive private benefits granted to its workers.

This paper analyzes the role of private benefits in contexts where they may either put a brake on firms’ flexibility or stimulate investment in capacity. It shows that indeed there is a remarkable distinction in the role played by non-pecuniary private benefits (job security, empire building feelings, perks, overstaffing...) depending on whether the regulated firm is under public ownership or its assets are privately owned.

In the following analysis, the fact that private benefits may play different roles according to the ownership regime will arise as a consequence of the incompleteness of the regulatory contract. In an hypothetical world of complete contracts with benevolent regulators, ownership would play no role. The regulator could mimic the market by offering a comprehensive incentive scheme to the firm. Some degree of incompleteness in regulatory contracts is thus necessary for asset ownership to matter at all. The recent works of Hart and Moore (1999) and Segal (1999) provide a foundation for contract incompleteness which emphasizes the role of ex-post renegotiations (rather than that of the inability to, ex-ante, describe the actions, an argument challenged by Maskin and Tirole (1999)). The infeasibility of a commitment not to renegotiate ex post, makes the nul (incomplete) contract optimal when the environment is rich enough. There exists also plenty of evidence of incompleteness in the contractual arrangements between regulatory bodies and

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1Railroad transportation and electricity production in France during the sixties and the seventies are good examples of such a situation.

2This is true when asset ownership is the sole distinction between the two regulatory regimes, in particular when there is no difference in the regulator’s information about the firm depending on who owns the assets.
private or public firms in the regulation of utilities in Western countries\(^3\). A concomitant characteristic feature of utilities regulation is the role played by \textit{ex post} negotiations whether the regulated firm is private or public. Regulation through negotiations is a reality as soon as one approaches concrete issues.

Contrary to several theoretical contributions to the privatization debate in terms of incomplete contracts which have emphasized the role of informational asymmetries - in particular Laffont and Tirole (1991) and Schmidt (1996)\(^4\)-, we will not appeal to informational specificities of public and private governance structures. Instead, the focus will be on incentive issues related to \textit{ex post} negotiation.\(^5\) In this respect, our analysis is closely related to an article by Hart, Shleifer and Vishny (1997). They investigate the efficiency of the government’s in-house provision of services (such as the operations of prisons, hospitals or schools) compared to contracting out with a private company. They emphasize a multi-task issue related to the lack of competition: private firms have too strong incentives in cost reduction and too weak incentives in quality improvement. In contrast, here the question at issue is how employees’ non-pecuniary private benefits affect the outcome of regulation.

A second important distinction with the Hart, Shleifer and Vishny paper is more technical: it is related to the way we define the default options. More specifically, what happens in case of negotiation failure when the firm is public? Hart, Shleifer and Vishny assume that, in such a case, the manager of a public firm can be replaced but then the government only realizes a fraction of the value of the investment. In our model, the manager cannot be replaced as long as he complies with the initial contract. The government who

\(^3\)See for instance Armstrong, Cowan and Vickers (1994), Einhorn (1994), and Helm (1994) on regulation of utilities in the UK.

\(^4\)Laffont and Tirole’s (1991) main argument is related to the costs of agency in a multi-principal framework. They assume better congruence between managerial and ownership goals in the privatized regime. But the manager in the private firm has two masters (shareholders and the regulator) which generates conflicts and reduces incentives. Similarly, Schmidt’s (1996) argument is essentially informational. He views privatization as a commitment device to credibly harden the budget constraint. The key to credibility is that the government has less information about the private firm than about the public one.

\(^5\)In particular we do not assume that the regulator is better informed only because the firm is in public ownership. In facts, empirical evidence shows that public firms (for instance, EDF or SNCF in France) are not seldom quite successful in effectively concealing information e.g., by providing huge amounts of untractable data. In contrast, the English Ofwat (Office of Water regulation) has been successful in imposing an accountability and reporting standard to the private water companies. This information is extensively used in yardstick competition.
owns the residual control rights can however decide for another (additional) use of the assets. It must then compensate the manager for the eventual additional verifiable costs these modifications of the basic good bring forth; in other words the manager is ensured to receive a salary. The private benefit bias follows as a distinguishing feature of public management, because of the conjunction of two features of the regulatory contract: incompleteness and guaranteed salary. The intuition is that the guaranteed salary protects the firm’s manager from full expropriation (in case of negotiation failure), it secures that private benefits are unalienable. Similar results (e.g., excess employment) have been obtained by Shleifer and Vishny (1994). However, in their model the politicians directly care for high employment in regulated firms while our government is benevolent: he maximizes social welfare.

We hope that our approach provides a sensible explanation for some historical and cross-country distinctions in preferences about the public or private ownership of utilities. In particular, publicly owned regulated firms can be more efficient than private ones in periods of extensive growth of the industry and in countries with a command and control approach to regulation where the government has a strong bargaining power. Examples are provided by railway and electricity industry in France during the sixties and seventies. In contrast, the regulated private firm is likely to be more efficient in periods of intensive, quality oriented, growth such as in today’s telecom industry. Furthermore, regulated private firms perform generally better in economies where the bargaining power of the government and of the firm are more balanced such as the Anglo-American ones. The intuition is that the gains from congruence between the government’s and the employees’ objectives (in periods of extensive growth) can be exploited to a larger extent when the firm is public, because incentives are driven by private benefits. In contrast, the costs of non-congruence (when more flexibility is needed) can be mitigated by private ownership insofar as privately owned assets can be redeployed to new activities in case of negotiation failure between the firm and the government.

The remaining of the paper is organized as follows. The general setting is presented in Section 2. Section 3 characterizes the outcome of the negotiations between the regulated firm and the government. Section 4 analyses the firm’s investment policy and presents our main results. Illustrations of the results and concluding comments are offered in Section 5. The proofs are gathered in an appendix.
2 The Setting

2.1 Basic assumptions

The model describes the relationship between two agents: the manager of a firm and the government. The firm produces a pure public good defined by \((y, f) \in \mathbb{R}^2_+\). The main distinction between \(y\) and \(f\) is that a larger \(y\) entails larger non-pecuniary private benefits for the manager, while it is the contrary for \(f\): increasing \(f\) would reduce the manager’s nonpecuniary benefits. We will interpret \(y\) as a quantitative measure of the output and \(f\) as consumer-oriented quality or flexibility in the organization of production. The manager likes increasing the output—in its quantitative dimension—because producing more increases job security or because it flatters the manager’s empire building feelings. On the contrary, turning the firm’s organization towards consumers’ tastes requires a better adaptability on the part of the manager. It may require an increase of flexibility in terms of working hours or location that typically runs counter to the manager’s nonpecuniary benefits. In what follows, keeping in mind this interpretation, we will refer to \(y\) and \(f\) respectively as to the output quantity and to flexibility in the firm’s organization. However, other interpretations of \(y\) and \(f\) are possible as soon as increases in \(y\) and \(f\) are related respectively to higher or lower nonpecuniary benefits for the firm’s manager.

The output is a pure public good that cannot be marketed.\(^6\) Production requires the manager’s human capital as well as non-human capital. Under public (private) ownership, non-human capital is owned by the government (the manager). The manager’s services can be contracted upon in a competitive market, but the government-manager contracts are incomplete. The manager and the government write a contract that specifies some characteristics of the goods or services to be supplied. These aspects of the allocation correspond to a “basic good” in Hart’s (1995) and Hart-Shleifer-Vishny’s (1997) terminology. The basic good is defined by a description (in terms of quantity and flexibility) of the output provided by the firm or by similar firms in the past periods. Since this description is unambiguous, the basic good can be contracted upon. Increasing capacity or flexibility beyond the basic good is possible but not contractible. More precisely, we may decompose \((y, f)\) as

\[
\begin{align*}
y &= y_0 + y_1 \\
f &= f_0 + f_1
\end{align*}
\]

\(^6\)Under some conditions our results carry over with only slight modifications to situations where the firm has also market revenues.
where \((y_0, f_0)\) correspond to the characteristics of the basic good (in terms of quantity and flexibility). For notational simplicity we let \((y_0, f_0) = (0, 0)\).

\((y_1, f_1)\) correspond to variations in quantity and flexibility that cannot be contracted upon, because they are embodied in specific management decisions depending on so many contingencies that it would be too costly to make them explicit in the contract. Since \((y_0, f_0) = (0, 0)\), we have \((y, f) = (y_1, f_1)\).

The \((y_1, f_1)\) components of the allocation is chosen as the outcome of a bargaining between the government and the manager once the state of nature is known. In case of negotiation failure, \((y_1, f_1)\) is chosen by the agent who owns the non-human assets - the government or the manager -. This agent has the residual right, i.e. the rights to choose the part of the allocation not included in the contract.

The contract also specifies the price \(w_0\), the net monetary transfer (in excess of compensation for monetary costs) to be paid by the government to the manager when the latter provides the basic good. Under private ownership, \(w_0\) is the price received by the manager who acts as an independent contractor. Under public ownership, \(w_0\) is the wage received by the manager as an employee of the government. Beside the monetary payoff, the manager earns private benefits which are non-pecuniary and non-verifiable.

After the contract is signed, the manager decides upon non-verifiable investments. These investments increase the consumer surplus associated with the quantity and the flexibility of the firm’s output. They are specific to the government-manager relationship. Using them outside this particular bilateral relationship would entail an efficiency loss -i.e. it would lead to a lower government-manager surplus. Some investments make an increase in the output quantity easier and other investments improve the flexibility in the adaptation of the output to the consumers’ preferences: we call them respectively investment in capacity and investment in organizational adaptability.

Let us consider the private and public ownership cases in turn in order to describe the dynamics of contractual relationships between the government and the manager. Under private ownership, the model is standard. After the contract is signed and the investments are made, the manager and the government learn about new contingencies that may call for modifications of the original contract. Unless the contract is renegotiated, the manager will only supply the basic good: indeed, in our model (see below), any departure from this agreement would be unprofitable insofar as the government would not pay for such a change in the absence of agreement. Renegotiations must therefore lead to the government paying a price larger than \(w_0\), while the manager commits to produce a “modified good”, i.e. an allocation \((y, f)\) that has been modified to take relevant contingencies into account. In what
follows, for notational simplicity, the various contingencies that may occur are not explicitly described and the expectation operator associated with the distribution of the states of the world is deleted. In the absence of renegotiation, the manager only provides the basic good. He then receives the price $w_0$ from the government and he may use assets outside the relationship with the government. As above indicated, he then incurs an efficiency loss because of the relation specificity of investments.

Under public ownership, the government owns the residual control rights over the non-human assets. The initial contract can be renegotiated and, in such a case, the manager commits on producing a modified good and the government increases the manager’s wages. In the absence of renegotiation, the government uses its assets to implement modifications in the allocation under the constraint that the manager is secured the contracted wage. In contrast with Hart, Shleifer and Vishny (1997), we assume that the government cannot fire the manager in case of negotiation failure when the latter fulfills his initial contractual obligations. This captures the fact that public employees generally enjoy a solid job security so that the threat of firing cannot be used as a credible threat. Next, we assume that the private benefits associated with the management of a public firm is so large that the manager would never choose to quit provided that the government secures his wage. Imposing a decision on a reluctant manager entails a fixed cost. This cost captures the expenditures related to preparing and following up the implementation of decisions. A key assumption in the model is that this direct monitoring of the firm’s activity makes the firm’s costs, associated with the imposed decisions, verifiable. So in particular the government can commit to compensate them i.e. to guarantee the manager’s monetary wage. So in a situation of renegotiation failure, the manager receives a monetary net payoff equal to $w_0$ and enjoys (puts up with) the nonpecuniary private benefits associated with the imposed allocation.

2.2 The Model

The main notations Let us first define the objective of each agent. The government’s payoff is denoted by $U_G$. It is the difference between the consumers’ surplus and the transfer to the firm. It is written as

$$U_G = v_1(y, i) + v_2(f, e) - t$$ (1)
where \( v_1(y,i) \) and \( v_2(f,e) \) denote the two components of the consumers’ surplus which are respectively associated with quantity and flexibility in the firm’s output. \( t \) is a monetary transfer to the firm which covers its monetary production costs and the payment to the manager. The consumers’ surplus depends on the output \((y,f)\) and also on a two-dimension investment of the firm denoted by \((i,e)\) \(\in \mathbb{R}_+^2\). The investments \(i\) and \(e\) correspond to the effort levels made by the manager in order to adapt the firm’s supply to the consumers’ tastes and requirements, as well as to new technologies. These are non-verifiable investment which cannot be contracted upon. \(i\) is an investment in capacity while \(e\) is an investment in organizational adaptability. We assume \( v'_{1i} > 0, v'_{1y} > 0, v''_{1y2} \leq 0, v''_{1ey} > 0, v''_{2f} > 0, v''_{2ey} \leq 0, v''_{2ey} > 0 \). In particular, the assumptions on the sign of the cross derivative of \( v_1 \) (respect. \( v_2 \)) mean that an additional investment in capacity (respect. organizational adaptability) makes it more valuable in terms of consumers’ surplus to increase the output (respect. the flexibility).

The payoff of the manager is denoted by \( U_M \). It is written as

\[
U_M = w + \mu_1(y) - \mu_2(f) - [\psi_1(i) + \psi_2(e)]
\]  

(2)

where

\[
w = \text{manager’s monetary income} \\
\mu_1(y) - \mu_2(f) = \text{non-pecuniary private benefits} \\
\psi_1(i) + \psi_2(e) = \text{investment cost}
\]

We assume that the manager is \textit{ex ante} willing to participate if \( U_M \geq 0 \). The functions \( \psi_1(i) \) and \( \psi_2(e) \) capture the non-verifiable private cost of the investment. They are such that \( \psi'_k(.) \geq 0, \psi''_k(.) \geq 0, \psi_k(0) = 0, \psi'_k(0) = 0, \psi_k(\infty) = \infty \) for \( k = 1 \) and \( 2 \). \( \psi_1(i) + \psi_2(e) \) include the costs of organizing production with new technologies, adapting the promotion system to mutations, developing a consumer oriented corporate culture etc... . The function \( \mu_1(y) - \mu_2(f) \) corresponds to the difference between non-pecuniary quasi-rents and non-pecuniary costs of the manager: status, perks, independence in decision-making, empire building feelings, etc... . We assume \( \mu'_1(.) > 0, \mu''_1(.) < 0 \) and \( \mu_2(.) > 0, \mu''_2(.) > 0 \). Hence, investing in capacity increases the manager’s private benefits whereas investment in organizational adaptability reduces the private benefits.

Let \( c_1(y) + c_2(f) \) denote the monetary production cost, including market wages paid to workers who may be hired by the manager on labor spot markets, with \( c'_k(.) > 0 \) and \( c''_k(.) > 0 \) for \( k = 1 \) and \( 2 \). The firm has no market revenue. Hence
\[ w = t - [c_1(y) + c_2(f)] \]

For notational simplicity, we assume \( \mu_k(0) = c_k(0) = v_k(0, .) = 0 \) for \( k = 1 \) and 2. Hence, \( w_0 \) denotes the transfer paid to the manager when the basic good is provided (since \( c_1(0) = c_2(0) = 0 \)).

**Timing**  The timing of the manager-government relationship is as follows:

1) The government proposes a contract to the manager as a take it or leave it offer. This contract specifies that the basic good \((y_0, f_0) = (0, 0)\) should be supplied by the manager and that a transfer \( t = w_0 \) will be paid by the government.

2) The manager either refuses the government’s proposal and the game ends, or he accepts it.

3) The manager chooses \( i \) and \( e \).

4) The manager and the government learn about the relevant contingencies.

5) The government and the manager negotiate about \((y_1, f_1, t) = (y, f, t)\).

6) If they reach an agreement, they proceed to implement it. If the negotiation fails, a non-cooperative game is played.

Hence, the government contracts the provision of the basic good on a competitive market, in which the managers’ reservation utility is normalized at \( U_M = 0 \). After the investments have been made, the manager and the government are locked in a bilateral relationship. A renegotiation of the initial contract may then take place, with specific bargaining powers for the government and for the manager.

The basic features of the game played in case of negotiation failure are the following. Firstly, the agent who owns the non-human assets chooses the output combination \((y_1, f_1) = (y, f)\) because he has the residual rights on the use of these assets. This means in particular that, under public ownership, the government may impose an increase in quantity or flexibility beyond the basic good, provided that \( w_0 \) is paid to the manager. In such circumstances, the government directly monitors the decisions of the firm which allows it to verify the variation in costs induced by its orders and thus to commit on paying the wage \( w_0 \). Secondly, whatever the property rights, the manager

\footnote{Apart from this particular case where the government monitors the decision of the firm, costs are not verifiable which prevents the parties to contract on them.}
may choose to stay or to quit. Let us describe this non-cooperative game with more details.

Under private ownership, if the manager stays, he can choose the output \((y, f)\), because he owns the non-human assets and his payoff is given by

\[
U_M = t - [c_1(y) + c_2(f)] + \mu_1(y) - \mu_2(f) - [\psi_1(i) + \psi_2(e)].
\]

If he quits, only the basic good is provided to the government but the manager can use his human and non-human assets outside the relationship with the government which will provide him some positive pecuniary and non-pecuniary benefits. These benefits will be denoted by \(K_1(i) + K_2(e)\), with \(K_1 \geq 0\) and \(K_2 \geq 0\). The manager’s payoff is then

\[
U_M = t + K_1(i) + K_2(e) - [\psi_1(i) + \psi_2(e)].
\]

Since the government will not pay more than the contractual transfer \(t = w_0\) whether the manager stays or quits (because no agreement has been reached), it is a dominant strategy for the manager to quit if

\[
\mu_1'(0) < c_1'(0) \tag{3}
\]

since in that case we have

\[
\mu_1(y) - c_1(y) < K_1(i) + K_2(e) \text{ for all } y, i, e \tag{4}
\]

Condition (4) means that the manager of the private firm has no incentives to produce more (of \(y\) and \(f\)) than the basic good unless he gets additional monetary rewards. In what follows, we assume that (3) holds.

Under public ownership, in case of negotiation failure, the output \((y, f)\) is decided upon by the government. The manager may decide to stay or to quit (after having provided the basic good). We denote by \(u^*\) the variation in the manager’s surplus if he quits\(^8\). We assume

\[
u^* < -\mu_2(f) \leq 0 \text{ for all } f \tag{5}
\]

which ensures that under public ownership the manager’s ex post participation constraint is not binding (see below): whatever the non-pecuniary private costs that correspond to the (imposed) allocation, the manager of the public firm does not want to quit. Here also, a dominant strategy for the government is to pay the contractual wage \(w_0\) and nothing more to the

\(^8\)Contrary to the private ownership case, this variation in the manager’s surplus does not depend on his investments \(i\) and \(e\), since they are incorporated in the non-human assets owned by the government.
manager. This is possible because costs are supposed to be verifiable when the government monitors the public firm’s activity. In any case (whether the manager stays or quit), the government incurs a fixed reorganization cost $P$ which represents the costs of preparing and implementing any imposed decision $(y, f) \neq (0, 0)^9$.

Hence, under our assumptions, in case of negotiation failure, the manager of the private firm quits and he uses his assets outside the relationship with the government. Under public ownership, the manager stays and he receives the nonpecuniary benefits in addition to the contractual wage.

3 Negotiations

We proceed by backward induction. We shall first analyze negotiations given that the investments $i$ and $e$ are sunk. We start by characterizing the status quo payoffs that prevail in case of negotiation failure. These default payoffs correspond to the dominant strategies of the manager and of the government in the non-cooperative game that has just been described.

3.1 The default payoffs

Assume first that private ownership prevails. Then, in case of negotiation failure, the basic good is supplied, the transfer $t = w_0$ is paid and the investments are used by the manager outside the firm-government relationship, i.e. the manager chooses to quit after having provided the basic good. The default payoffs of the government and of the manager are then respectively written as

$$U_{G_p} = -w_0$$

$$U_{M_p} = K_1(i) + K_2(e) + w_0 - [\psi_1(i) + \psi_2(e)]$$

Under the public ownership regime, a negotiation failure leads to the government simply imposing its most preferred allocation $y, f, t$ — at additional cost $P$ if $(y, f) \neq (0, 0)$— under the constraint that the manager receives at least $w_0$, i.e.

$$t \geq w_0 + c_1(y) + c_2(f)$$

It will be optimal for the government to choose $(y, f) \neq (0, 0)$ if $P$ is not too large (see below for the definition of the upper bound of $P$). Assume

---

9More realistically, we could assume that the reorganization cost continuously depend on $(y, f)$
that this is actually the case. The most preferred allocation corresponds to an output quantity $\tilde{y}(i)$ and to a flexibility $\hat{f}(e)$. Hence, the government’s default payoff is

$$\mathcal{U}_{G_n} = \hat{\Omega}_1(i) + \hat{\Omega}_2(e) - w_0 - P$$

(8)

if the manager stays or

$$\mathcal{U}_{G_n} = \hat{\Omega}_1(0) + \hat{\Omega}_2(0) - w_0 - P$$

if the manager quits\(^{10}\), where

$$\hat{\Omega}_1(i) = v_1(\tilde{y}(i), i) - c_1(\tilde{y}(i))$$

(9)

$$\hat{\Omega}_2(e) = v_2(\hat{f}(e), e) - c_2(\hat{f}(e))$$

(10)

where $\tilde{y}(i), \hat{f}(e)$ maximize

$$v_1(y, i) + v_2(f, e) - [c_1(y) + c_2(f)]$$

with respect to $(y, f)$ i.e. $\tilde{y}(i)$ and $\hat{f}(e)$ are such that

$$v'_1y(\tilde{y}, i) = c'_1(\tilde{y})$$

(11)

$$v'_2f(\hat{f}, e) = c'_2(\hat{f})$$

(12)

which implies $\tilde{y}'(i) > 0$ and $\hat{f}'(e) > 0$. Indeed, choosing $\tilde{y}(i), \hat{f}(e)$ and paying $t = c_1(\tilde{y}(i)) + c_2(\hat{f}(e)) + w_0$ to the manager is a dominant strategy of the government. If the manager stays, his default payoff is then

$$\mathcal{U}_{M_n} = w_0 + \mu_1(\tilde{y}(i)) - \mu_2(\hat{f}(e)) - [\psi_1(i) + \psi_2(e)].$$

(13)

If the manager quits (after providing the basic good and receiving his contractual wages $w_0$), his payoff would be

$$\mathcal{U}_{M_n} = u^* + w_0 - [\psi_1(i) + \psi_2(e)]$$

(14)

\(^{10}\)We here assume that the gains from investment are cancelled if the manager quits. We could assume that a fraction of the gains from investment are preserved if the manager of the state-owned firm quits in which case we would have

$$\mathcal{U}_{G_n} = \hat{\Omega}_1(\lambda_1 i) + \hat{\Omega}_2(\lambda_2 e) - w_0 - P$$

when the manager quits, where $\lambda_1$ and $\lambda_2$ are the proportions of investments which are preserved with $0 < \lambda_1 < 1$ and $0 < \lambda_2 < 1$. This is in fact an unimportant aspect of our modelling since, under public ownership, staying is a dominant strategy of the manager.
Condition (5) implies that staying is a dominant strategy of the manager.

If the government chooses \((y, f) = (0, 0)\), no reorganization cost would be incurred and the government default payoff would be \(U_{G_{a}} = -w_0\). Hence choosing \((y, f) = (\hat{y}(i), \hat{f}(e)) \neq (0, 0)\) is an optimal strategy of the government if

\[
P \leq \bar{\Omega}_1(i) + \bar{\Omega}_2(e)
\]

which provides an upper bound on the size of \(P\). In what follows we assume that (15) holds for all \(i, e\). Note that by condition (3) the manager would prefer to deliver \(y = 0, f = 0\) when no agreement is reached.

### 3.2 Equilibrium allocation

We assume that the negotiation between the manager and the government leads to the Nash bargaining solution. Hence given \(w_0, i\) and \(e\), the outcome of the negotiation is obtained by maximizing

\[
\left( U_M - \bar{U}_M \right)^{1-\alpha} \left( U_G - \bar{U}_G \right)^{\alpha}
\]

with respect to \(y, f\) and \(t\), where \(\alpha\) and \(1-\alpha\) are respectively the government’s and the manager’s bargaining powers\(^{12}\). \(\bar{U}_M\) and \(\bar{U}_G\) are the default payoffs: they are given by (6)-(7) if the firm is private or by (8)-(13) if it is public.

At the Nash solution, \(y, f\) maximize the aggregate surplus

\[
U_M + U_G = v_1(y, i) + v_2(f, e) + \mu_1(y) - \mu_2(f) - c_1(y) - c_2(f) - \psi_1(i) - \psi_2(e)
\]

which gives \(y = y^*(i)\) and \(f = f^*(e)\) with

\[
c_1'(y^*) = v'_{1y}(y^*, i) + \mu'_{1}(y^*)
\]

\[
c_2'(f^*) = v'_{2f}(f^*, e) + \mu'_{2}(f^*)
\]

Note that \(y^*(i) > 0\), \(f^*(e) > 0\) and also that

\[
y^*(i) > \hat{y}(i)\ 
\]

footnote 13 for the consequences of deleting inequality (15)

footnote 12 The parameter \(\alpha\) captures features of the institutional context in which regulation operates independently of the ownership regime. Indeed, more often than not, regulation is operated in a complex of institutions that are a bequest from the past. One example of such an institutional context is provided by the Common Law tradition in Anglo-American countries. This context secures for regulatory bodies a larger independence from the political power than in a country like France. In France, public interventionism and the command and control approach to regulation are inherited from the so-called Colbertian tradition.
\[ f^*(e) < \hat{f}(e) \text{ for all } e. \]

Let

\[
\begin{align*}
\Omega_1^*(i) &= v_1(y^*(i), i) - c_1(y^*(i)), \\
\Omega_2^*(e) &= v_2(f^*(e), e) - c_2(f^*(e)), \\
\mu_1^*(i) &= \mu_1(g^*(i)), \\
\mu_2^*(e) &= \mu_2(f^*(e)).
\end{align*}
\]

At equilibrium, we have

\[ U_M + U_G = W_1^*(i) + W_2^*(e) \]

where

\[
\begin{align*}
W_1^*(i) &= \Omega_1^*(i) + \mu_1^*(i) - \psi_1(i), \\
W_2^*(e) &= \Omega_2^*(e) - \mu_2^*(e) - \psi_2(e).
\end{align*}
\]

The equilibrium payoffs are

\[
U_G^* = \alpha[W_1^*(i) + W_2^*(e) - (\bar{U}_G + \bar{U}_M)] + \bar{U}_G
\]

and

\[
U_M^* = (1 - \alpha)[W_1^*(i) + W_2^*(e) - (\bar{U}_G + \bar{U}_M)] + \bar{U}_M.
\]

The gains from negotiation are \( W_1^*(i) + W_2^*(e) \) is supposed to be concave with respect to \((i, e)\). Using the envelope theorem shows that it is maximized at \( i = i^* \) and \( e = e^* \) such that

\[
\begin{align*}
\psi_1'(i^*) &= v_{1i}'(y^*(i^*), i^*), \\
\psi_2'(e^*) &= v_{2e}'(f^*(e^*), e^*).
\end{align*}
\]

Finally, we will also assume

\[
0 \leq K_1'(i) < v_{1i}'(y^*(i), i) \text{ for all } i,
\]

and

\[
0 \leq K_2'(e) < v_{2e}'(f^*(e), e) \text{ for all } e.
\]
This simply states the relation specificity of investment in capacity or flexibility, i.e., the marginal value of the investment in the best alternative use is less than its marginal social value within the relationship between the manager and the government. Intuition suggests that investment in capacity is probably more specific than investment in organizational adaptability. This is particularly the case when the former includes aspects of site specificity (for instance when the issue is the production of a local public good). Hence, we will devote special attention to the case where investment in capacity is totally specific, i.e. \( K_1(i) = 0 \).

### 4 The firm’s investment policy

#### 4.1 The private ownership regime

Under private ownership, after substituting \( U_G = U_{Gp} \) and \( U_M = U_{Mp} \) in (23), the government’s equilibrium payoff is written as

\[
U^*_G = \alpha \{[\omega_1(i) + \omega_2(e) + \mu_1(i) - \mu_2(e)] - [k_1(i) + k_2(e)]\} - w_0
\]

Similarly, the manager’s payoff is

\[
U^*_M = (1 - \alpha) \{[\omega_1(i) + \omega_2(e) + \mu_1(i) - \mu_2(e)] - [k_1(i) + k_2(e)]\} + w_0 + k_1(i) + k_2(e) - [\psi_1(i) + \psi_2(e)]
\]

Let \( \{i_p, e_p\} \) be the manager’s optimal investments. \( \{i_p, e_p\} \) maximize \( U^*_M \) with respect to \( i, e \geq 0 \) which implies

\[
[\alpha k_1'(i_p) + (1 - \alpha) v'_1(y^*(i_p), i_p)] - \psi'_1(i_p) \leq 0
\]

\[= 0 \text{ if } i_p > 0 \tag{29}\]

and

\[
[\alpha k_2'(e_p) + (1 - \alpha) v'_2(f^*(e_p), e_p)] - \psi'_2(e_p) \leq 0
\]

\[= 0 \text{ if } e_p > 0 \tag{30}\]

We assume that \( U^*_M \) is concave with respect to \( i \) and \( e \). Hence (29) and (30) fully characterize the investment levels under private ownership.
Given the manager’s participation constraint $U_M \geq 0$, the optimal transfer decided upon by the government is such that $U_{M^*} = 0$, which gives

$$w_0 = \psi_1 (i_p) + \psi_2 (e_p) - (1 - \alpha) [\Omega_1^* (i_p) + \Omega_2^* (e_p) + \mu_1^* (i_p) - \mu_2^* (e_p)] - \alpha [K_1 (i_p) + K_2 (e_p)].$$

The government’s payoff is thus

$$U_{G^*} = W_1^* (i_p) + W_2^* (e_p). \quad (31)$$

4.2 The public ownership regime

The government’s payoff from negotiation with a state-owned firm is

$$U_{G^*_n} = \alpha \{[\Omega_1^*(i) + \Omega_2^*(e) + \mu_1^*(i) - \mu_2^*(e)] - [\hat{\Omega}_1(i) + \hat{\Omega}_2(e) + \hat{\mu}_1 (i) - \hat{\mu}_2 (e) - P]\}
+ \hat{\mu}_1 (i) - \hat{\mu}_2 (e) + w_0 - [\psi_1 (i) + \psi_2 (e)]$$

where $\hat{\mu}_1 (i) = \mu_1 (\hat{g} (i))$ and $\hat{\mu}_2 (e) = \mu_2 (\hat{f} (e))$. Let $i_n$ be the investment level chosen by the firm in the public ownership regime: $i_n$ maximizes

$$U_{M^*_n} = (1 - \alpha) \{[\Omega_1^*(i) + \Omega_2^*(e) + \mu_1^*(i) - \mu_2^*(e)] - [\hat{\Omega}_1(i) + \hat{\Omega}_2(e) + \hat{\mu}_1 (i) - \hat{\mu}_2 (e) - P]\}
+ \hat{\mu}_1 (i) - \hat{\mu}_2 (e) + w_0 - [\psi_1 (i) + \psi_2 (e)]$$

We assume that $U_{M^*_n}$ is concave in $(i, e)$. Maximizing $U_{M^*_n}$ with respect to $i \geq 0$ and $e \geq 0$ yields the following first-order optimality conditions

$$\{\alpha \hat{\mu}'_1 (i_n) + (1 - \alpha) [v'_1 (g^* (i_n), i_n)] - v'_1 (\hat{g} (i_n), i_n)]\}
- \psi'_1 (i_n) \leq 0 \quad (32)
= 0 \text{ if } i_n > 0$$

and

$$\{-\alpha \hat{\mu}'_2 (e_n) + (1 - \alpha) [v'_2 (f^* (e_n), e_n)] - v'_2 (\hat{f} (e_n), e_n)]\}
- \psi'_2 (e_n) \leq 0 \quad (33)
= 0 \text{ if } e_n > 0$$

Given the manager’s participation constraint $U_M \geq 0$, the optimal wage chosen by the government is such that $U_{M^*} = 0$, which gives

$$w_0 = (1 - \alpha) [\hat{\Omega}_1(i_n) + \hat{\Omega}_2(e_n) - (\Omega_1^* (i_n) + \Omega_2^* (e_n) + \mu_1^* (i_n) - \mu_2^* (e_n))]$$
$$+ \psi_1 (i_n) + \psi_2 (e_n) - \alpha [\hat{\mu}_1 (i_n) - \hat{\mu}_2 (e_n)] - (1 - \alpha) P$$

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Hence, the government’s payoff is

\[ U^*_Gn = W^*_1(i_n) + W^*_2(e_n) \]  

Conditions (29)-(30) and (32)-(33) establish that, at equilibrium, the marginal benefit of investment for the firm is equal to its marginal cost \( \psi'_1(i) \) or \( \psi'_2(e) \) when the investment level is strictly positive. However, the definitions of the marginal benefit of investment strongly differ depending on whether the firm is private or public. The marginal benefit of a private firm -i.e. the terms in square brackets in (29) and (30)- is a weighted sum of the increases in the surplus inside and outside the firm-government relationship associated with a unit increase in investment. When the firm is state-owned, the marginal benefits of investments in capacity or organizational adaptability -i.e. the terms in curly brackets in (32) and (33)- are written as a weighted sum of the marginal non-pecuniary benefits in the imposed solution \( \hat{\mu}'_1(i_n) \) or \( -\hat{\mu}'_2(e_n) \) and of the difference between the marginal consumers’ surplus associated with a unit increase in investment, respectively in the equilibrium allocation and in the imposed allocation. In what follows, this difference is called the incremental marginal surplus.

(31) and (34) show that the government’s optimal payoff is equal to the aggregate surplus. Obviously, this comes from the fact that the government contracts with the manager on a take or leave it basis, which allows the government to extract the whole surplus.

These results allow us to characterize the investment behavior of the firm. Let us consider the private and public ownership regimes in turn.

**Proposition 1** The investment behavior of a private firm is such that:

\[
0 < i_p < i^* \text{ and } 0 < e_p < e^* \text{ if } \alpha > 0 \\
i_p = i^* \text{ and } e_p = e^* \text{ if } \alpha = 0
\]

Proposition 1 states that the private firm under-invests except when \( \alpha > 0 \), because the government holds up a part of the benefits of its investments through ex post negotiation. The only case where the investment level of the private firm coincide with the socially optimal level is when the government has no bargaining power (\( \alpha = 0 \)), in which case there is no issue of expropriation through negotiation.
**Proposition 2** The investment behavior of a state-owned firm is such that\(^{13}\)

i) \(i_n > 0\) and \(e_n = 0\);

ii) \(i_n > i_p\) if and only if \(\alpha K'(i_n) < (1 - \alpha)\nu'_1(\tilde{y}(i_n), i_n)\);

iii) \(i_n > i^*\) if and only if \(\alpha\psi'(i^*) - (1 - \alpha)\nu'_1(\tilde{y}(i^*), i^*) > \alpha\psi'_1(i^*)\).

**Corollary 1** Suppose \(K_1(i)\) is replaced by \(\theta K_1(i)\), where \(\theta > 0\). Then for \(\theta\) sufficiently small, there exists \(\hat{\alpha} \in (0, 1)\) such that \(i_n > i_p\) whenever \(\alpha > \hat{\alpha}\).

Proposition 2-i establishes the existence of a bias in the investment policy of a public firm: the manager of such a firm only invests in capacity, he never invests in organizational adaptability. To understand the logic of this result, let us come back to the two determinants of investment of a state-owned firm: the incremental marginal surplus and the marginal non-pecuniary benefits. We know that \(y^*(i) > \tilde{y}(i)\) and \(f^*(e) < \tilde{f}(e)\), i.e., in the imposed solution the quantity is insufficient and the flexibility is excessive, by comparison with the socially efficient allocation. Consequently, the incremental marginal surplus is positive when investment is in terms of capacity and it is negative when investment is in term of flexibility. We also have \(\tilde{y}'(i) > 0\) and \(\tilde{f}'(e) > 0\). Hence, a larger investment in capacity leads to a larger output quantity in the imposed solution and thus to larger non-pecuniary benefits for the manager. Conversely, increasing investment in organizational adaptability provides a better flexibility in the imposed solution and thus lower private benefits. We conclude that, under public ownership, the two determinants of the manager’s investment go in the same direction: they induce positive marginal profits when investment is in terms of capacity and negative marginal profits when investment is in terms of organizational adaptability. This explains the result in Proposition 2-i.

Proposition 2-ii and Corollary 1 show that investment in capacity may be larger when the firm is public than when it is private. This is particularly the case when the investment in capacity is highly specific and the bargaining power of the firm is low. In that case the private firm strongly under-invests because the hold-up of its profits is particularly high and capacity investment of the public firm may exceed the one of the private firm.

\(^{13}\)When (15) does not hold at equilibrium, we have \(\tilde{y}(i) = 0\) and \(\tilde{f}(e) = 0\). Comparing (29) and (32) then shows that \(i_p > i_n\) in that case. In other words, when it is too costly to the government to impose a change in the output vector, the public manager’s equilibrium investment is smaller than that of the private manager.
In particular, when $i_n > i_p$, then $\mu_1^*(i_n) + \mu_2^*(e_n) > \mu_1^*(i_p) + \mu_2^*(e_p) = \mu_2^*(i_p)$. Hence, when capacity investment is higher in the public firm than in the private firm, the manager of the public firm obtains larger non-pecuniary benefits than the manager of the private firm. Two reasons cumulate here: investment in capacity induces positive non-pecuniary benefits and the manager of the public firm do not incur the non-pecuniary costs of organizational adaptability investments.

Proposition 2-iii shows that a state-owned firm may even invest more than what would be socially efficient: we would then have $i_n > i^*$. Since $i^*$ and the $\tilde{\mu}_1(i)$ function do not depend on $\alpha$, the inequality in Proposition 2-iii is satisfied if $\tilde{\mu}'(i^*) > \psi'(i^*)$ and $\alpha$ is large enough.

Proposition 3  

i) Under private ownership, the investments in capacity and in organizational adaptability and the government’s payoff are decreasing with respect to the government’s bargaining power, i.e. $\frac{\partial i_p}{\partial \alpha} < 0$, $\frac{\partial e_p}{\partial \alpha} < 0$ and $\frac{\partial U^*_{Gp}}{\partial \alpha} < 0$. The first-best optimum is reached at $\alpha = 0$.

ii) Under public ownership, a sufficient condition for investment in capacity to be increasing with respect to the government’s bargaining power, i.e. $\frac{\partial i_n}{\partial \alpha} > 0$, is $v''_{1y_2} \leq 0$ and $v''_{1y_3} - c'' \leq 0$. In such a case, we have $\frac{\partial U^*_{Gn}}{\partial \alpha} > 0$ if $i_n < i^*$.

An increase in the government’s bargaining power exacerbates the hold-up problem, which discourages the firm from investing in specific assets. Hence, as indicated in Proposition 3-i, optimally under private ownership the whole bargaining power should be given to the manager. Proposition 3-ii shows that, for capacity investment, this result may be reversed under public ownership. This may at first sight appear paradoxical. Although the issue of expropriation is more serious the larger the government’s bargaining power, the firm has stronger incentives to invest! The reason is that, when the government’s bargaining power increases, the manager cares more about his private benefits in the imposed solution which incites him to invest in capacity. As regards investment in organizational flexibility, we know that it is entirely neglected by the manager of the state-owned firm, whatever the distribution of bargaining powers. Hence, in the public ownership regime, the government payoff varies in the same direction as the capacity investment. The intuition of Proposition 3-ii is the following. Equation (24) shows that the equilibrium payoff of the manager gets closer to his default payoff when the government’s bargaining power increases. Furthermore, under public
ownership, the default payoff of the manager is equal to the sum of the contractual wages \( w_0 \) and of the private benefits, less investment costs -see(13)-. Hence, the manager’s investment behavior is more and more affected by private benefits when the government’s bargaining power is increasing, which stimulates capacity investment. More precisely, we know from (32) that in a state-owned firm, the marginal benefits of capacity investment is a weighted sum of the marginal private benefits (with weight \( \alpha \)) and of the incremental marginal surplus (with weight \( 1 - \alpha \)). As above mentioned, the marginal private benefit and the incremental marginal surplus are both positive for capacity investment. Under the conditions given in Proposition 3-ii, the marginal private benefit is larger than the incremental marginal surplus, so that an increase in \( \alpha \) leads to an increase in the marginal benefits of capacity investment, which exerts a positive effect on capacity investment.

**Proposition 4** Suppose that the functions \( v_1(y, i) \), \( \mu_1(y) \), \( c_1(y) \) and \( \psi_1(i) \) are respectively replaced by \( \sigma v_1(y, i) \), \( \sigma \mu_1(y) \), \( \sigma c_1(y) \) and \( \sigma \psi_1(i) \) and that the functions \( v_2(f, e) \), \( \mu_2(f) \), \( c_2(f) \) and \( \psi_2(e) \) are respectively replaced by \( (1 - \sigma)v_2(f, e) \), \( (1 - \sigma)\mu_2(f) \), \( (1 - \sigma)c_2(f) \) and \( (1 - \sigma)\psi_2(e) \), where \( 0 < \sigma < 1 \). Suppose also that \( K_1(i) \) is replaced by \( \theta_1 \sigma K_1(i) \) and \( K_2(e) \) is replaced by \( \theta_2(1 - \sigma)K_2(e) \) where \( 0 < \theta_1 < 1 \) and \( 0 < \theta_2 < 1 \). Let

\[
\begin{align*}
    i^0 &= \arg \max \{ K_1(i) - \psi_1(i), i \geq 0 \} \\
    i^1 &= \arg \max \{ \hat{\mu}_1(i) - \psi_1(i), i \geq 0 \}
\end{align*}
\]

Assume that \( i^0 < i^1 < i^* \). Assume also \( v''_{1y^2} \leq 0 \) and \( v''_{1p^3} - e'' \leq 0 \). Then, there exists \( \hat{\alpha}(\sigma, \theta_1, \theta_2) \) in \( (0, 1) \), decreasing in \( \sigma \) and increasing in \( \theta_1 \) and \( \theta_2 \), such that \( i_p > i_n \) and \( U^*_p > U^*_n \) if \( \alpha < \hat{\alpha}(\sigma, \theta_1, \theta_2) \) and \( i_p < i_n \) and \( U^*_p < U^*_n \) if \( \alpha > \hat{\alpha}(\sigma, \theta_1, \theta_2) \). If \( i^1 < i^0 \), then \( U^*_p > U^*_n \) for all \( \alpha, \sigma, \theta_1, \theta_2 \).

Proposition 4 shows that the superiority of private or public ownership depends simultaneously on three factors: the bargaining powers of the manager and of the government, the degree of specificity of investments and the relative weight of quantity and flexibility concerns in the social welfare. Note that \( i^0 \) and \( i^1 \) in Proposition 4 respectively denote the equilibrium investments in capacity under private and public ownership when \( \alpha = \theta_1 = 1 \). If \( i^0 < i^1 < i^* \), then public ownership dominates private ownership when \( \alpha = \theta_1 = 1 \) and when renegotiation of the government-manager contract is only about the quantitative dimension of the output (i.e. \( \sigma = 1 \)). By
continuity, still when $\sigma = 1$, there exists $\hat{\alpha}$ less than one, such that public ownership is superior to private ownership if $\hat{\alpha} < \alpha < 1$. When $\sigma$ decreases, then the relative weight of the flexibility dimension in the social welfare increases which makes a case for private ownership. Consequently, when $\sigma$ is less than one, the threshold value $\hat{\alpha}(\sigma, \theta_1, \theta_2)$ over which public ownership is superior to private ownership is decreasing with $\sigma$. Likewise $\hat{\alpha}(\sigma, \theta_1, \theta_2)$ is increasing in $\theta_1$ and $\theta_2$ because a less specific investment in capacity favors private ownership. When $i^1 < i^0$, private ownership is always superior to public ownership. The definition of $i^0$ and $i^1$ shows that public ownership may possibly be superior to private ownership only if capacity investments are highly specific (as for instance in the case of site specificity) and if such investment bring large positive private benefits to the firm’s manager in the imposed solution.
5 Illustrations and concluding comments

The effects of private benefits on managers’ incentives has been widely emphasized in the literature on corporate governance. Indeed, one of the most popular ways to model the basic moral hazard problem in corporate governance uses the concept of private benefit enjoyed by insiders (cf. Tirole (2001)). Although this is not usual, it should not be astonishing to also focus the analysis of ownership and control of public utilities on private benefits. Among the many different examples of private benefits of controlling a public utility, we may name a few: empire building feelings, private interest for a particular activity (e.g., a new technology development project), job security, opportunities to hire friends and relatives, convenient overstaffing, lack of internal conflict, channeling money to affiliated entities, unmotivated expenses, etc...

The approach and results of this paper may be usefully illustrated by some examples. SNCF (the French railroad monopoly) provides a good example of how deeply insiders’ private benefits may affect the management of a public utility. According to the Fondation Saint Simon (1997), a French think tank on the efficiency of public administrative bodies, SNCF is characterized by a corporate culture which neglects the economic indicators in favor of a system relying on technical and budgetary performances. As a result, financial responsibility is weak and we are in a situation of a soft budget constraint. This culture also systematically favored new investment as opposed to reorganization of the work force, successfully resisting to most attempts to structural changes. Insiders have also succeed in acquiring and defending very significant privileges in terms of working conditions, overstaffing and retirement legislations.

As an illustration of possible interactions between managers’ private benefits and non-contractible investments, let us consider two examples.

The first one is related to security enhancing organizational changes and innovations. We here may think about developing a corporate culture supporting personal responsibility for safety, or emphasizing safety aspects in the elaboration of new projects and in R&D activities. Such concerns are particularly important in risky activities such as nuclear energy but also for public transportation. When such investments are intensive, renegotiation should lead to an increase in safety standards. Likewise, in public transportation, safety is often used as an argument to resist cuts in the labor force and to implement innovative projects. This suggests that a concern for safety is congruent with the employee’s interest, i.e. it is connected with positive private benefits. In such a case, our model predicts that public own-
ership may be efficient because the government can exploit this congruence to achieve a high level of welfare. It turns out that some of the sectors that are still strongly resisting against privatisation are sectors where safety is highly valued. In France, examples are precisely railroad transportation and electricity production.

The second type of investment is related to flexibility enhancing organizational changes and innovations. Non-contractible investments may include adapting the organizational structure to enable a quick response to changes in consumer demand, for instance by preparing for an out-sourcing of some activities or, more generally, for a restructuring of the firm’s activities among sites or product lines. It may also include developing a strategy to get rid of “older” less flexible workers. Out-sourcing or restructuring often means unemployment or at best reduced job security if the old employees can keep their employment in the new structure. In such a case, a concern for flexibility would not be congruent with employee’s private interests. Our theory then predicts that public ownership is inefficient. The telecom industry provides a good example of this situation. It witnesses quick developments that necessitates a high degree of flexibility to respond to technological innovations, and it has been extensively privatized in Europe most successfully.

Our theoretical approach has been developed in terms of incomplete contracts. The model we have presented shows that, at equilibrium, the private benefits play a different role in the determination of incentives to invest. Under public ownership, the investment incentives are strongly affected by the non-pecuniary private benefits obtained by the firm’s employees within the relationship with the government. Under private ownership, the incentives to undertake non-contractible investment are affected by pecuniary and non-pecuniary benefits obtained outside the relationship and the driving force behind investment is the ability of the firm to redeploy its assets to other uses in case of negotiation failure (i.e. the specificity of its investments).

This distinction yields interesting implications for the relative performances of the two regulatory regimes depending on the technological and the institutional context. If the firm’s investment is connected with positive marginal private benefits for the employees such as a decision to expand the activity and if the investment is significantly specific, public ownership may yield a higher payoff to the government. This suggests that the technological

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14 Of course, safety is also a major concern for many other sectors (such as airlines and the chemical industry) which are private in France. However such branches of industry are highly competitive, with a worldwide market place, contrary to utilities like railroad transportation and (still to a large extent) electricity. The fact that firms operate in competitive markets may explain by itself for numerous reasons that a private ownership regime emerged as the most efficient one.
state of a regulated industry is of crucial importance when the issue of privatization is discussed. Historically, most public utilities have gone through a period of extensive development and they are today in a phase of consumer-oriented intensive growth. This is, for instance, the case of the European electricity and telecom industry. The previous results gives a rationale for why the electricity industry in France may have been kept in public ownership under the sixties and the seventies in countries like France, during the building up of the nuclear power plants, while its privatization is discussed today.

The relative efficiency of the ownership structure also depends on the institutional context in so far as it determines the regulator’s effective bargaining power. Our model predicts that private ownership dominates public ownership when the government’s bargaining power is not too large. In practice, this should be related to the ability of the government to credibly commit not to abuse its power. In contrast, when the regulator is interventionist, public ownership may be preferable. This provides us with a non-ideological argument for explaining cross-country distinctions in the regulation of public utilities. While the technological and informational contexts are essentially the same, the Anglo-American countries have typically been ahead of the privatization wave. Our analysis suggests that the gains of privatization were more important in these countries than in continental Europe.
APPENDIX

Proof of Proposition 1

The results follow from equations (25) to (30) and from the fact that $U_{mp}^*$ is concave with respect to $i$ and $e$. ■

Proof of Proposition 2

(i) We have

$$\tilde{\mu}_1'(i) = \mu_1'\left(\tilde{y}(i)\right) \tilde{y}'(i) > 0$$

Furthermore $v''_{1iy} > 0$ and $y^*(i) > \tilde{y}(i)$ give

$$v_{1i}'\left(y^*(i), i\right) - v_{1i}'\left(\tilde{y}(i), i\right) > 0$$

Assume $i_n = 0$. We then have

$$\alpha \tilde{\mu}_1(0) + (1 - \alpha)\left[v_{1i}'(y^*(0), 0) - v_{1i}'(\tilde{y}(0), 0)\right] - \psi_1'(0)$$

which contradicts (32). Hence $i_n > 0$.

We have

$$\tilde{\mu}_2'(e) = \mu_2'(\tilde{f}(e)) \tilde{f}'(e) > 0$$

Furthermore $v''_{2ef} > 0$ and $f^*(e) < \tilde{f}(e)$ give

$$v_{2e}'(f^*(e), e) - v_{2e}'(\tilde{f}(e), e) > 0$$

Hence the left-hand side in (33) is negative which gives $e_n = 0$.

(ii) We know from (29) that $i_n > i_p$ if and only if

$$\alpha K_1'(i_n) + (1 - \alpha) v_{1i}'(y^*(i_n), i_n) - \psi_1'(i_n) < 0$$

Using $i_n > 0$ and (32) gives

$$\psi_1'(i_n) = \alpha \tilde{\mu}_1'(i_n) + (1 - \alpha)\left[v_{1i}'(y^*(i_n), i_n) - v_{1i}'(\tilde{y}(i_n), i_n)\right]$$

Consequently, $i_n > i_p$ if and only if

$$\alpha K_1'(i_n) - \alpha \tilde{\mu}_1'(i_n) + (1 - \alpha) v_{1i}'(\tilde{y}(i_n), i_n) < 0$$

hence the result.
(iii) We know from (32) that $i_n > i^*$ if and only if
\[
\{ \alpha \tilde{\mu}_1^*(i^*) + (1 - \alpha) \left[ v_{i1}^* (y^* (i^*), i^*) \right] - v_{i1}^* (\tilde{g}(i^*), i^*) \} \]
\[ - \psi_1^* (i^*) > 0 \]

Using (25) allows us to rewrite this condition as
\[
\alpha \tilde{\mu}_1^*(i^*) - (1 - \alpha) v_{i1}^* (\tilde{g}(i^*), i^*) - \alpha \psi_1^* (i^*) > 0
\]

hence the result. ■

**Proof of Corollary 1**

Proposition 2-ii shows that $i_n > i_p$ if and only if
\[
\alpha \tilde{\mu}_1^*(i_n) + v_{i1}^* (\tilde{g}(i_n), i_n) - \theta K_1^*(i_n) > v_{i1}^* (\tilde{g}(i_n), i_n)
\]

(35)

Observe that $i_n$ does not depend on $\theta$. Assume
\[
\theta < \frac{\tilde{\mu}_1^*(i_n)}{K_1^*(i_n)}
\]

Then (35) is satisfied if and only if $\alpha > \tilde{\alpha}$, with
\[
\tilde{\alpha} = \frac{v_{i1}^* (\tilde{g}(i_n), i_n)}{v_{i1}^* (\tilde{g}(i_n), i_n) + \tilde{\mu}_1^*(i_n) - \theta K_1^*(i_n)} \in (0, 1)
\]

■

**Proof of Proposition 3**

(i) Using (29) and the concavity of $U_{M_p}^*$ with respect to $i$ shows that $\partial i_p / \partial \alpha$ and $K_1^*(i_p) - v_{i1}^* (y^* (i_p), i_p)$ have the same sign. Using (27) then shows that $\partial i_p / \partial \alpha < 0$. One can show similarly that $\partial e_p / \partial \alpha < 0$.

(31) then gives
\[
\frac{\partial U_{M_p}^*}{\partial \alpha} = W_1^{*'}(i_p) \frac{\partial i_p}{\partial \alpha} + W_2^{*'}(e_p) \frac{\partial e_p}{\partial \alpha}
\]

with $W_1^{*'}(i_p) > 0$ and $W_2^{*'}(e_p) > 0$ when $\alpha > 0$ because $0 < i_p < i^*$ and $0 < e_p < e^*$ in that case and $W_1^*(i_p), W_2^*(e_p)$ are concave functions. Hence
\[
\frac{\partial U_{M_p}^*}{\partial \alpha} < 0
\]
When $\alpha = 0$, we have $i_p = i^*$, $e_p = e^*$ and
\[ U_{Gp}^* = W_1^*(i^*) + W_2^*(e^*) \]
which shows that the aggregate surplus is maximized in such a case.

(ii) Using (32) and the concavity of $U_{Mn}^*$ with respect to $i$ shows that
\[ \partial p / \partial \alpha \]

hence, using (36), (37) and (38) allows us to write
\[ A = \tilde{\mu}_1^*(i) - [v_{1i}^*(y^*(i), i) - v_{1i}^*(\tilde{y}(i), i)] \]

have the same sign. Equation (11) allows us to write
\[ \tilde{y}'(i) = \frac{v''_{1iy}(\tilde{y}(i), i)}{c''_{1}(\tilde{y}(i)) - v''_{1y}(\tilde{y}(i), i)} \]
which gives
\[ \tilde{\mu}'_1^*(i) = \mu'_1^*(\tilde{y}(i))\tilde{y}'(i) = \frac{\mu'_1^*(\tilde{y}(i))v''_{1iy}(\tilde{y}(i), i)}{c''_{1}(\tilde{y}(i)) - v''_{1y}(\tilde{y}(i), i)} \quad (36) \]

Furthermore,
\[ v_{1i}^*(y^*(i), i) - v_{1i}^*(\tilde{y}(i), i) = v''_{1iy}(\theta y^*(i) + (1 - \theta)\tilde{y}(i), i) [y^*(i) - \tilde{y}(i)] \quad (37) \]

for some $\theta$ in $(0, 1)$.

Assume $v''_{1iy} \leq 0$. Using $y^*(i) > \tilde{y}(i)$ gives
\[ v''_{1iy}(\theta y^*(i) + (1 - \theta)\tilde{y}(i), i) \leq v''_{1iy}(\tilde{y}(i), i) \quad (38) \]

hence, using (36), (37) and (38) allows us to write
\[ A \geq v''_{1iy}(\tilde{y}(i), i) [\frac{\mu'_1(\tilde{y}(i))}{c''_{1}(\tilde{y}(i)) - v''_{1y}(\tilde{y}(i), i)} - y^*(i) + \tilde{y}(i)] \quad (39) \]

Assume also $v'''_{1y^3} - e''' \leq 0$, which means that $c'(y) - v'_{1y}(y, i)$ is a (weakly)
convex function of $y$. We obtain
\[
\begin{aligned}
&c''(\tilde{y}(i)) - v''_{1y}(\tilde{y}(i), i) [y^*(i) - \tilde{y}(i)] \\
&\leq c'(y^*(i)) - v'_{1y}(y^*(i), i) - [c'(\tilde{y}(i)) - v'_{1y}(\tilde{y}(i), i)]
\end{aligned}
\]
\[ = \mu'_1(y^*(i)) \quad (40) \]

(39) and (40) imply
\[ A \geq v''_{1iy}(\tilde{y}(i), i) [y^*(i) - \tilde{y}(i)] [\frac{\mu'_1(\tilde{y}(i)) - \mu'_1(y^*(i))}{\mu'_1(y^*(i))}] \]
Proof of Proposition 4

Let \( \iota_p(\alpha, \theta_1), e_p(\alpha, \theta_2), \iota_n(\alpha) \) and \( e_n(\alpha) \) be the equilibrium investment strategies, respectively under private and public ownership. We have \( \iota_n(1) = i^1 \) and \( \iota_p(1, 1) = i^0 \) and

\[
\frac{\partial \iota_p}{\partial \alpha} < 0, \quad \frac{\partial \iota_p}{\partial \theta_1} > 0, \quad \frac{\partial e_p}{\partial \alpha} < 0, \quad \frac{\partial e_p}{\partial \theta_2} > 0, \quad \frac{\partial \iota_n}{\partial \alpha} > 0, \quad e_n(\alpha) = 0
\]

We may write \( U^*_G_p \) as a function of \( \alpha, \sigma, \theta_1 \) and \( \theta_2 \):

\[
U^*_G_p(\alpha, \sigma, \theta_1, \theta_2) = \sigma W^*_1(\iota_p(\alpha, \theta_1)) + (1 - \sigma) W^*_2(e_p(\alpha, \theta_2))
\]

with

\[
\frac{\partial U^*_G_p}{\partial \alpha} = \sigma W^*_1 \frac{\partial \iota_p}{\partial \alpha} + (1 - \sigma) W^*_2 \frac{\partial e_p}{\partial \alpha} < 0 \quad (41)
\]
\[
\frac{\partial U^*_G_p}{\partial \theta_1} = \sigma W^*_1 \frac{\partial \iota_p}{\partial \theta_1} > 0 \quad (42)
\]
\[
\frac{\partial U^*_G_p}{\partial \theta_2} = (1 - \sigma) W^*_2 \frac{\partial e_p}{\partial \theta_2} > 0 \quad (43)
\]

Likewise we may write \( U^*_G_n \) as a function of \( \alpha \) and \( \sigma \):

\[
U^*_G_n(\alpha, \sigma) = \sigma W^*_1(\iota_n(\alpha)) + (1 - \sigma) W^*_2(0)
\]

Using \( \iota_n(1) = i^1 < i^* \) gives

\[
\frac{\partial U^*_G_n}{\partial \alpha} = \sigma W^*_1 \frac{\partial \iota_n}{\partial \alpha} > 0 \quad (44)
\]

We also have

\[
U^*_G_p(0, \sigma, \theta_1, \theta_2) > U^*_G_n(0, \sigma) \quad \text{for all } \sigma, \theta_1, \theta_2 \quad (45)
\]

and

\[
U^*_G_p(1, \sigma, \theta_1, \theta_2) = \sigma W^*_1(i^0) + (1 - \sigma) W^*_2(e_p(0, \theta_2)) < \sigma W^*_1(i^1) + (1 - \sigma) W^*_2(0)
\]

because \( i^0 < i^1 < i^* \). Using \( \iota_n(1) = i^1 \) gives

\[
U^*_G_p(1, \sigma, \theta_1, \theta_2) < U^*_G_n(1, \sigma) \quad \text{for all } \sigma, \theta_1, \theta_2 \quad (46)
\]
(41), (44), (45) and (46) show that there exists \( \hat{\alpha}(\sigma, \theta_1, \theta_2) \) in \((0, 1)\) such that
\[
U^*_G(p, \hat{\alpha}, \sigma, \theta_1, \theta_2) = U^*_G(n, \hat{\alpha}, \sigma)
\]
which implies \( U^*_G(p) > U^*_G(n) \) if \( \alpha < \hat{\alpha}(\sigma, \theta_1, \theta_2) \) and \( U^*_G(p) < U^*_G(n) \) if \( \alpha > \hat{\alpha}(\sigma, \theta_1, \theta_2) \).

We also have \( i_p(\hat{\alpha}, \theta_1) < i_n(\hat{\alpha}) \) and \( c_p(\hat{\alpha}, \theta_2) > 0 \). (42) and (43) imply
\[
\frac{\partial \hat{\alpha}}{\partial \theta_1} > 0 \quad \text{and} \quad \frac{\partial \hat{\alpha}}{\partial \theta_2} > 0
\]
Furthermore
\[
\frac{\partial \hat{\alpha}}{\partial \sigma} = \frac{\partial U^*_G(p)}{\partial \sigma} - \frac{\partial U^*_G(n)}{\partial \sigma} < 0
\]
because
\[
\frac{\partial U^*_G(n)}{\partial \alpha} > 0 \quad \frac{\partial U^*_G(p)}{\partial \alpha} < 0
\]
and
\[
\frac{\partial U^*_G(n)}{\partial \sigma} - \frac{\partial U^*_G(p)}{\partial \sigma} = W^*_1(i_p(\hat{\alpha}, \theta_1)) - W^*_1(i_n(\hat{\alpha})) - [W^*_2(e_p(\hat{\alpha}, \theta_2)) - W^*_2(0)] < 0
\]

\[\blacksquare\]


References


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