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GOVERNMENTS WHEN COSTS  
ARE CONTRACTIBLE**

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## ABSTRACT

### The Proper Scope of Governments When Costs are Contractible\*

We discuss the relative merits of public and private ownership. Our starting point is the analysis of Hart, Schleifer and Vishney (HSV), who apply an incomplete contract framework to study the difference between private and public ownership. Our analysis departs from HSV's model in two aspects. First, we allow for cost-sharing contracts between the government and the firm. Second, we assume that the manager of a private firm may incur additional costs in order to produce private benefits, or perks (alternatively, this may reflect cross-subsidization). Managers in publicly-owned firms do not have the same opportunity to produce perks, as the government when it owns the firm can monitor the manager's costs more closely. The cost-sharing contract allows the government to govern the incentives for cost reductions in a privatized firm, and the government can thereby reduce the private firm's incentives to dump quality in order to save on costs. This comes at a cost, however, as a low-powered incentive contract increases the manager's incentives to consume perks. We show that if quality dumping is important, public ownership is still preferable to private ownership.

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# 1 Introduction

A wind of privatisation has blown over most of the world. In former communist countries in Eastern Europe, entire industries that formerly were state-owned have been sold to the private sector. In Western Europe, politicians and economists alike have advocated private rather than public ownership, and privatisation of large state monopolies for instance in the telecom and energy sector has followed. For other institutions within the public sector, like universities, schools and hospitals, there seems to have been a move towards more independence and less direct control by the government.

From a contract-theoretical perspective, it is not obvious why a change from public to private ownership should improve economic performance. The government could in principle run a firm as efficiently as private owners, since the government has the option of running the state-owned firm in the same manner as a private firm. The argument has been put forward by Williamson (1985) and Sappington and Stiglitz (1987). Note the analogy with the claims in Lange and Taylor (1938) that a socialist economy can always do as well as and may do better than the market economy.<sup>1</sup>

Williamson's argument is weakened if it is impossible to write complete contracts. In this case, ownership may matter. Shapiro and Willig (1990) and Schmidt (1996) both argue that the owner of a firm has superior information regarding his firm. Schmidt writes that "allocation of ownership rights has an important impact on the allocation of inside information about the firm." The owner of a company has better access to detailed inside information about managerial activities, products, and accounting than a regulator has. If the government owns a company, therefore, the degree of information asymmetry between the government and the manager of the company is reduced. In Schmidt (1996), ownership matters because the government cannot constrain itself from using this information *ex post* in order to obtain allocative efficiency at that stage. However, *ex ante* this reduces the incentives to undertake cost-saving investments, as the firm in effect faces soft budget constraints. In Shapiro and Willig (1990) ownership matters because the government is sometimes malevolent, and being less informed (privatizing the regulated firm) makes it more difficult for the government to pursue its private agenda.<sup>2</sup>

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<sup>1</sup>Shleifer (1998) offers a recent summary of the thinking about privatisation. See Megginson and Netter (2001) for a survey of empirical evidence about the effect of privatisation.

<sup>2</sup>Kessler and Lulfesmann (2002) also assume that the owner gets access to inside in-

Hart, Shleifer, and Vishny (1997) (hereafter HSV), by contrast, focus on the residual right of control aspect of ownership. With incomplete contracts ownership becomes important since this governs who has the right to decide in contingencies not covered by the original contract. It is argued that if the manager rather than the government owns the company, this will strengthen the manager's bargaining position *ex post* and thus also his incentives to innovate *ex ante*. The main advantage of public ownership is that it weakens incentives to cut quality in order to save costs. The main benefit from privatisation is that it increases the manager's incentives to invest in quality-enhancing innovations.

The set of feasible contracts in HSV is severely limited. Even contracts based on accountable costs are ruled out. However, contracts in which the price or transfers from the government are based on accountable costs are widely used. Cost-based pricing, much in use in regulated network industries, is one example of contracts exploiting verifiable cost figures. As demonstrated by Laffont and Tirole (1993), an optimal regulatory policy will be characterized by cost-sharing arrangements between the government and the company even though this comes at a cost in terms of reduced effort by the firm.

Our starting point is the HSV model of public versus private ownership. We extend this model in two directions. Firstly, we allow for cost-contingent contracts between the government and a regulated private company. Exploiting this option, the government becomes able to dampened the private firm's excessive incentives to reduce costs by holding back on quality. Secondly, we follow Schmidt (1996) by assuming that the government has better access to inside information in a state-owned firm than in a private firm. A privately owned firm, therefore, will to a larger extent than a public firm be able to exploit cost-plus contracts, for instance through cross subsidation, reduced attention (effort) and possibly on-the-job consumption by the owners. We refer to this as cost inflation. Thus, reducing a privatised firm's excessive incentives to undertake quality-reducing cost-saving investments through a cost-sharing contract creates side effects in the form of cost inflation.

Our analysis thus indicates that the possibility of cost-reducing quality dumping is not sufficient to support public ownership, as the incentives to do so can be dampened by a properly designed cost-sharing contract. An

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formation. However, they consider the case in which this information is available upon costly monitoring. In their study of ownership they compare the owner's (either private or public) incentives to monitor.

additional factor that has to be taken into account is the scope for cost inflation. Cost-reducing investments with adverse effect on quality is only a problem if the scope for cost inflation is large.

If the government owns the firm, it can avoid cost inflation directly. Hence, if the government is able to write a cost-sharing contract directly with the manager of the firm, using a cost-sharing contract is less costly for the government. Our model thus gives an explanation as to why the incentives for cost reductions will be higher in regulated private firms than in state-owned companies. In HSV, this difference in incentives - which is crucial for their results - enters by assumptions about the negotiation game between the manager/owner and the government. In our model it appears as an optimal response by the government.

Our approach is also related to a recent study by Lüflesmann (2002). He considers wage contracts between the firm's owner (government or private entrepreneur) and its manager. The wage contract is incomplete, and can only be made contingent on the firm's future operation. The owner's decision to uphold production depends on the manager's effort to develop an innovative technology. The ownership structure feeds back on managerial effort since private and public owners may make different shut-down decisions *ex post*, which in turn affect the initial wage contract.

Similar to HSV and the present paper, Lüflesmann considers an incomplete contract environment under symmetric information. Other contributions that use this approach are Hart (2003) and Besley and Gatak (2001). Hart (2003) proposes a HSV-type of model to gain insight about the costs and benefits of public-private partnerships. Instead of focusing on private and public ownership, he investigates whether the construction stage and the service production stage should be bundled together in a long term partnership. By bundling the two stages together, the government establishes a governance structure that motivates productive investment at the construction stage. Besley and Gatak (2001) extend the incomplete contracting models of Grossman, Hart and Moore to consider ownership issues for public good provision. They show that if the return from the investments undertaken by the parties is a public good, then the party with the highest valuation should be the owner irrespective of the relative importance of their investments.

Similar to Schmidt (1996), Laffont and Tirole (1991) use an agency setting with informational asymmetries to address the importance of public versus private ownership. Whereas Schmidt (1996) considers a situation in which ownership affects the degree of asymmetric information, Laffont and

Tirole(1991) argue that privately owned but regulated firms may suffer from a conflict of interest between the shareholders and the regulator. This creates a common agency problem which may cause managerial slack to be higher under private ownership.

The rest of the paper is organized as follows. Section 2 describes the model and the re-negotiation game between the manager and the government. Section 3 characterises the equilibrium under private and public ownership. Section 4 compares private and public ownership. Section 5 concludes.

## 2 The model

The government wants a non-divisible public good to be available (freely) to the consumers. The quality of the good is of importance for consumers, but although quality is observable for the involved parties, it is not contractible. The main issue for the government is to decide whether to produce the good in-house (by a public firm) or by a private firm (out-sourcing). Ownership determines who has the residual rights of control over the non-human assets used to provide the good. If the good is provided in-house, the government has residual control rights over these assets, whereas the private company has the residual control right over the assets in the case of out-sourcing. Ownership may therefore matter for the incentives to provide quality.

Our starting point for the analysis is the HSV model. There is a single principal-agent tier (G and M) in both ownership statutes. With in-house production, there is a relationship between the government (G) and the manager (M) of the public firm, and with out-sourcing the agent is a manager-owned firm (see footnote 12 in HSV). The manager of the company can make two kinds of innovations. A cost innovation will reduce the costs by  $C$  of providing the good. However, a cost innovation will also reduce the quality  $Q$  of the good. An effort  $e$  devoted to cost innovations will reduce costs with  $\phi c(e)$ , and reduce quality with  $\theta q(e)$ . The manager may also undertake quality innovations. An effort  $i$  devoted to quality innovations will increase the quality of the product with  $\gamma\beta(i)$  units. The crucial assumptions are, first, that  $e$  and  $i$  are non-contractible, and, second, that these are personal costs or "effort costs" which do not show up in the accounts and are thus not included in  $C$ .

The timing of our model is as in the HSV-model, and goes as follows:

1. The manager and the government write an initial contract, including choice of ownership.
2. The manager chooses effort variables  $e$  and  $i$ .
3. The manager and the government learn the outcome of the manager's effort:  $c(e)$  and  $\beta(i)$ .
4. The contract is re-negotiated.
5. The re-negotiated contract is implemented.

We change the model in two important aspects. Our first change regards the set of contract available at stage one. In HSV, it is assumed that the contract only specifies an unconditional price  $T_0$ . We believe this is unsatisfactory in some circumstances; when governments make procurements from private firms they can and do make payments conditioned on accounted costs. This is also reflected in the literature, in which cost sharing contracts between the government and private providers have received much attention. We therefore introduce cost-sharing contracts at stage 1, and write

$$T_0 = a + bC, \tag{1}$$

where  $C$  is realized costs. The restriction that contracts are linear does not reduce the generality of the analysis: Since neither uncertainty or asymmetric information regarding the manager's "type" are present in the model, the optimal allocation can be implemented by a linear contract.

It is not so obvious whether it is reasonable to assume that the government can use cost-sharing contracts for in-house production. Suppose that the government agency is the legal subject in the contract. As the government owns the government agency, a contract between the government and the agency may not have much credibility, as the government in effect contracts with itself. The objectives of the agency and how profit should be distributed within the agency are not clear either. With a narrow interpretation of the manager (simply the person in charge of running the agency), the government may govern his incentives to devote effort to cost-saving and quality-enhancing innovations by the personal wage contract that he is given. This requires that both parties can commit to honor the contract, and not withdraw from it *ex post* by firing the manager or quitting the job. In what



follows we will analyse the case of public ownership both with and without cost-sharing contracts.

Our second change regards diversion of resources. A private firm makes many decisions that influence costs, both in a static and a dynamic perspective. HSV is concerned with the dynamic perspective, that is, the incentives to invest in activities that lead to cost-reducing innovations. However, by reducing a firm's incentives to reduce costs this will inflate the firm's costs through other channels as well. Furthermore, we argue that a firm's incentives to inflate costs will depend on the ownership structure.

Let us first discuss cost inflation created by cost-sharing contracts. A multi-product firm will have incentives to cross-subsidise, by (wrongly) including costs from activities where the firm is residual claimant to activities where costs are shared. Similarly, the multi-product firm will have an incentive to employ resources with a low internal shadow price relative to their market price in those segments where costs are shared. Second, the firm may have an incentive to misrepresent investments as operating costs. More generally, more low-powered incentives may reduce the owners' "effort" to reduce costs, given the level output and quality, and of on-the-job consumption. See section 4 for a more detailed discussion.<sup>3</sup>

A fundamental assumption in our model is that cost inflation is observable for the owners but not for a regulator. We thus follow Schmidt (1996), who argues that an important dimension of ownership is that it gives access to internal information about the company's activities. On p. 9 he rationalises this assumption as follows:

"The argument is that having access to inside information of a firm is not a specific right, which can be contracted upon easily, but rather a residual right, which is tied together with ownership. Information is not just "available" in a firm – it has to be produced, collected, accounted, processed, and transmitted, and it is the owner who in the end controls this process of information production. Therefore, the owner is always able to manipulate the information. For example, she may manipulate transfer prices, thus shifting profits from one division of her firm to another, or

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<sup>3</sup>There is also a large literature in corporate finance with Jensen and Meckling (1976) as the seminal contribution concerning management's incentives to consume "perks" (see for instance Hart (1995, part II) and Matos (2002)).

she may choose among different depreciation methods, thus shifting profits between periods etc. After the information has been produced, it is impossible to verify it to an outsider even if the owner wishes to do so.”

Williamson (1985) and Holmstrom and Tirole (1989) make similar claims. For our purpose, the main point is that the government can control cost inflation if production is performed in-house but not if production is performed by a private firm. Let  $P$  denote the amount cost inflation, and let  $v(P)$  denote the value of this cost-inflation to the firm. We assume that  $v'(0) = 1$  and that  $v''(P) < 0$ . In order to get a metric for the scope for perk consumption, we parametrise  $v(P)$ , and set<sup>4</sup>

$$v(P) = P - \frac{P^2}{2\rho}$$

The parameter  $\rho$  captures the scope for cost inflation, a high value of  $\rho$  implies a large scope for cost inflation. The determinants of  $\rho$  will be discussed below. Note that  $v(P) - P < 0$  for all  $P > 0$ . In this sense perks is always inefficient. However, with a cost-sharing contract, perks may be efficient for a private firm. Total costs and obtained quality can thus be written as

$$C(e, P) = C_0 - \phi c(e) + P \tag{2}$$

$$Q(e, i) = Q_0 - \theta q(e) + \gamma\beta(i) \tag{3}$$

Since  $v(P) < P$ , there is no cost diversion if the government owns the firm, ( $P = 0$ ). If production is out-sourced, the private firm chooses  $P$  so as to maximise its income  $T_0 - C + v(P)$ , i.e. solve the problem

$$\max_P \{a - (1 - b)[C_0 - \phi c(e) + P] + P - \frac{P^2}{2\rho}\}.$$

The associated first-order condition is that  $P = \rho b$ .

In what follows, we assume that the utility of the government is given by  $U^G = Q - T$ , where  $T$  is total payment to the firm. Thus, without loss of generality we assume that the government's preferences do not include the profit of the firm or the well-being of the manager if production is made in-house.

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<sup>4</sup>None of our qualitative results depend on this parametrisation.

## Re-negotiations

The incentives to innovate will depend on the outcome of the re-negotiation game, and the formulation of the re-negotiation game is therefore crucial for the equilibrium of the model. We model the re-negotiation game in the same way as in the HSV model.

### *Re-negotiation with a private, manager-owned firm*

Consider first re-negotiations between the government and a private firm. By assumption, the government is able to commit to a cost-sharing contract with the company. Any cost innovation *ex post*, therefore, may be implemented by the manager without triggering re-negotiation (as in the HSV model). If the manager-owner invests in quality-enhancing innovations, the value of the public good increases by  $\gamma\beta(i)$ . The initial contract gives no incentives to implement the quality innovation, and the firm will therefore not do so unless the contract is re-negotiated. Without re-negotiation, the government's pay-off is given by  $Q_0 - \theta q(e) - a - bC(e, P)$ , and the manager's pay-off by  $a - (1 - b)[C(e, P)] + v(P) - e - i$ .

If the quality innovation is implemented, the joint payoff increases with  $\gamma\beta(i)$ . This additional pay-off is divided between the parties according to the Nash sharing rule. Thus, half of this gain is allocated to the firm through an additional payment and the remaining half is allocated to the government. The equilibrium payoffs to the government and the manager/owner in case of private ownership are thus

$$U_P^G = Q_0 - \theta q(e) + \frac{1}{2}\gamma\beta(i) - a - bC(e, P). \quad (4)$$

$$U_P^M = a - (1 - b)C(e, P) + \frac{1}{2}\gamma\beta(i) + v(P) - e - i \quad (5)$$

### *Re-negotiation with in-house production and no cost-sharing contract*

Consider first the case where the government cannot commit to a cost-sharing contract with the manager of the public firm. In this case, the re-negotiation game is as in HSV. To repeat, the manager is assumed to be only partly replaceable, in the sense that his presence is required in order to reap the full gains of the innovations. More specifically, if the manager does not participate, the effect of the innovations are reduced with a fraction  $\lambda$ .

The disagreement point in the re-negotiation game is that the manager is replaced. The manager will not utilise his unique competence, and receives  $a - e - i$ , where  $a$  is a fixed payment (we thus assume that the government is committed to paying the manager  $a$ , even if he quits). In this scenario the pay-off to the government is  $Q_0 - (1 - \lambda)\theta q(e) + (1 - \lambda)\gamma\beta(i) - [C^0 - (1 - \lambda)\phi c(e) + a]$ .

If the contract is re-negotiated, the manager's unique competence increases the joint surplus by  $\lambda(\gamma\beta(i) + \phi c(e) - \theta q(e))$ . Again this is shared according to the symmetric Nash sharing rule. The equilibrium re-negotiation payoffs are thus

$$U_{GN}^G = Q_0 - C_0 - a + (1 - \lambda/2)[\gamma\beta(i) + \phi c(e) - \theta q(e)] \quad (6)$$

$$U_{GN}^M = a + \lambda/2[\gamma\beta(i) + \phi c(e) - \theta q(e)] - e - i \quad (7)$$

*Re-negotiation with in-house production and cost-sharing contracts*

In this scenario both the manager and the government are committed to a cost-sharing contract. As with private ownership, commitment to a cost-sharing contract rules out *ex post* negotiation about costs. The disagreement point, therefore, is that the manager works under the initial cost-sharing contract. In contrast to private ownership, however, the manager cannot prevent the government from implementing the quality innovation in the absence of re-negotiation (disagreement). The quality innovation, which is observable *ex post*, now belongs to the government. If the government chooses to implement the quality innovation without re-negotiation, however, the manager has no incentives to utilise his unique competence. The pay-off to the manager is then  $a - (1 - b)C(e, 0) - e - i$ . The pay-off to the government is  $Q_0 - \theta q(e) + (1 - \lambda)\gamma\beta(i) - a - bC(e, 0)$ . If the government and the manager reach an agreement concerning the implementation of quality innovation, the manager's unique competence increases the joint surplus by  $\lambda\gamma\beta(i)$ , which is split between the parties. The equilibrium re-negotiation payoffs are thus

$$U_{GC}^G = Q_0 - \theta q(e) + (1 - \lambda/2)\gamma\beta(i) - a - bC(e, 0) \quad (8)$$

$$U_{GC}^M = \lambda\gamma\beta(i)/2 + a - (1 - b)C(e, 0) - e - i \quad (9)$$

### 3 Equilibrium

Before deriving the equilibrium when  $e$  and  $i$  is noncontractible, it is convenient to establish the first-best solution as a benchmark. If both  $e$  and  $i$  were contractible, the government and the manager of the company would agree on a level  $e$  and  $i$  in order to maximize total surplus of the production activity. Hence, the first-best solution is given by

$$\text{Max}_{e,i,P} \{-\theta q(e) + \gamma\beta(i) + \phi c(e) + v(P) - P - e - i\}.$$

The first-order conditions to this problem define the first-best solution  $(e^*, i^*, P^*)$ :

$$-\theta q'(e^*) + \phi c'(e^*) = 1 \quad (10)$$

$$\gamma\beta'(i^*) = 1 \quad (11)$$

$$P^* = 0 \quad (12)$$

The last equation comes from the assumption that  $v(P) < P$  for  $P > 0$ .

#### 3.1 Private ownership

The manager /owner of the firm (hereafter the firm) is contracting with the government. The quality innovation makes both parties willing to renegotiate a new price.

The firm chooses  $e$ ,  $i$ , and  $P$  so as to maximize  $U^M$ . For a given contract  $(a, b)$ , the effort choices of the firm is given by the first-order conditions (from equation 4 and 5)

$$\begin{aligned} (1-b)\phi c'(e) &= 1 \\ \frac{1}{2}\gamma\beta'(i) &= 1 \\ P &= \rho b \end{aligned} \quad (13)$$

As in HSV, we find that the level of quality innovation  $i$  deviates from first-best. The reason is that innovation creates a total benefit  $\gamma\beta(i)$ , whereas only 50 per cent of this falls on the firm. Different from HSV, the incentives

to devote effort to reduce costs will be governed by the contract. If  $1 - b = \frac{1}{1 + \theta q'(e^*)}$ , then the firm would have chosen the first best effort level devoted to cost-reductions. As will be clear shortly, this is not second-best optimal when cost inflation is taken into account.

The optimal contract  $(a^*, b^*)$  maximises the government's utility, given the incentive- and participation constraints of the firm. Since there is no asymmetric information regarding the productivity of the firm, the optimal contract for the government leaves no rents to the firm.<sup>5</sup> To derive the optimal contract, we thus determine  $b$  so as to maximise total surplus,  $S^P = U^G + U^M$ . The constant  $a$  is then adjusted so that the relevant participation constraints bind (we do not find it necessary to state this formally).  $S^P$  is given by (since  $v(P) - P = -P^2/(2\rho)$ )

$$S^P = Q_0 - \theta q(e) + \gamma\beta(i) - C_0 + \phi c(e) - \frac{P^2}{2\rho} - e - i. \quad (14)$$

where  $e$ ,  $i$ , and  $P$  are determined by the first order conditions in (13). The optimal value of  $b$  is thus given by the following first-order condition:

$$[-\theta q'(e) + \phi c'(e) - 1] e'(b) - b\rho = 0$$

Since the first-best level of cost-reducing effort - implemented with  $b^{FB}$  - is given by  $-\theta q'(e(b^{FB})) + \phi c'(e(b^{FB})) - 1 = 0$ , we see that  $\frac{\partial S^P}{\partial b} \Big|_{b=b^{FB}} < 0$ . With private ownership, therefore, the government will offer an initial contract with a more high-powered cost-sharing scheme than first-best (i.e.  $b^P < b^{FB}$ ). Let  $e_P$  and  $i_P$  denote the investments in cost-and quality innovations with private ownership, respectively. Then the following holds

**Proposition 1** *Suppose the public good is provided by a private (manager-owned) firm. Then the incentive contract is more incentive powered the larger is the scope for cost inflation, measured by  $\rho$ . Relative to first best there is too much cost-saving,  $e_P > e^*$ , and too few quality innovations,  $i_P < i^*$ .*

The intuition for this proposition is as follows: due to the negative effect of cost-reductions on quality (which is not contractible), the government

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<sup>5</sup>There is no bilateral bargaining over rent distribution between the firm and the government *ex ante*. We thus assume that several firms compete for the contract *ex ante*.

wants to reduce the private firm's incentives to undertake cost-reducing effort. However, this comes at a cost, as weaker incentives for cost reductions also mean more cost inflation. When choosing  $b$ , the government therefore balances the gains of higher quality against more cost inflation when lowering the incentive power of the contract. The optimal incentive power is therefore higher than if cost inflation were not an issue, and more so the larger is the scope for cost inflation. The resulting level of quality-reducing cost-saving is therefore higher than in first best, and more so the higher is  $\rho$ .

### 3.2 Public ownership and no cost-sharing contract

In this case the government owns the firm and can thus implement any innovations at will. However, as we have seen, the manager of the firm may be only partially replaceable, and this gives him some bargaining power in the re-negotiation game. When the government becomes the owner and gets access to inside information, the manager will not be allowed to consume perks.

As before, the incentives to innovate can not be governed by the initial contract. The first order conditions for his choice of  $e$  and  $i$  are given by

$$\begin{aligned}\lambda[\phi c'(e) - \theta q'(e)]/2 &= 1 \\ \lambda\gamma\beta'(i)/2 &= 1\end{aligned}$$

As in HSV, both cost-reductions and quality innovations are under-provided in this scenario. Let  $e_{GN}$  and  $i_{GN}$  denote investments in cost-reducing and in quality-enhancing innovations by , respectively. The following proposition then follows directly:

**Proposition 2** *With in-house production and no cost-sharing contracts, the following holds: 1) the level of cost-reducing effort is too low ( $e_{GN} < e^*$ ). 2) There are too few quality-enhancing innovations, and the level is below the level with private ownership ( $i_{GN} < i_p < i^*$ ).*

### 3.3 Public ownership and cost-sharing contracts

The manager will choose  $e$  and  $i$  to maximize  $U^M$ . The first-order condition to this problem is given by (from equation (9))

$$\begin{aligned}
(1-b)\phi c'(e) &= 1 \\
\lambda \frac{1}{2} \gamma \beta'(i) &= 1
\end{aligned} \tag{15}$$

Total joint expected income  $S^G = U^G + U^M$ , is given by

$$S^G = Q_0 - \theta q(e) + \gamma \beta(i) - C_0 + \phi c(e) - e - i.$$

where  $e$  and  $i$  are given by (15). The relationship between  $e$  and  $b$  is the same as with private procurement, while  $i$  is independent of  $b$  and equal to  $i_{GN}$ . The only difference between the expected income with in-house production and with private production is that in the latter case, perks reduce the joint expected income. The optimal contract  $b^G$  is given by:

$$[-\theta q'(e) + \phi c'(e) - 1] e'(b) = 0 \tag{16}$$

By comparing (16) and (10) it follows that the government chooses  $b$  so that the first best level of cost-reducing effort is realised. With public ownership, the government will offer an initial contract containing a cost-sharing scheme that implements the first-best level of cost reducing effort.

Let  $e_{GC}$  and  $i_{GC}$  denote investments directed at cost-reductions and in quality-enhancing innovations, respectively. We have then shown the following

**Proposition 3** *With public ownership and cost-sharing contracts, the following holds: 1) The first-best level of cost-reducing effort is realised ( $e_{GC} = e^*$ ) 2) There are too few quality-enhancing innovations ( $i_{GN} = i_{GC} < i^*$ ).*

Comparing with Proposition 1 (Private ownerships) and Proposition 2 (public ownership without contracts), we immediately get the following result:

**Corollary 4** *The incentives for cost reductions in a regulated private company is higher than in a public agency.*



Public ownership goes together with low-powered incentives to reduce costs. Different from in HSV, however, this is not a consequence of ownership rights per se. It is because the government deliberately chooses (in the initial contract) to provide the manager of a public company with low powered incentives. Using the words of Shleifer (1998): *"Ironically, the government sometimes becomes the efficient producer precisely because employees are not motivated to find ways of holding costs down."*<sup>6</sup>

Since costs are verifiable, the government could have chosen equally low powered incentives for a private company. But since the problem of cost inflation becomes more serious when the government gives away its ownership, the government finds it optimal to respond by increasing the power of cost-sharing contracts. This could explain why privatisation often goes together with regulatory reforms characterized by stronger incentives (e.g. the privatisation in UK electricity industry and the introduction of RPI+X regulation).

## 4 Private or public?

When the government is permitted to govern the incentives to reduce costs through a cost-sharing contract, this will obviously improve efficiency. Consider first the private ownership case. Without a cost-sharing contract, the manager-owner is residual claimant on cost saving. The manager, therefore, has excessive incentives to invest in cost-saving innovations that also reduce quality. A cost-sharing contract reduces these excessive incentives. When the firm is publicly owned, the problem (without a cost-sharing contract) is the opposite, the manager has too weak incentives to invest in cost-savings, as he has to bargain over the surplus (net of quality reductions) created. A contract with the manager of the firm can then be used to boost his incentives to undertake in cost-reducing effort.

Let us first compare public versus private ownership when the government is not able to write incentive contracts with the manager when production takes place in-house. Since the utility of the manager / firm is equal to his exogenously given outside option, the proper efficiency measure is the utility of the government. The point of reference is the HSV-model. Cost-sharing contracts then increase the attractiveness of private ownership relative to public ownership, as the costs of private procurement in terms of excessive

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<sup>6</sup>See also Williamson (2000, p. 602).

cost reductions are reduced. However, if the scope for cost inflation is sufficiently large, this option is expensive for the government. Thus, if both  $\rho$  and the quality-reducing effect  $\theta$  are sufficiently high, in-house production is still preferable to private procurement provided that quality innovations are not too important.

**Proposition 5** *Suppose the government can use cost-sharing contracts with private firms but not incentive contracts with public firms. Then the following holds:*

a) *Relative to the situation without cost-sharing contracts, private ownership is more attractive relative to public ownership. Thus, the set of parameters  $(\theta, \phi, \gamma, \lambda)$  for which private ownership is more efficient is strictly larger with cost-sharing contracts than without*

b) *The larger is the scope for cost inflation, the smaller is the set of parameters  $(\theta, \phi, \gamma, \lambda)$  for which private ownership is more efficient than public ownership*

c) *If the effect of cost savings on quality is sufficiently strong ( $\theta$  is sufficiently high) and at the same time the scope for cost inflation is sufficiently large ( $\rho$  is sufficiently large), public ownership is still preferable to private ownership provided that  $\gamma$  is not too large.*

Proof of part a). Introducing cost-sharing contracts strictly increases the choice set of the government. By setting  $b = 0$ , the government obtains exactly the same incentive structure as with no cost-sharing contracts. As it is never optimal to set  $b = 0$ , it follows that the private procurement alternative is strictly more attractive with cost-sharing contracts than without for all parameter values. The alternative of in-house production is not affected. The result thus follows.

Proof of part b). This follows directly from the fact that the government's pay-off with private procurement is strictly decreasing in  $\rho$ .

Proof of part c). As  $\theta \rightarrow \infty$ ,  $e^* \rightarrow 0$ . As  $e_{GN} < e^*$ , it follows that inefficiencies due to under-provision of effort in the public firm converges to zero as  $\theta$  goes to zero. It also follows that the optimal value of  $b$  converges to 1, and cost inflation converges to  $\rho$ . For  $\gamma = 0$  it follows that in the limit, the utility of the government is higher with public than with private ownership. If  $\gamma > 0$ , it follows that public ownership is preferable to private ownership in the limit if and only if  $\rho/2 > \gamma\beta(i_{PC})$ . QED

HSV finds that if the scope for quality-reducing cost-saving is sufficiently large, this may call for government ownership. We have just shown that this is a necessary but not a sufficient condition for government ownership. An additional requirement is that the scope for cost inflation must be large, otherwise the government will cope with the private firm's excessive incentives for cost reductions simply by using a cost-sharing contract.

When evaluating the relative merit of private versus public ownership, a two-step procedure can thus be undertaken. The first step is, as in HSV, to evaluate the importance of non-contractible quality innovations and quality-reducing cost-saving. If the evaluation indicates that private ownership is superior to in-house production, the procedure ends. If the scope for quality-reducing cost-saving is sufficiently large so that private ownership is unwarranted without a cost-sharing contract, the second step of the procedure is to evaluate the scope for cost inflation. Examples of sources of cost inflation can be as follows

1. Cross subsidiation in space. If a firm operates in different markets, some of which are not regulated, the firm will have incentives to attribute costs to activities with a high degree of cost sharing. An example (taken from Norway) can be that a hotel chain (operating in a competitive market) also delivers nursing services financed by the government. Misspecification of costs may be particularly relevant for common costs, such as headquarters, intrafirm infrastructure and R&D expenses.
2. Cross subsidiation in time. If the firm expects the cost-sharing contract to be more incentive-powered in the future, the firm will have an incentive to overinvest in all kinds of physical and human capital which will reduce future costs. Overinvestment will also occur if such investments improve the prospects in future tournaments for new contracts or contract renewal. Finally, overinvestment will occur if the investments give rise to spillovers to other firm activities which operate in competitive markets (similar to cross subsidiation in space).
3. Missallocation of internal resources. If the internal shadow values of the firms' resources deviate from the market price of these resources, the firm will have an incentive to deploy resources with a higher market price - shadow price ratio on projects where it faces cost-sharing contracts. For instance, if the market for a particular input, say specialised labour, is thin, productivity differentials may not fully be reflected in

wage differentials. The firm will then have an incentive to allocate low-productivity workers to projects with cost-sharing contracts.

4. Lower incentives to reduce costs. The owners of the firm (in our case the manager) has lower incentives to exert non-observable effort in order to reduce costs, for instance by monitoring the manager.
5. On-the-job consumption. If the firm is manager-owned, the manager faces increased incentives to enjoy on-the-job consumption.

Intuitively, one would therefore think that the scope for cost-inflation is prominent in firms with a diversified portfolio of activities and complex production processes which make it simpler to camouflage cross subsidiation. A high capital-, knowledge- and technology intensity may increase the scope for cross subsidiation over time, while activities with highly specialised inputs traded in thin markets may give scope to misallocation of internal resources. On the other hand, manager-owned firms (often small firms) have strong incentives to inflate costs through on-the-job consumption.

Let us then compare private and public ownership when the government is able to write cost-sharing contracts with a private firm and to write incentive contracts with the manager of the public firm. Again, the benchmark is the HSV-model. In this case, the government will implement a first-best effort level with in-house production. Thus, if the government's only concern is cost-reducing innovations, public ownership is always preferable to private ownership. On the other hand, if quality innovations are sufficiently important, the government still prefers private ownership to public ownership

**Proposition 6** *Suppose the government can write cost-sharing contracts with both a private manager-owner and the manager of a public firm. Then the following holds*

*a) If the scope for quality innovations is small relative to the scope for cost inflation and the importance of quality-reduction due to cost-saving innovation ( $\gamma$  is small relative to  $\theta$  and  $\rho$ ), then public ownership is more efficient than private ownership.*

*b) If the scope for quality innovations is large relative to the scope for cost inflation, private ownership is more efficient than public ownership.*

Proof of part a). Keep  $\theta$  and  $\rho$  fixed. Then the scope for quality-reducing cost innovations gives public ownership a discrete advantage over private ownership. But that implies that for sufficiently low values of  $\gamma$  public ownership dominates.

Proof of part b). Keep  $\gamma$  and  $\theta$  fixed. As  $\rho \rightarrow 0$ , the advantage of no cost inflation in public firms vanishes. Thus, for sufficiently low values of  $\rho$ , private ownership dominates.

Thus, in this case the argument that private firms may be better than public ownership for cost efficiency reasons is contradicted by our model. The situation is actually the opposite: With in-house production, the incentives to undertake cost-reducing measures can be determined so as to achieve efficiency. With private production this is costly, as it leads to cost inflation.

## 5 Conclusion

In this paper we have extended the analysis of HSV by including cost-sharing contracts in the box of tools for the government. As a result, the government may dampen the excessive incentives for privately owned firms to implement quality-reducing cost cuts. This increases the efficiency of private procurement. Still, as the reduced incentive power of a cost sharing contract increases the amount of cost inflation in private firms, the equilibrium incentives to cut costs are still higher than in the first best allocation of resources.

The relative merits of public versus private production depends on whether the government is able to write cost-sharing contracts (i.e., incentive contracts) with the manager of a public firm. If this is not the case, cost sharing contracts between the government and the private firm strengthen the case for private production of the good. Public ownership is only warranted if 1) the quality-reducing effect of cost-reductions is large relative to the importance of quality innovations, and 2) The scope for cost inflation is small.

If the government can write cost-sharing contracts both with the private manager-owner and the manager of a public firm, the government will implement a first-best level of cost-reductions in the public firm. Thus, cost efficiency concerns always favours public ownership. In this case private ownership is preferable if either quality innovations are sufficiently important or if the scope for cost inflation is small.

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