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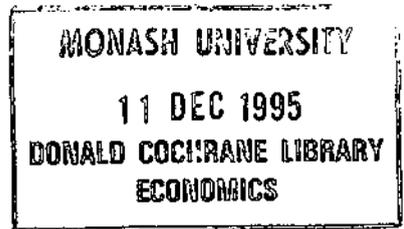
**ECONOMIC THEORIES OF PRIVATISATION AND
CORPORATISATION**

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Economic Theories of Privatisation and Corporatisation.*

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Abstract

Despite the widespread use of privatisation and corporatisation to reform public sector enterprises, there are very few models which formally analyse these policy tools from a contract-theoretic perspective. This paper develops such a model. Following Schmidt (1990) we argue that if contracts are complete, then the choice between public and private ownership of assets should be a matter of indifference to a benevolent policy-maker. Further, for a trade-off to exist between private and public ownership, we argue that incompleteness is required over some aspects of both profits and non-profit social surplus. If contracts are complete over social and not private surplus, then privatisation with regulation is optimal. If contracts are complete over private surplus and not social surplus, then we are indifferent between ownership structures. Issues of partial privatisation and corporatisation are also discussed. In particular, it is demonstrated that corporatisation can lead to outcomes which are worse than partial privatisation, and should be questioned as a policy tool, when partial privatization is feasible.

1. Introduction

Formal theories of asset ownership are a relatively new addition to economic theory¹. It may be for this reason, that there are few models based on formal notions of ownership, which analyse corporatization and privatization, despite the widespread use of these measures as tools of reform.

The key insight from the theories of ownership, is that incomplete contracts are necessary to explain it. If contracts are complete, then ownership is irrelevant.

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¹The paper by Grossman and Hart (1986) is widely cited as the first to do so in a rigorous fashion.

Complete contracts enable consenting parties to control all relevant actions in every state of the world. Ownership becomes a meaningless title, since all rights can be separately transferred.

Our paper presents a review of the literature which explicitly uses incomplete contracts to explain why a planner would prefer private ownership in some cases, and public ownership in others. Following a critique of this literature, we develop a model to analyze various ownership structures. The model is used to answer the question as to when public, partial private, and full private ownership is optimal.

We show that for a trade-off to exist between private and public ownership, incompleteness is required over some aspects of both profits and non-profit social surplus. If contracts are complete over social surplus and not profits, then privatization with regulation is optimal. If contracts are complete over profits and not non-profit social surplus, then a benevolent planner will be indifferent between ownership structures. We show that non-contractibility means different ownership regimes generate inherently different agency problems. Private ownership can be undesirable in cases where it induces managers to take actions which undermine social surplus. Private ownership of some degree is preferred when managers are not consequently granted unalienable incentives to take actions which can greatly harm social surplus.

We also define and analyse corporatization. Our main result is that corporatization can lead to outcomes which are worse than partial privatization, and should be questioned as a policy tool when partial privatization is feasible.

2. Survey and Critique of Current Literature

The theoretical literature on privatization can be divided into two groups. One class of models assume that the planner is a benevolent social welfare maximizer. The other class of models has the planner maximize an objective function which has additional arguments, such as labour surplus, personal gain from bribes and so on. We shall refer to the first class of models as "benevolent planner" models. The other class shall be referred to as "planner-politician" models. Clearly a planner-politician will generate outcomes which are socially less desirable under any ownership structure. However, it is not clear which with such a planner which ownership structure will yield the highest level of social welfare. The politician-planner will inappropriately interfere with both private and public enterprise. Further, we cannot expect a politician ever to choose consistently the ownership structure that is best for society. Indeed, this will only happen by co-incidence when the planner's preferences align with social preferences. In these models, the role of policy advice is minimal, since the malevolent planner will never act on such advice unless it suits his goals. The role of the economist is reduced to one of observer or apologist.

In this paper we focus on those models which assume a benevolent planner. In

reality government is not benevolent. However, analyzing the actions a benevolent planner would take establishes a benchmark against which we can judge real world policies. Analysis of optimal policy rules is a pre-requisite to critique of government policy on theoretical grounds. Otherwise, how does one tell if government is pursuing bad or good policy?

2.1. Benevolent Planner Literature

The literature in this area is sparse. Only two papers we have found so far, Schmidt (1991) and Laffont and Tirole (1993), explicitly use an incomplete contracts framework to analyze privatization. However, as we will show below, the inability of a planner to write complete contracts with an agent — be they a public sector manager or the owner/manager of a private firm — is the key determinate of the optimal ownership structure. That optimal ownership structures depend on contractual incompleteness is not a new observation. In a seminal paper, Grossman and Hart (1986) show that the optimal ownership structure of a private firm crucially depends on the nature of contractual incompleteness. That such incompleteness is also a key factor in public sector reform, however, is less well recognised. We shall critique the Schmidt and Laffont and Tirole models in some detail. Our criticisms of these papers together with their important insights, will provide the basis for our own analysis.

Schmidt's (1991) model has the following timing. At the beginning of date 1, the manager of the firm makes a non-contractible private investment e which enhances the chance that costs will be low when production takes place. Costs c depend on output and a non-contractible random variable θ realized at the end of date 1. The manager is paid a fixed wage, incurs effort cost from the investment, and receives utility $u(y)$ from production y . Thus, his total payoff in period 2 is $U = w - e + u(y)$. Production generates net benefits (excluding effort cost) of $b(y) - c(y, \theta)$.

The assumed information structure is the crucial difference between private and public ownership in Schmidt's model. Under either ownership structure, the manager, and whoever is the owner, can observe θ when it is realized. However, under private ownership, the government (not being the owner) cannot observe θ . Thus with private ownership, the government must set an optimal regulatory contract which accounts for the private information held by the private parties. Public ownership presents the government with a commitment problem, rather than an information problem. Recall that if the government is the owner, it can observe θ . Schmidt argues that this is problematic because once the state of the world is revealed, the government will choose an ex-post optimal level of production which ignores the sunk investment costs incurred by the manager. The government cannot commit to a regulatory regime ex-ante.

Under public ownership, the government is too soft on the manager if costs are high, and doesn't deliver sufficient reward if costs are low. The result of this

commitment problem is sub-optimal ex-ante effort by the manager. A privatized firm finds itself with a harder budget constraint. The government as regulator cannot observe θ , which allows it to commit to a regulatory regime ex-ante which does reward the manager for her efforts. In summary, public ownership confers benefits in the form of ex-post efficient production, and costs due to insufficient ex-ante managerial effort (often called X-inefficiency). Private ownership, while leading to higher ex-ante effort, is deficient in its delivery of productive efficiency, because the planner cannot observe cost.

Schmidt's analysis explains some key differences often observed between public and private firms. For example, it is commonly argued that the public firm tends to have costs which are too high, because the government forgives bad outcomes. The private firm has lower costs through managerial contracts that better reward ex-ante efforts.

We have some difficulties with the analysis, however. It assumes that ownership confers better information. The argument has two parts. For one, information has to be *produced*. Second, it is the owner who controls the production process because ownership confers the residual rights of control over the variables associated with the production of information. This is not entirely clear. Does ownership confer such residual rights? While some form of manipulation of the information process by the manager is clearly possible, this right is conferred to the *manager*, rather than the owner. This means both owners and government as regulator are not as well informed as the manager. If we put this assumption in the model, ownership should not matter because the government will set the same optimal contract in either case.

If we are analysing owner-managed firms, or those that behave nearly as such, then the assumption of better information seems more reasonable. However, it is clearly true that the government cannot be an owner-manager, unless the benevolent planner himself runs the firm. Therefore, when the government is an owner there is an agency problem because the government cannot observe costs. When the firm is privately owned and managed, there is an equivalent agency problem for the government as regulator. It follows again that there should be no difference between private and public ownership.

The model by Laffont and Tirole (1993) is more complex, since it explicitly models the behaviour of shareholders who do not have the manager's private information. The manager knows his own type β , and the effort he puts into cost reduction e . Separately, these are private. Total cost $c = \beta - e$ is observed by outsiders - that is by government and shareholders. The corresponding output is discrete, and yields social value S . The manager makes a non-contractible investment $\tilde{I} \in (0, I)$ in addition to the effort directed at cost reduction. A key assumption is that I delivers a non-contractible private benefit to the manager of D , but that if the investment is redirected towards a public use, it yields non-contractible public benefit $D' > D$.

The timing in the case of public ownership is as follows. The government

chooses an optimal managerial contract based on observed cost. Then, the manager chooses effort at cost $\psi(e)$ and investment \tilde{I} . Costs and output are subsequently realized, and the manager is paid.

Public ownership leads to inefficiency for two reasons. First, because the manager's investment and the subsequent return is non-contractible, the government will always redirect the investment to public use. It follows that the manager will choose $\tilde{I} = 0$. Second, the optimal contract induces managers other than the most efficient type to distort their effort choice, by giving them low-powered incentives. (This is to prevent more efficient types from masquerading as less efficient types).

In the case of private ownership, the planner first sells the assets of the firm. Then the government and the private shareholders *simultaneously* set a regulatory regime, and a managerial contract (respectively). The government is assumed not to be able to observe the manager's private remuneration. Next, the manager chooses his effort and investment levels. Finally production and costs are realized, and payments are made.

The key source of inefficiency in the private case comes from the two principals setting contracts that influence the manager's incentives. Effort is therefore lower than under public ownership. This inefficiency would make public ownership superior to private ownership if that was the end of the story. However, Laffont and Tirole argue that the private owners, since they do not capture the public benefit of D' , do not have an incentive to hold up the manager's investment \tilde{I} . Thus, the manager will choose investment $\tilde{I} = I$.

The model's main innovation is to point out the effect multi-principal arrangements can have on a private firm. We have sympathy with this view, since it seems to accord with what we observe in practice. The question does arise, however, as to why the government cannot retain the right to set the manager's contract, just as it retains the right to regulate other variables such as price, output, and rate of return. If in their model the government has the right to set managerial compensation, the private owners would still receive a return on their investment, in a similar fashion to bond holders. Even if it does not set managerial wages directly, if the government can observe the manager's reward, then it can undo the private contract. In either case, the multi-principal situation would also not arise.

In the absence of a multi-principal problem, private and public regimes can be compared only on the basis of the investment \tilde{I} that they induce. Laffont and Tirole argue that the private sector is better able to commit not to expropriate this investment. Therefore, without the multi-principal problem, we might be led to conclude that private ownership is always superior to public ownership. However, the question that remains to be answered is why the private owners, who by definition have the right to sell their assets as they wish, cannot sell the assets associated with the manager's investment to the public sector for an amount up to D' ? If so, then the private manager would not invest. Therefore, if there is no

multi-principal problem, we are indifferent between ownership regimes. However, if there is a multi-principal problem - which will certainly happen if illegal side payments or perks are paid by the owners to the manager - then we always prefer public ownership.

2.2. Summary

The main difficulty that we can see with the current literature, is its lack of robustness to what we feel are reasonable perturbations in assumptions. In Schmidt (1991), if we drop the assumption that ownership confers informational advantages, and replace it with what we feel is a more reasonable assumption that *managers* have informational advantages, then public and private ownership deliver the same level of welfare. In Laffont and Tirole (1993), the assumption that the private owners can commit not to expropriate the manager's non-contractible investment is crucial to endogenizing the choice of ownership structure.

2.3. Agency Problems and Ownership

In this paper we assume that firms, if private, are owner-managed. This is a logical first step in developing a framework which can be applied to a variety of modes of private ownership, such as "public" companies². The model we develop will be directly applicable to owner-managed or closely held companies. It will also approximate situations where any agency problems between private firm owners and managers are relatively small.

Our focus on owner-managed firms ensures that there is a single principal-agent relationship between the government and the relevant decision maker under any ownership structure. With public ownership, the operation of the firm must be delegated to a public sector manager. The planner will attempt to align the manager's interests with those of wider society by setting some form of managerial incentive contract. Beyond this contract, however, the public sector manager has no more or less ownership rights over the capital, land or other assets that embody the value of the company than any other citizen. In particular, all profits arising from the firm's activities must accrue to the government or planner as public owner. The manager can only be rewarded on the basis of such profits to the degree that they can be observed and verified and, thus, form part of his contract.

Under private ownership the planner faces a similar incentive problem. He can write a contract with the *owner-manager* in an attempt to align private and social incentives. This contract is labelled a regulatory regime, whereas under public ownership the contract is called an employment agreement or managerial contract.

While these distinctions are important, the difference between public and private ownership is not the ability of the planner to commit to a specific contract.

²We refer here to publically held companies or those which are floated on the stock exchange.

Rather the difference turns on who is the recipient of those elements of social welfare that are uncontractable, and this depends directly on *ownership*. To be precise, the distinction between a private owner and a public manager is that the former, by virtue of their ownership, is the residual claimant of the company's value. Unlike their public counterpart, the private owner-manager receives profits directly. While the planner can seize such profits through their regulatory regime, they can only do so to the degree that such profits are observable and verifiable. This distinction is our definition of private ownership. Such ownership endows a single right - to receive any profits that are non-contractible.

For privatization to have any meaning, it must be possible for the planner to commit to some kind of economic structure. For example, if the planner can seize all profits, even when these profits may be unverifiable and may not even be realised as cash flows until some indeterminate date in the future, then any so-called private ownership would be chimeric. We assume that the government can create legal or legislative hurdles for itself in order to prevent it from reversing or altering a regime which it initially desires. For example, the government may be able to commit to either a public or a private regime, by adhering to the same laws of contract which constrain citizens.

A theory of private versus public ownership must be able to explain, in a robust way, why the government under one ownership structure cannot replicate the incentives chosen under another. In other words, it must be explained how private ownership leads to an inherently different agency problem compared with public ownership. Our analysis is based on this observation. The manager is the claimant of residual profits under private ownership. The government is the claimant under public ownership. This distinction generates the only difference in incentives between public bureaucrats and private owner-managers in the model. As we show below, it is of sufficient importance to allow us to explain why public ownership may be optimal in some circumstances, and why partial or full private ownership may be optimal in others.

3. A Simple Model of Private vs Public Ownership

3.1. Basic Framework

Consider a manager who oversees production of an output which generates pure profits π , and non-profit social surplus s . Non-profit social surplus consists of consumers' surplus from the purchase of the product and any externalities which may be generated by production. For example, consider a manager who oversees water distribution to a community. Profits are generated from sales of water to households less input costs. Social surplus is the consumer's surplus from water usage, the reliability of the service that the company provides (for example the water pressure), and the quality of the water in terms of its impact on health. Externalities may be generated for example in terms of water diverted from al-

ternative uses and the building of reservoirs which have an impact (positive or negative) on the environment.

The manager has specific skills which enable her to undertake activities as summarized by the non-negative vector e . The personal cost to the manager of choosing e is given by $\psi(e)$. This cost is assumed to be convex and increasing in e . We normalize $\psi(0)$ equal to zero. Both profit and non-profit social surplus depend on the activity vector chosen by the manager. We assume that $\pi(e)$ and $s(e)$ are concave in e and are increasing in at least one element of e . Profit, social surplus and activity cost are twice continuously differentiable. We assume that the vector e is non-contractible.³

Given any ownership regime, the planner chooses a contract $t(\cdot)$ for the manager. The contract will be accepted by the manager if they expect to receive at least their reservation utility. Non-acceptance of the contract by the public manager is equivalent to "quitting". For a private owner-manager, non-acceptance implies a refusal to operate the firm. There is no reason why the reservation utilities need to be identical with different ownership structures. However, the government can always ensure that participation is in the managers best interest by adding an uncontingent payment to $t(\cdot)$. As the planner is indifferent to such transfers, there is no loss of generality in normalising the reservation utility under any ownership structure to zero.

The manager's utility is additively separable in monetary benefits $t(\cdot) + z(\cdot)$, activity cost $\psi(e)$, and personal returns from non-profit social surplus $\gamma(s(e))$. The manager is risk neutral.

$$u(e) = t(\cdot) + z(\cdot) - \psi(e) + \gamma(s(e))$$

The term $z(\cdot)$ refers to benefits which accrue from private ownership. We shall explain this term in detail below. The final term, $\gamma(\cdot)$ allows that the manager may act in an altruistic fashion. In other words, the manager gains utility from "doing the right thing".

Given the contract offered by the planner, the manager will choose the activity vector e to solve

$$\max_e u(e) \quad \text{subject to} \quad u(e) \geq 0$$

The planner is assumed to be benevolent and chooses $t(\cdot)$ to maximize $\pi(e) + s(e) + \gamma(s(e)) - \psi(e)$, subject to the manager's optimal choice of e . Formally, the timing in the model is as follows:

Insert Timing Diagram Here

³We could assume that only some components of e are non-contractible, however these components would be set optimally by the planner, and leaving a residual problem which involved only non-contractible actions.

To allow for the possibility of partial privatization, we assume that the assets in place which produce the output are infinitely divisible, and can be sold off as such. Hence, it is possible to sell to the manager a fraction $z \in (0, 1]$ of the assets, which confers to her an amount $z\pi$ in profits. If assets are not divisible or if uncontractable profits always accrue to a subset of the firm's assets which are not divisible, then $z \in \{0, 1\}$. In this case full private or full public ownership are the only relevant feasible alternatives. This explains the term $z(\cdot)$ introduced above. If the manager owns fraction z of the assets it receives a benefit of $z(\pi) = z\pi$.

As noted above, we assume there are no additional agency problems which arise in a private firm due to a separation of ownership and control.

3.2. Results

3.2.1. Privatization and contractibility

As argued in the literature, for ownership of assets to make any difference, some economic variables must be non-contractible. Proposition 1 explores various configurations of non-contractibility and relates these configurations to the optimal ownership structure and regulatory regime. Both π and s can be non-contractible, or one is contractible and the other is not. It is important to stress what we are trying to argue by assuming magnitudes can be non-contractible. Clearly in practice, some *components* of s and π are contractible and some are not. We would not expect that entire magnitudes are non-contractible. However, the components which are contractible will be included in contracts. Those which are not serve as the residual that we intend to analyze in the proposition below.

Proposition 1

(i) If π is contractible, then the ownership structure is irrelevant. Public ownership with an incentive scheme is equivalent to full or partial private ownership with some form of regulation.

(ii) If s is contractible, and π is non-contractible, then full private ownership with regulation is optimal.

(iii) Suppose both s and π are non-contractible. In addition, assume that assets can only be sold to the private sector in discrete amounts, so that $z \in [0, z_1, \dots, z_m, 1]$, with $z_i \in (0, 1)$, $i = 1, \dots, m$. Then the following regimes may be optimal depending on the functions s , π and ψ : Full public ownership; mixed ownership, and full private ownership.

Proof.

Consider (i). The solution is very straight forward, so we include it for comparison with later parts of the proposition. Let t be the transfer under public ownership, and τ be the transfer under private ownership. If s and π are contractible, then any solution $t^*(s(e), \pi(e))$ to the public problem:

$$\begin{aligned} & \max_t s(e) + \pi(e) - \psi(e) \\ & \text{subject to} \\ & e = \arg \max \gamma(s(e)) + t(s(e), \pi(e)) - \psi(e) \\ & \gamma(s(e)) + t(s(e), \pi(e)) - \psi(e) \geq 0 \end{aligned}$$

can be implemented in the private problem:

$$\begin{aligned} & \max_{\tau} s(e) + \pi(e) - \psi(e) \\ & \text{subject to} \\ & e = \arg \max \gamma(s(e)) + z\pi(e) + \tau(s(e), \pi(e)) - \psi(e) \\ & \gamma(s(e)) + z\pi(e) + t(s(e), \pi(e)) - \psi(e) \geq 0 \end{aligned}$$

by setting $\tau = t^* - z\pi$. Conversely, any solution τ^* to the private problem can be implemented in the public problem by setting $t = \tau^* + z\pi$. Note that the first-best is clearly attainable by setting $t = s - \gamma(s) + \pi$. If s is non-contractible, then the same argument as above can be made, but the transfer functions depend only on π .

Consider (ii). Private ownership is the only means by which the manager can be made to benefit from profit-enhancing actions. In the private problem, give full ownership to the private firm by setting $z = 1$, and regulate with transfer $\tau = s - \gamma(s) - k$, where k is some constant. The reason this cannot be replicated in the public problem is that the manager does not receive the return π ; this can only be done through private ownership.

To prove (iii) it suffices to present special cases where each of these regimes is optimal.

(1) $z = 1$ is optimal

Assume that e can be partitioned into subvectors e^1 and e^2 such that $s = s(e^1)$ and $\pi = \pi(e^2)$. Also, suppose that the dis-utility of effort is of the form $\psi = \alpha \sum_{i=1}^n e_i$, where $\alpha > 0$. Both the planner's problem and the manager's problem can be partitioned into separate maximization problems, one which focuses on "social" elements of effort e^1 and the other which involves profit related elements e^2 . The manager will have insufficient incentives to choose the first-best level of e^1 under either private or public ownership. This follows because her objective function for the social sub-problem is $\gamma(s(e^1)) - \alpha \sum_{i=1}^n e_i^1$, with $e^1 \geq 0$ (under both regimes) and the planner's objective function is $s(e^1) - \alpha \sum_{i=1}^n e_i^1$, with $e^1 \geq 0$. For the profit sub-problem under partial privatization, the manager's objective function is $z\pi(e^2) - \alpha \sum_{i=1}^n e_i^2$, with $e^2 \geq 0$. With the social sub-problem the planner's objective is $\pi(e^2) - \alpha \sum_{i=1}^n e_i^2$, with $e^2 \geq 0$. Clearly, setting $z = 1$ is optimal for the profit sub-problem, and does not affect the social sub-problem, so that full privatization is optimal.

(2) $z = 0$ is optimal

We make the following assumptions:

- (a) There are two types of (scalar) effort e_1 and e_2 .
- (b) Non profit social surplus is separable: $s(e_1, e_2) = s(e_1) - \sigma e_2$, with $s'(e_1) > 0$, and σ a positive constant.
- (c) Profits depend only on e^2 : $\pi = \pi(e_2)$, with $\pi'(e_2) < 0$.
- (d) Effort is linear: $\psi(e_1, e_2) = \alpha(e_1 + e_2)$.
- (e) The manager gets utility $\gamma(s(e_1) - \sigma e_2)$ from social surplus, where γ is a positive constant.

The Planner's first-best problem under these assumptions is

$$\begin{aligned} \max \quad & s(e_1) - \sigma e_2 + \pi(e_2) - \alpha(e_1 + e_2) \\ \text{Subject to} \quad & \\ & e_1 \geq 0 \quad e_2 \geq 0 \end{aligned}$$

The Kuhn-Tucker conditions for this problem are

$$\begin{aligned} s'(e_1) - \alpha - \delta_1 &\leq 0, \quad e_1(s'(e_1) - \alpha) = 0, \quad \delta_1 e_1 = 0 \\ -\sigma + \pi'(e_2) - \alpha + \delta_2 &\leq 0, \quad e_2(-\sigma + \pi'(e_2) - \alpha), \quad \lambda \delta_2 e_2 = 0 \end{aligned}$$

To construct an example where public ownership is optimal, we shall suppose that it is optimal in the first-best. Thus, we assume that $-\sigma + \pi'(0) - \alpha < 0$, which is sufficient to make $e_2 = 0$ optimal. We show below that there are feasible assumptions which lead the manager to choose $e_2 > 0$ whenever $z \geq z_0$. It will follow that any degree of privatization is therefore sub-optimal.

The manager's problem with partial privatization is:

$$\begin{aligned} \max_{e_1, e_2} \quad & \gamma(s(e_1) - \sigma e_2) + z\pi(e_2) - \alpha(e_1 + e_2) \\ \text{subject to} \quad & \\ & e_1 \geq 0, \quad e_2 \geq 0 \end{aligned}$$

The Kuhn-Tucker conditions are as follows:

$$\begin{aligned} \gamma s'(e_1) - \alpha - \lambda_1 &\leq 0, \quad e_1(\gamma s'(e_1) - \alpha) = 0, \quad \lambda_1 e_1 = 0 \\ -\gamma\sigma + z\pi'(e_2) - \alpha + \lambda_2 &\leq 0, \quad e_2(-\gamma\sigma + z\pi'(e_2) - \alpha), \quad \lambda_2 e_2 = 0 \end{aligned}$$

Comparing the planner's and manager's Kuhn-Tucker conditions, notice that e_1 as chosen by the manager will generally be too low, but any change in z has no effect on e_1 . Thus we can consider the impact of changes in z on e_2 , independently of e_1 . Suppose that $-\gamma\sigma + z_0\pi'(0) - \alpha > 0$. (Recall that z_0 is the lowest feasible level of asset ownership under partial privatization). From the properties of π , it follows that there exists $e_2 > 0$, with $-\gamma\sigma + z_0\pi'(e_2) - \alpha = 0$, and the Kuhn-Tucker conditions will yield a positive level of e_2 . Thus $z = 0$ is optimal

(3) $z \in \{z_0, z_1, \dots, z_m\}$ is optimal

Consider the planner's first-best problem, and suppose that some level $e_2^* > 0$ is optimal, i.e. $\pi'(e_2^*) = \sigma + \alpha$. Note that we are implicitly assuming that $\lim_{e_2 \rightarrow \infty} \pi'(e_2) < \sigma + \alpha < \pi'(0)$. Consider the manager's problem. Assuming $\lim_{e_2 \rightarrow \infty} \pi'(e_2) < \alpha + \gamma\sigma$, and $\pi'(0) > \sigma + \alpha > \frac{\alpha + \gamma\sigma}{z_m}$, there exists a level $e_2' > e_2^*$, which satisfies $z_m \pi'(e_2') = \alpha + \gamma\sigma$. Clearly then, setting $z = 1$ in the manager's problem yields will yield an effort level greater than e_2' , and cannot be optimal. Moreover, setting $z = 0$ yields $e_2' = 0$ which is dominated by any value $e_2 \in (0, e_2^*)$. We can easily induce the manager to choose effort in this interval, provided there is some level of privatization $z_k \in \{z_0, \dots, z_{m-1}\}$, with $\pi'(0) > \frac{\alpha + \gamma\sigma}{z_k} \geq \sigma + \alpha$. QED

3.2.2. Interpretation

Proposition 1 is straightforward to explain intuitively. Consider part (i). First, if all components of social surplus and profits are contractible, ownership does not matter, since under any regime it is possible to obtain the first best through some contract. As previously mentioned, this is not a new result. The other results are new, however. If pure profits are contractible, but social surplus is not, then again ownership does not matter. This is because the manager's actions can be equally well controlled in the public and the private ownership regimes through a contract based on pure profits. The fact that social surplus is not contractible has no impact on the choice of ownership, because it is equally disadvantageous under either regime.

If social surplus is contractible, and pure profits are not, then full privatization is optimal. The private owner's impact on social surplus can always be controlled by regulations based on social surplus. However, the public manager cannot be given an incentive to increase pure profits unless she owns some of the assets. Ownership confers a return which cannot be contracted upon, and consequently gives her an incentive to choose efforts associated with those assets which can increase her payoff.

3.2.3. The non-contractibility assumption

The assumption that both profits and non-profit social surplus are non-contractible, and that there are actions which managers can take which also cannot be contracted upon, allows for the possibility that there are particular cases where any given ownership structure is optimal. Therefore, it is worth examining in detail why we think these magnitudes can be non-contractible in practice. We do this below, as well as outlining the cases which lead to each of the various ownership regimes.

Consider non-profit social surplus. As mentioned, we think of social surplus as the value of consumer's surplus from the product, plus surplus from externalities generated by the manager's efforts. Any student of empirical economics who has tried to estimate consumer's surplus with any accuracy will realize that it

is a difficult task. There are also a variety of opinions on how to define this magnitude. It seems reasonable to assume that magnitudes which are difficult to define and measure are not likely to be readily contractible. This is particularly pertinent, remembering that contractibility means these magnitudes potentially have to be used as evidence in court.

The justification that profits can be non-contractible is more subtle. It is true that economic profits are also difficult to define and measure. Indeed, the book value of a firm is likely to be inaccurate, and reflect factors based on accounting practice rather than economic principles⁴. In the model above we have assumed that there are no signals of profit that the planner can rely on. In the case of a publicly owned firm, this amounts to an assumption that there is no accounting system available which is not perfectly and costlessly manipulable by the manager. Even if there is no reliable accounting system, one may ask why firm value could not be determined in a market. Clearly, market valuation is not possible in the case of a publicly owned firm, because by definition it is not sold to the private sector⁵. However, market valuation is possible in the case of a private firm. Thus we are implicitly assuming that this form of valuation is perfectly and costlessly manipulable, and therefore useless as a variable to include in a contract. For example, if the planner set a contract which was positively related to the realized sale value of a company, then the owner could inflate this value and make side-payments to the purchaser⁶. We relax the assumption of perfect and costless manipulation of signals of profit in our analysis of corporatization below.

There are also a variety of actions that managers can take which cannot be written in a legally enforceable way in a contract. Managers of regulated private firms can take a variety of actions which may be profit enhancing and inimical to social surplus, but which are not easily proscribed. For example, in a situation with two competing regulated telephone companies, one may charge the other exorbitant access fees by overstating the costs of access. The regulators can face a difficult time in court to prove that fees were too high. Similarly, when price caps are being set, a regulated firm has an incentive to take actions such as manipulation of accounting data, in order that the caps are set high. Other examples include any actions which firms can take which are anti-competitive, for example those which deter entry, or encourage collusion. These efforts are difficult to eliminate, since anti-trust court cases are costly, and the outcomes are

⁴See the paper by Fisher and McGowan AER March 1983 Vol 73 No. 1. "On the Misuse of Accounting Rates of Return to Infer Monopoly Profits", for a discussion of the difficulties of measuring profits.

⁵It is also not credible for the government to attempt to sell it just to get a signal of value.

⁶The reverse problem is true in India, where private parties understate the value of property when sold in order to avoid government transfer tax. Side payments make up the difference when property is transferred. Hart (1991) p143 makes an analogous assumption concerning managerial contracts.

not always predictable. A well publicized example of this is where British Telecom used the legal system to delay the entry of its competitor Mercury by four years.⁷ Still further examples of non-contractible efforts include those directed towards meeting environmental standards.

Managers of publicly owned companies have an equivalent set of undesirable actions which they can take. The common complaint against public firms is that service is poor, and staff are apathetic. Thus it seems likely that profit enhancing services are neglected in these companies, probably because these efforts are hard to observe. Other complaints include claims that public sector companies are slow at adopting new technology. Effort in choosing new technologies is likely to be a difficult variable to contract upon. There are likely to be numerous other examples.

The main point of these examples is that non-contractibility of these variables exists. As proposition 1 states, this can lead to a variety of ownership structures being optimal. It is instructive to think about the examples that were generated to prove part (iii) of the proposition. To find a case where public ownership is optimal, we came up with an example where efforts which generate profits were inimical to social surplus, and were bad enough to outweigh the positive impact of the profits themselves. We could imagine a manager who can undertake two types of effort. One is to find innovative ways around regulation which enhance profits and reduces social surplus, and the other is to undertake research into ways which will help it reduce pollution below current levels. A private firm will not undertake the latter type of effort unless it receives a return for this (and we assume for the sake of argument here that any such return is very small). Moreover, the first kind of effort increases profits at the expense of social surplus. If this impact is high enough, we will do better keeping the firm in the public sector.

To show that full private ownership can be optimal, we generated an example where there were no effort variables which affected profits but which were inimical to non-profit social surplus. A generalization of this idea is that pure profit related variables have a small effect on non-profit social surplus. In such a situation, private ownership is optimal for two reasons. One is that profits are enhanced for incentive reasons by making the manager the residual claimant of these flows. The other is that little or no harm can be done to social surplus. For reasons such as this there would seem little point in having public ownership of a firm in a competitive industry. Indeed, such ownership would remove profit incentives for little gain in non-profit social surplus.

Partial privatization is a case intermediate between the above two. It is optimal when some profit enhancing actions are beneficial, but where rewards which are too high at the margin to the manager lead to socially undesirable outcomes. Thus, for example, we may wish to partially privatize a firm to increase incen-

⁷See Armstrong, Cowan and Vickers 1994.

tives to provide better service. However, full privatization focuses the manager too much on profits, and the result could be an increase in the frequency of actions which deter entry.

4. Partial Privatization, regulation and reform

The analysis presented in section 3 assumed that s and π either were or were not contractible. It may be possible, however, for either of these variables to be imperfectly contractible. In particular, there may exist imperfect measures of profit which are both observable and verifiable. If such measures exist, then they can be included in the contract $t(\cdot)$.

The use of proxy measures for profit is a common element of both regulation and public sector reform. For example, common regulatory regimes for private firms, such as rate-of-return or price cap regulation are often set or tested by comparison to some measure of accounting profits. The accounting rules and conventions that are used to generate these figures, such as "fully distributed costs", mean that accounting profits are often far from reliable indicators of true profits. Similarly, public sector reform often involves implicit or explicit rewards for managers based on measured profit performance. Reform of government business enterprises to emphasise measured profits was a common pre-privatization policy in the UK during the 1980s (Vickers and Yarrow). More generally, profit-oriented reform of public enterprise has been widely pursued in a variety of western countries. In Australia, such reform has been labelled by the highly ambiguous title of "corporatization". In this section we consider the effect of including a proxy measure for profits in the managerial contract.

Assume that a proxy for current profits, A , is both observable and verifiable. We can think of this proxy, for example, as accounting profits that are able to be verified by audit and depend, in part, on accounting laws and conventions. The adequacy of A as a proxy for profits will depend both on the relationship between A and π and the nature of the optimal contract.

Consider, for example, that $A = f(\pi)$ where $f(\cdot)$ is a one-to-one function so that the inverse function f^{-1} is well defined and one-to-one. Then A provides a perfect proxy for π in the managerial contract. The contract $t(\cdot, \pi)$ which would be (constrained) optimal if π were observable is simply replaced by $t(\cdot, f^{-1}(A))$. Similarly, consider $A = f(\pi) + \varepsilon$ where ε is random variable of mean zero. If the optimal contract with profits contractible is linear in π , then A can again be used as a perfect proxy as the manager is risk neutral.

In general, A will not be a perfect proxy for profits. A significant reason for this is that measures, such as accounting profits, may be subject to manipulation. If the manager's contract depends upon A then she will have an incentive to try and manipulate A in a favourable way. Such manipulation has been thoroughly researched for private firms, particularly for contracts which use short-term share

prices as a proxy for managerial value added (REF). However, they can equally be abused by public or private-regulated firms. The well known "Averch-Johnson" effect is an example of manipulation of rate-of-return regulation (REF).

To allow for imperfect contractibility and manipulation, assume that an imperfect proxy A of profits is contractible and that the manager can devote some effort, e_A to distorting this proxy. The manager's total action vector is given by (e, e_A) with associated utility cost $\psi(e, e_A)$. As before, $\psi(\cdot, \cdot)$ is convex and increasing in e and e_A .

Manipulating the proxy variable A will not involve a direct social cost. Both profit and non-profit social surplus are unaffected by e_A . However, such manipulation will have two undesirable effects. First, to the degree that manipulating A undermines the incentives contained in any managerial contract, the social planner will have to anticipate and compensate for any distortion when devising an optimal contract. The greater the ability to distort A , the less the social planner can rely on this proxy as a measure of profits. Second, if the manager faces a contract where her payments depend upon A , then she is likely to spend time and effort manipulating this proxy. Such effort is purely wasteful from a social viewpoint.

Formally, let $A = \pi(e) + h(e_A)$. A is either increasing or decreasing in e_A depending upon which way the manager wishes to distort accounting profits. This will depend upon whether the manager is "rewarded" or "punished" for reporting a higher value of A . If $h' > 0$ then $h'' < 0$. If $h' < 0$ then $h'' > 0$.

We can now examine the effect of A on the government's privatization decision. If neither s nor π are contractible, what mix of privatization and incentives based on A will be socially optimal? Consider that the government has sold a fraction z of the firm to a private owner/manager and sets a regulatory contract to the manager given by $k + t(A)$. We will restrict our analysis to those contracts which are twice continuously differentiable. The manager's utility is given by $u(e, e_A) = t(A) + z\pi + \gamma(s) - \psi(e, e_A)$. The manager will choose e and e_A to maximise her expected utility. Denoting each element of e by e_i , this gives first order conditions:

$$\left[\frac{\partial t}{\partial A} + z \right] \frac{\partial \pi}{\partial e_i} + \gamma' \frac{\partial s}{\partial e_i} \leq \frac{\partial \psi}{\partial e_i} \quad \left(= \frac{\partial \psi}{\partial e_i} \text{ if } e_i > 0 \right) \quad (4.1)$$

$$\frac{\partial t}{\partial A} h' \leq \frac{\partial \psi}{\partial e_A} \quad \left(= \frac{\partial \psi}{\partial e_A} \text{ if } e_A > 0 \right) \quad (4.2)$$

Note that the contract only influences the manager's behaviour to the extent that it effects the $\partial t / \partial A$. Thus, any effort vector (e, e_A) that can be implemented by a general contract $k + t(A)$ will also be a solution of the manager's problem for some linear contract $k + tA$. Consequently, for the rest of this section we will, without loss of generality, limit the discussion to linear contracts.

With linear contracts, the owner/manager's first order conditions become:

$$[t + z] \frac{\partial \pi}{\partial e_i} + \gamma' \frac{\partial s}{\partial e_i} \leq \frac{\partial \psi}{\partial e_i} \quad (= \frac{\partial \psi}{\partial e_i} \text{ if } e_i > 0) \quad (4.3)$$

$$th' \leq \frac{\partial \psi}{\partial e_A} \quad (= \frac{\partial \psi}{\partial e_A} \text{ if } e_A > 0) \quad (4.4)$$

The government will set z and t subject to these constraints on managerial behaviour and any constraint imposed by the manager's alternative options. As the government is indifferent to transfers we can consider that such outside options are dealt with simply by altering k and concentrate on the incentive effects of z and t .

The government will set z and t to solve:

$$\max_{z,t} W(t, z) = S + \pi + \gamma(S) - \psi(e, e_A)$$

subject to (4.3) and (4.4). Let the solution to this problem be denoted by z^* and t^* . If $z^* > 0$ then the optimal policy involves at least partial privatization. If the government sets $z^* = 0$ but $t^* > 0$ then the optimal policy is public sector reform or "corporatization". If $z^* = 1$ with $t^* < 0$ then the optimal policy is complete private ownership subject to profit-based regulation.

Consider two alternative restrictions on managerial utility:

Restrictions on managerial utility

(1) The disutility of effort is additively separable in e and e_A ; i.e. $\psi(e, e_A) = \psi_1(e) + \psi_2(e_A)$.

(2) $\psi(e, e_A) = \psi(e_A + \sum_i e_i)$ and $\gamma(S)$ is constant for all values of S .

Under restriction (1), the disutility associated manipulating A has no cross effects with other effort variables. For example the disutility of effort could be constant for each of e_A and e_i . With restriction (2), the manager's disutility of effort only depends upon the sum of the individual effort levels. The manager also does not gain any incremental utility from raising non-profit social surplus. While these restrictions on the disutility of effort, particularly restriction (2), may be considered relatively standard, we will show how they imply that partial privatization dominates either public sector reform or profit-based regulation of private firms.

4.1. Partial privatization and public sector reform

Consider a government deciding whether to partially privatize a public utility, or to retain it in the public sector with a reform program based on A .

Proposition 4.1. *Under either restriction (1) or (2) it is never optimal for the government to set $z = 0$ and $t > 0$.*

Proof: First, assume that the manager has additively separable utility in e and e_A . Note that this means that the system of equations (4.3) solve for e independently of e_A while (4.4) solves for e_A .

Consider that the government has set $z = 0$ and $t^* > 0$. Now, consider the alternative ownership structure with $\tilde{z} = \min(t^*, 1)$ and $\tilde{t} = \max(0, t^* - 1)$. Note that from equations 4.3, e is unchanged under \tilde{z} and \tilde{t} compared with the original z and t , but from equation 4.2 e_A will be diminished. As social welfare is strictly decreasing in e_A this implies that the structure \tilde{z} and \tilde{t} is strictly preferred by the government to the original values of z and t so that these values could not have been optimal.

Second, consider that the manager may have an increasing disutility in the sum of actions but that $\gamma(S)$ is constant for all S . Note that (4.3) can be written as:

$$\frac{\partial \pi}{\partial e_i} = \frac{\psi'(e_A + \sum_i e_i)}{t + z} \quad \text{for all } e_i > 0 \quad (4.5)$$

Let $z=0$ and denote the optimal contract and effort values for the government by t^* , e_i^* and e_A^* . Given e_i^* , note that the left-hand-side of (4.5) is constant for all i and that the right-hand-sides are continuous and increasing in e_A and continuous and decreasing in $(t + z)$. Thus, the equation

$$\psi'(e_A + \sum_i e_i^*) / (t + z) = K \quad (4.6)$$

where K is a positive constant, implicitly defines a continuous function $e_A(t + z)$ with $\partial e_A / \partial [t + z] > 0$. Now, consider $e_A = 0$. By (4.6), there will be a value of $(t + z) \in (0, t^*]$ associated with this value of e_A which supports e_i^* for all i . Further by (4.4), $e_A = 0$ is consistent with $t = 0$. Hence, there exists a value of $\tilde{z} > 0$ which supports e_i^* for all i with $e_A = 0$ and $t = 0$, so that social welfare is increased relative to $t = t^*$ and $z = 0$. If $\tilde{z} \leq 1$ we are finished. If not, but $t = \tilde{z} - 1$ and $(t + z) = \tilde{z}$ satisfy (4.4) for $e_A = 0$ then we are done.

If neither of these conditions hold, then consider the function $e_A(t+1)$ defined by (4.4) when $z = 1$, and $e_i = e_i^*$ for all i . This function is continuous with $e_A > 0$ for $t = \tilde{z} - 1$ and $e_A < e_A^*$ for $t = t^* - 1$. The implicit function $e_A(t+1)$ defined by (4.6) is also continuous with $e_A = 0$ for $t = \tilde{z} - 1$ and $e_A = e_A^*$ for $t = t^* - 1$. By continuity, there must exist a \hat{t} such that $z + t = 1 + \hat{t}$ simultaneously satisfies (4.4) and (4.6) with $e_A < e_A^*$. Thus, privatization with $z = 1$ and $t = \hat{t}$ is socially preferred to $z = 0$ and $t = t^*$. \square

Proposition 4.1 shows that, under either restriction (1) or (2), the government will always prefer to at least partially privatize an organisation rather than to maintain public sector ownership and use managerial incentive contracts. It shows how manipulation of the profit proxy and other managerial actions need to interact if, in contrast, public sector reform is to be preferred. In particular, for corporatization to be desirable it must be the case that the act of manipulating A produces a socially desirable spillover by altering the marginal disutility of other

managerial activities. In other words, the social planner must prefer the manager to engage in some wasteful manipulation rather than have them engage in activities that raise profits but, overall, are socially detrimental. A simple example of this is presented below.

Example 4.2. Consider that there are three actions, e_1 , e_2 and e_A and $\gamma(s) = 0$. Let $s = s(e_1)$ with $s' < 0$. Let $\pi = f(e_1) + f(e_2)$ and $A = \pi + f(e_A)$ with $f(0) = 0$ and all partial derivatives positive. Assume that $s(x) + \pi(x, x) < s(0) + \pi(0, 0)$ for any $e_1 = e_2 = x > 0$. Finally, let $\psi = e_1 + e_2 + 0.5e_A + g(e_A, e_1)$, where $g(0, \cdot) = g(\cdot, 0) = 0$ and $\frac{\partial g(0, \cdot)}{\partial e_A} = \frac{\partial g(\cdot, 0)}{\partial e_1} = G$ where G is an arbitrarily large positive number.

If $t = 0$ then by increasing z the manager will always set $e_1 = e_2$ and $e_A = 0$. But by our assumptions the optimal solution for the planner in this case is $z = 0$. Conversely, let $z = 0$ and consider increasing t . For G sufficiently high, it will never pay the manager to set both e_A and e_1 positive. However, both variables have the same effect on accounting profits (when the other is set to zero) while the marginal disutility of e_A is always lower. Hence the manager will set $e_1 = 0$ and e_A and e_1 positive in general when $t > 0$. Further, if $\frac{\partial \pi(0, 0)}{\partial e_1}$ is sufficiently large, the planner will always prefer $t > 0$ rather than $t = 0$.

Example 4.2 shows how the cross effects of managerial effort must interact in order for public sector reform without at least partial privatisation to be optimal. The reform program will lead the manager to expend effort on manipulating the proxy variable for profits. For example, if the manager is rewarded according to the measured rate of return, then she will try to raise the measured rate relative to the true rate. Such effort is generally socially wasteful, but may be desirable if it leads the manager to disproportionately reduce the effort they expend on activities that will raise true profits but are overall socially harmful. In other words, the government will favour public sector reform only if the manipulation of measured profits has desirable crowding out effects on other effort variables.

The relevance of restrictions (1) and (2) are clear. Under restriction (1), there is no crowding out between e_A and other effort variables, so that partial privatisation is always preferred. Under restriction (2) crowding out occurs, but is "proportionate" over all activities so that a preferred outcome can be achieved by moving to lower powered but direct incentives on profits.

4.2. Partial privatisation and profit based regulation

The proxy profit A may also be used as part of a regulatory regime by the government. The government could privatise the firm completely subject to a regulatory regime that "punishes" the owner/manager as A increases. Such regulation would create incentives to reduce A relative to the true level of profits. The result presented in proposition 4.1, however, can easily be extended to cover this situation.

Corollary to proposition 4.1. *Under either restriction (1) or (2) it is never optimal for the government to set $z = 1$ and $t \in [-1, 0)$.*

Proof: This follows directly from the proof of proposition 4.1, remembering that if $t < 0$ then $h' < 0$. \square

The logic behind this corollary is identical to that for proposition 4.1. Regulation based on a proxy for profits will lead to wasteful effort. Such effort is only desirable if it leads to a disproportionate decrease in some other effort variable which is socially undesirable. In other words, regulation is only desirable if, from a social viewpoint, we prefer the owner/manager to spend time manipulating the regulation rather than doing something else.

4.3. The limitations of partial privatisation

The results presented above suggest that, under certain restrictions on the managers effort cost function, direct profit incentives through partial privatisation dominate indirect incentives involving contracts based on A . Conversely, the government should only use incentives based on imperfect and manipulable measures of profits if, in fact, manipulation is socially desirable due to cross-effects between managerial activities.

Both public sector reform and manipulable regulation of private companies are common managerial tools. In fact, these modes of reform appear far more wide spread than partial privatisation. Where it has been used in countries like the UK and Australia, partial privatisation has been a temporary reform as part of an ongoing change in ownership. For example (FILL IN). In contrast, both public sector reform and regulated private ownership are common structures in the US, Europe and Australia.

These empirical facts do not appear to accord with the analysis above. This may reflect that restrictions (1) and (2) are unrealistic and that cross effects between effort expenditure on manipulating A and undesirable profit enhancing activities are large. Perhaps more reasonably, the wide spread use of proxy measures of profit in controlling both public and private sector managerial behaviour, may reflect the impracticality of partial privatisation. Our assumption, that the non-contractible elements of profits can be divided between the government and the manager by selling a share of the firm to the manager, may be false. Rather, it may be impossible to prevent one of the owners from seizing some or all of these profits.

To see this, consider that a firm is 51% privately owned. In the analysis above, this implied that the private owner/manager received 51% of the uncontractable profits. However, these profits will often only be realisable if some or all of the assets of the firm are sold. By maintaining a controlling interest in the firm, the owner/manager may be able to manipulate any asset sales to reap most if not all of these profits. For example, it may be possible for the manager to divide the firm and sell off a division below its true value to a holding company which she

fully owns. The manager could then resell the division as a separate company and seize all the profits associated with the asset sale.

Alternatively, even though the manager owns a majority share of the firm, it may be impossible to realise the uncontractable profits due to the threat of government intervention. The government may be able to block any sale or limit the pool of buyers. While such interference could occur with a fully private firm, it may be easier to override the majority shareholder when the government itself is also a part owner.

If partial privatisation does not enable a continuous division of the non-contractible profits then optimal policy may involve incentive contracts based on A even when restriction (1) or (2) holds.

Example 4.3. Consider that partial privatisation is infeasible so that $z = 0$ or $z = 1$. The manager has only one profit relevant activity e where $\pi = e$ and $s = -\alpha e$. There is a manipulable proxy for profits A , where $A = \pi + \beta e_A$ if $t > 0$ and $A = \pi - \beta e_A$ if $t < 0$. $\psi = e^2 + e_A^2$ and satisfies restriction (1). $\gamma = 0$ for all s . If partial privatisation was possible then a first-best result could be achieved by setting $z = 1 - \alpha$.

If $z = 0$ with $t \geq 0$ the manager will choose e and e_A to maximise $te + \beta te_A - e^2 - e_A^2$. The optimal activity choices for the manager are given by $e = \frac{t}{2}$ and $e_A = \frac{\beta t}{2}$. Substitution into the social planner's problem then leads to optimal values of t and total welfare given by

$$t^*(0) = \frac{1 - \alpha}{1 + \beta^2} \quad w^*(0) = \frac{(1 - \alpha)^2}{4(1 + \beta^2)}$$

If $z = 1$ with $t \leq 0$ the owner/manager's objective is given by $(1 + t)e - \beta te_A - e^2 - e_A^2$. The optimal activity levels are given by $e = \frac{1+t}{2}$ and $e_A = \frac{-\beta t}{2}$. Substitution into the social planner's problem leads to optimal values of t and w given by

$$t^*(1) = \frac{-\alpha}{1 + \beta^2} \quad w^*(1) = \frac{1 - 2\alpha}{4} + \frac{\alpha^2}{4(1 + \beta^2)}$$

To determine the optimal ownership structure, note that

$$w^*(1) - w^*(0) = \frac{\beta^2}{4(1 + \beta^2)} [1 - 2\alpha]$$

Consequently, the optimal ownership structure only depends on α with privatisation subject to regulation optimal if $\alpha < 0.5$, public ownership with managerial incentive contracts based on A if $\alpha > 0.5$ and indifference if $\alpha = 0.5$. In other words as the undesirable "spillover" effects of profit enhancing activities rise, the government will move from regulated private to public ownership.

While the correct ownership structure only depends upon α , the relative importance of that structure depends on both α and β . If β is large then both the

relative loss due to the inability to partially privatise and the potential cost due to a suboptimal ownership choice will rise. For example, if $\alpha = 0.2$ so that the spillover effect is relatively small, then the first-best welfare is 0.32. Privatisation is the second-best alternative. If $\beta = 0.3$ then welfare under privatisation is 0.16. Under public ownership welfare is 0.15. If, however, $\beta = 0.9$ then welfare under privatisation falls only slightly but under public ownership welfare falls to 0.09. Similarly, if $\alpha = 0.8$, first-best welfare is 0.02. Public ownership is the preferred choice with constrained z . If $\beta = 0.2$ public ownership leads to welfare of 0.0096 while welfare with privatisation is 0.0038. If $\beta = 0.8$ these figures change to 0.0061 and -0.052 respectively.

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