



**TOPIC K3**  
ROLE OF GOVERNMENT

## **ROAD SECTOR ORGANISATION ISSUES IN AN ASYMMETRIC INFORMATION FRAMEWORK**

**GUNNAR LINDBERG**

Centre for Research in Transportation and Society  
Högskolan Dalarna  
781 88 Borlänge, SWEDEN

**JAN-ERIC NILSSON**

Centre for Research in Transportation and Society  
Högskolan Dalarna  
781 88 Borlänge, SWEDEN

### **Abstract**

Organisation of road maintenance in Sweden is under radical restructuring. Previously, the National Road Administration has had its own resources to perform the activities but today maintenance is increasingly procured on competitive terms. A special feature of the contracts signed with an entrepreneur is that they comprise all activities to meet a pre-set level of standard within the maintenance district in question.

## **INTRODUCTION**

Over the years there has been a persistent while not always fertile debate over different ways to organise road sector activities. The World Bank has for several years discussed the possibility to use different types of earmarking or hypothecation schemes to guarantee that revenue from road use taxation is secured for funding of road sector activities. The road fund concept has also been discussed in the sub-Saharan context, again sponsored by the World Bank (Heggie 1994) and—since a few years—Tanzania has a road fund in operation. Profound reforms of road sector organisation have moreover been completed in New Zealand (Bruzelius 1994).

A less far-reaching type of institutional change has been implemented by the Swedish National Road Administration (*Vägverket* or VV for short). Its road maintenance activities are today provided under the purchaser-provider paradigm. VV's maintenance staff and equipment have been separated from the rest of the organisation and maintenance is increasingly being competitively procured. Firms bid for road maintenance contracts that are awarded to the least-cost bidder. The entrepreneur has to meet a certain quality standard for all roads within a carefully defined district. Which specific maintenance activities that must be performed to meet these standards are decided by the contractor.

The purpose of the present paper is to suggest that analysis of different institutional options, ie different road sector ownership and organisation designs, should be based on asymmetric information types of models; cf. Kreps 1990 for a textbook introduction. As will be demonstrated, modelling institutional choice in this way has very specific implications: When private and public sector officials have access to the same set of information, and given that all information is public knowledge or contractible, private and public institutions should be expected to generate identical results. The preference to one institution over another is therefore related to that institutional structure generates different types of information asymmetries. The specific asymmetries of the road sector that may work to skew performance will be in focus of the paper.

To this end, the next section gives a brief presentation of the Swedish separation of production activities from the task to procure the maintenance jobs. The following section presents the model. It is a recycled version of an asymmetric information model suggested by Shapiro and Willig (1991) adopted for analysis of the choice between public and private involvement in road maintenance. Then model results are applied in order to understand the trade-off between on the one hand the traditional way to handle road maintenance—staff and plant owned by a Road Authority—and on the other hand competitive procurement of the services. The final section concludes.

## **ORGANISING ROAD MAINTENANCE IN SWEDEN**

Sweden has 410,000 km of roads, 25% of which are state-owned, the balance controlled by local municipalities (8%) and private interests (67%; primarily low-density forest roads). 75% of all traffic is on state roads.

The 1988 Transport Policy Act sets out objectives for activities within all modes of transport, including planning of how state roads are to be extended and cared for. A key formulation is that '...people and business in all parts of the country must be offered satisfactory, safe and environment-friendly transport services at lowest possible costs to the society' (Prop. 1987/88:50, p 1). This overriding objective is operationalised in terms of (i) accessibility, (ii) efficiency, (iii) traffic safety, (iv) environmental concerns and (v) regional balance objectives.

On behalf of the government, *Vägverket* handles the state road network. To this end, VV is allocated budget funds via the Ministry of Transport for investment in new, and maintenance of existing roads. Ministry of Finance is decisive in all taxation matters, including taxes and surcharges on road traffic. In 1993/94 the budget for road investment and maintenance was SKr

6.3 and 5.6 billion, respectively; the exchange rate is in mid-1995 about SKr 7/US\$1 and SKr11/GB£1.

Private firms have been used in road construction for many years. In 1993 private enterprise won 75% of the competitively procured investment projects. While single maintenance tasks such as snow clearance have been purchased externally, maintenance at large has been undertaken by internal resources; VV employs staff and owns its own maintenance plant. This way to handle road maintenance will be referred to as the traditional road organisation model.

The 1990s has, however, seen a process aimed at introducing competitive procurement also in road maintenance. In 1992 VV was therefore organisationally separated into the Road Management and the Production Divisions, the former contracting road maintenance to the latter. The intention by Sweden's 1991-1994 non-socialist government was that in 1996 the Production Division would have been transformed so much so that it could be fully corporatised and so that it could bid for jobs in full competition with private firms. In the meantime, a share of the total maintenance volume has been reserved for the Production Division. Privatisation of the Division has been discussed but no final stand taken. The fall 1994 general election meant that Social Democrats came back in government, and the corporatisation and privatisation has been stalled and is waiting for new initiatives.

The Management Division of VV is thus today in charge of transforming the state's universal objectives for infrastructure into operational terms. The particular feature of the contracts is that they establish functional objectives or standards of the road rather than specify which activities that are to be undertaken.

The process is that, first, the Management Division supplies potential bidders with a set of standard requirements with respect to carrying capacity, friction, smoothness, drainage etc. that must be met by the contractor. Secondly, contractors submit their bids. In doing this, each entrepreneur must consider the costs for alternative ways to handle winter and around the year maintenance, methods to care for road-side installations and the road reserve etc. Third, the Management Division evaluates the different bids and awards the contract. Contracts exclude renewal activities such as resurfacing unless separately specified. Ways and means to monitor standard targets are also specified.

## **THE MODEL**

The present section outlines a model for analysis under which circumstances private and public options can be expected to perform better (Shapiro and Willig 1993). The information asymmetries of the problem are defined, including who the Framer is and specification of the social welfare function. The objectives of the archetype Public and Private Enterprises are stated. Cases where the public and private options generate equal outcome are discussed, as are situations where one can be preferred to the other. The possibility of nondiscretionary regulation is introduced and its consequences discussed. The presentation rests heavily on the original paper and no formal proof of results are given.

### **The asymmetric information framework**

Three types of information are required in order to implement an efficiency enhancing maintenance policy. While informed guesses can be made on some of these, knowledge is notoriously unavailable in other cases. And more than that, some parties to the transactions may have the required information while others have not.

Type I information refers to consequences internal to the society of road users plus the provider of road maintenance services. An efficient maintenance policy must be based on information about alternative production technologies and their costs, about geotechnical features of the road network, about the impact of climate on road deterioration, about the composition of use (mix heavy/light traffic), about use-related road wear and so on. Efficiency also requires information

about how road users value shorter travel time and distances, and likely effects for vehicle operating costs of different maintenance strategies.

The information asymmetry comes from that concerned individuals best know their benefits of a change. The official in charge of aggregate benefit calculations knows more about these things than other concerned parties. And the firm in charge of maintenance is best equipped to know the quality of the roads and the costs of different maintenance activities.

Type II information is related to external costs and benefits. Externalities here refers to consequences of road maintenance for others than the party responsible for the maintenance. More salt on the roads is, for instance, good for users' winter safety standards. Salt may, however, be negative for environmental reasons in that gardens etc. adjacent to the road can be spoiled. Externalities also occur because of exhaust emissions and noise emissions of road traffic; to some extent the choice of maintenance strategy may influence these disturbances. Externality information is asymmetric in that appropriate knowledge about benefits or costs is vested with affected individuals or institutions.

Type III information is related to discrepancies between official organisation objectives and the actual spur of individuals' toil. Employees are told to fulfil certain objectives spelled out by their organisation. A private firm takes on personnel to generate profits to owners; public sector organisations may be instructed to maximise social welfare. Single individuals can, however, have interests that not fully comply with those of their employer. A traditional example is the effort put into a certain job which may be lower than what can be reasonable to expect (moral hazard). Another is a manager that has opinions about what is best to himself that differ from what would best achieve the official objective of the organisation. Any such discrepancies between official and individual objectives are, of course, purely private information for the persons concerned.

The above three aspects of asymmetric information cannot easily be held apart. An accountant could not ex post verify that a certain decision was taken because of a certain mix of type one, two and three information. In particular, an official can claim that a particular choice has been made because of certain reasons while other individuals have difficulties in telling whether this is correct or not. As a result it may be hard to enforce accountability. Since relevant information is not publicly available, decisions on resource use may be inferior to the full information case. But there may be ways to influence decisionmaking by choosing that way to organise activities that is most beneficial to society.

### **The framer and the social welfare function**

The Framer is responsible for designing the institutional structure of a society, including the appropriate way to handle road sector activities. This Framer is something more than the sitting government; we can think of her as the group of people designing the country's constitution. Her objective is to organise matters in a way that maximise expected social welfare ( $W$ ).

To specify what this means in a road sector application, consider the following framework. Road maintenance activities are represented as  $x$ . Maintenance activities generate costs  $C(x)$ . To capture the information asymmetry aspect of the cost function, let  $\theta$  denote private information about relevant cost parameters;  $C(x, \theta)$ . Assume for instance that  $\theta = \{B, G\}$ .  $C(x, \theta)$  then means that under condition (B)—the road network is in bad shape—projected costs to meet targeted standards are high and under good (G) conditions they are low. The enterprise has lower costs to meet a target standard if the road is of good initial quality. It is thus assumed that  $C_{\theta} < 0$ . It is also assumed that  $C_{x, \theta} < 0$  at all  $x$  and  $\theta$ , meaning that the marginal cost of increasing the activity level is lower when the external conditions are better.

To maximise social welfare the Framer wants to trade off social benefits ( $S$ ) against the maintenance costs.

$$W = S(x, \psi) - kC(x, \theta) \quad (1)$$

The benefits of alternative maintenance strategies is found by estimating type I and type II information as defined above, and symbolised by  $\psi$ ; which are the direct (vehicle operating and

time costs for road users etc.) and indirect (externality) effects of different maintenance strategies and their concomitant road standard levels. Benefits are related to maintenance costs augmented by  $k \geq 1$  to capture the dead-weight losses related to tax funding. Equalising marginal benefits and costs indicates the optimal maintenance policy.

The Framers problem when designing road sector institutions is that she is aware of that all information relevant for decision-making is not publicly available. In particular, some party(-ies) know more about aspects relevant to the choice of activity level than others. Because of this, different ways to organise the business may generate different outcomes.

It is assumed that the Framer can choose between two extreme forms of institutions to maintain a road network. The task can be handled by a *Public Enterprise*, managed by a Minister. This Minister is instructed by the Framer to consider both consumer surplus and maintenance cost aspects of his decisions, as well as their indirect, external effects. Secondly, the Framer can choose a *Private Enterprise*, headed by a Director. Since the Private Enterprise cares only about financial aspects of the decisions, and since the Framer is keen to ensure that resources are put to best possible use for the society as an aggregate, this option must be combined with a Regulator. Thereby, the private firm can be induced to take also social welfare and external effects into account.

The Minister and the Director, respectively, possess the best information about whether cost conditions are favourable or not. The Framer has beliefs about  $\theta$  distributed over  $[\theta_0, \theta_1]$  with a probability density function  $f(\theta)$  and the cumulative distribution function  $F(\theta)$ .

### The public enterprise

From the Framers perspective a problem is that the Minister in charge of the Public Enterprise may have an agenda of his own; this is type III information. The process towards increased competitive procurement in Swedish road maintenance may provide an example of what this may look like. Interviews have indicated that road users—after some time with the new organisation—perceive improvements of road standard on the high density, and deteriorating quality on the low density roads. One way to understand this is that local VV officials previously held an approximately equal maintenance standard on all roads. It is more easy to undertake a certain task on roads with little traffic than on extensively used roads. And moreover, an official may know (some of) the people that use the ‘small’ roads and realise the value to them of a high standard, while users of ‘large’ roads are anonymous. The contracting institution may have made it easier to specify quality targets that differ between road categories.

The private agenda is known only by the official and cannot be foreseen by the Framer. In particular, the Framer cannot know just who the public official will be, or what his private aims are, so it is difficult systematically to counteract such private agendas.

The Ministers objective function ( $V^M$ ) can be modelled as in (2) where the expectation is taken over the possible values of  $\theta$ ;  $\epsilon$  represents the divergence between the public interest and that of the Minister. Since the Minister is employed to take social welfare into account, it is reasonable to expect that  $W$  is part of his objective function.  $J$  represents his private agenda with  $\alpha$  ( $0 < \alpha < 1$ ) measuring the impact of the Ministers idiosyncratic objectives on the objective function. If  $\alpha = 0$  objectives of the Minister and the Framer coincide.

$$V^M = E [W + \alpha J(x, \epsilon)] = E [S(x, \psi) - kC(x, \theta) + \alpha J(x, \epsilon)] \quad (2)$$

### The regulator and the private enterprise

The Private Enterprise seeks to maximise its profits from road sector activities. Since this is not sufficient to the Framer, the private option comes with a public official, here called the Regulator. His task is to observe the public-interest impact variable  $\psi$  and to specify the road standard that has to be met by the Private Enterprise. Just as with a Public Enterprise, also the Regulator may have his own agenda  $\epsilon$ .  $\rho = (\psi, \epsilon)$  summarises the Regulators private information.

In order to attract private investment, the Regulator must put into place a regulatory scheme that offers at least a competitive rate of return on the investors sunk capital, ie the plant and other specific spending required to accept the job. A regulatory contract,  $T(x)$ , holding the promise of profits, is therefore specified prior to the investment decision. The private firm, first, chooses whether to accept the contract or not. If so, it will, secondly, settle for an activity level  $x$  by maximisation of (3). This choice is automatically sensitive to relevant cost information,  $\theta$ .

$$\pi^P = T(x) - C(x, \theta) \quad (3)$$

There is also the possibility that the Regulator receives additional (private) information about the consequences of certain maintenance standards subsequent to that the firm has invested. The Regulator can give himself post-investment discretion by using a generalised version of the regulatory scheme. In particular, he can offer a remuneration function  $T(x, \rho)$ , so that if the Regulator announces  $\rho$  and then the firm chooses  $x$ , it will receive a transfer of  $T(x, \rho)$ ; cf. (3').

$$\pi^P = T(x, \rho) - C(x, \theta) \quad (3')$$

So the timing of decisions is that the Regulator first announces the contract. Then the firm accepts it and invests in plant, the Regulator observes what happens and declares the value of  $\rho$ . Finally, the firm, observing its own cost structure, chooses the profit maximising action.

The objectives of the Framer are now adjusted to include also the payment to an outside party, ie the Private Enterprise, in the welfare function (cf. (1')). Corresponding adjustment of the Minister's objective function is made in order to account for that it now is the Regulator that is in charge [cf. (2')].

$$W = S(x, \psi) + \pi^P - k T(x, \rho) = S(x, \psi) + (1-k) T(x, \rho) - C(x, \theta) \quad (1')$$

$$V^R = E [W + \alpha J(x, \epsilon)] = E [S(x, \psi) + (1-k) T(x, \rho) - C(x, \theta) + \alpha J(x, \epsilon)] \quad (2')$$

### **Analysis: equivalence of the extremes**

So we have one Framer with a social welfare function and two ways to organise road maintenance. Under one, a private enterprise maximises profits, where revenue is given by a contract, and where the contract is controlled by a Regulator with objective function (2'). Under the other, both definition of tasks and actual activities are undertaken by a Ministry that is ruled by objectives set out in equation (2). The situation is illustrated in Figure 1.

Under the prerequisites of the previous sections there are some situations that provide equal outcomes. These are cases where the Regulator can exert sufficient indirect regulatory control over a private firm to achieve the same results he could obtain as Minister with direct control over a Public Enterprise. If the Regulator induces the private firm to do the same that he as Minister would do, the Framer is indifferent between Public and Private Enterprise.

The first equivalence is at hand if there is no private information. When information about all benefits and costs of the activities is contractible, the Regulator can design a contract where remuneration is contingent on what will become the commonly known realisations of costs and benefits of the operations. It is in the interest of the Private Enterprise owners to accept the deal since the alternative—no contract—is (marginally) inferior. While there is no guarantee that the Regulator maximises social welfare, there is no difference between Regulator and Minister policies.

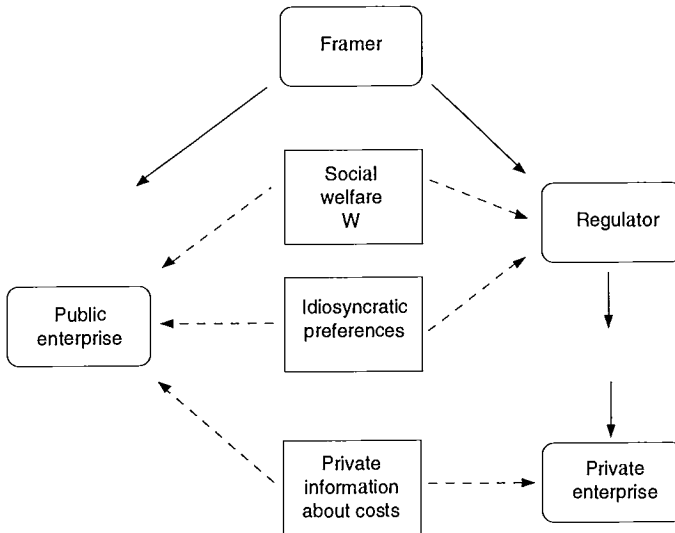


Figure 1 Private Information impact on private and public options to organise road maintenance activities (based on Shapiro and Willig 1990, p. 60)

There are at least another two cases where Public and Private Enterprise are equal also in the presence of private information. Under the first, the Private Enterprise has no private information about maintenance costs before it takes a stand on the contract; this knowledge will be acquired once the activities are under way. The enterprise can therefore not make use of private information in the negotiation process; costs have to be estimated as an expected value. The Regulator has information about  $\rho$ —ie social benefits plus private agenda—when the regulatory mechanism is designed and can therefore exert control over the private firm to obtain the same outcome and payoff as under Ministerial rule. This is accomplished by paying the firm according to (4) where  $G(\rho)$  is independent of activity level  $x$  and is just so large that is required to induce the firm to accept the contract.

$$T^*(x, \rho) = 1/k [S(x, \psi) + \alpha J(x, \epsilon) + G(\rho)] \quad (4)$$

The mechanism operates by forcing the firm to internalise the objectives of the regulator. If  $k=1$  the firm links its costs to a revenue defined as  $S(x, \psi) + \alpha J(x, \epsilon) + G(\rho)$ .  $k>1$  makes the regulator scale back the transfers to account for the extra costs of public funds.

Another case generating the neutrality result is where the private firm may have private information, but where there is no social cost of public funds. So the firm knows the value of  $\theta$  and the regulator is aware of that fact but does not know the pertinent value. To assure that the private firm accepts the job, the regulator commits to a payment schedule that provides non-negative profit for all possible levels of  $\theta$ ;  $G(\rho)$  in equation (4) is sufficiently large to guarantee the firm non-negative profit even if its cost level  $\theta$  is the worst possible. If, however,  $k=1$  this does not matter; the cost to the public sector is merely an offsetting revenue to the private enterprise (cf. (2')).

To summarise, the discussion has demonstrated that the Framers is indifferent between a Minister and a Regulator that selects a regulatory scheme for a Private Enterprise if (i) all eventualities are contractible, or (ii) all private information about profitability is revealed only after the contract is signed or (iii) the Framers is unconcerned about transfers of funds from the treasury. To escape neutrality between Public Enterprise and discretionary regulation the environment must consequently be such that non-contractible private information about costs is available prior to that the deal is signed and that there is concern about the drain on the treasury.

**Analysis: when is public better than private enterprise?**

The objective function of the Minister is given by (2). The Minister selects the activity level  $x$  as a function of  $\theta$  and  $\rho$  without any constraints. The first-order condition for the optimal choice of activity level  $x$  conditional on these values is therefore

$$S_x(x, \psi) - kC_x(x, \theta) + \alpha J_x(x, \epsilon) = 0 \tag{5}$$

The Regulator has a more complex problem. Knowing  $\psi$  and  $\epsilon$  but in ignorance of  $\theta$ , he has to select  $T(x, \rho)$  to maximise his objective function (2'). Facing the contract  $T(\cdot)$  and upon observing  $\theta$ , the firm chooses its level of  $x$  so as to maximise its profits  $\pi^P = T(x, \rho) - C(x, \theta)$ . The regulator chooses  $T(x, \rho)$  in the fashion that is optimal for his objective function  $V^R$ , given this connection between the payment schedule, the actual value of  $\theta$  and the firm's choice of  $x$ . The constraint on the choice of  $T(x, \rho)$  is that it must yield non-negative profits for the firm at all possible levels of  $\theta$ ; otherwise the firm would be unwilling to go into the business in some situations, and it is assumed that the Regulator finds it optimal to enter into the deal at all levels of  $\theta$ .

It is then possible to demonstrate that equation (6) characterises the actions  $x$  that the Regulator induces the private firm to take as a function of the firm's costs,  $\theta$ .  $h(\theta) \equiv (1 - F(\theta)) / f(\theta)$ , is the inverse of the hazard rate for  $\theta$ .

$$S_x(x, \psi) + \alpha J_x(x, \epsilon) - kC_x(x, \theta) + (1 - k) h(\theta) C_{x\theta}(x, \theta) = 0 \tag{6}$$

Let  $T^{**}(x, \rho)$  be the Regulator's optimal payment schedule that induces the actions given by (6). It is possible to prove that the expected profit of the Private Enterprise is positive— $E_\theta[\pi^P] > 0$ —constituting a drain on the treasury and with  $k > 0$  imposing a genuine welfare cost on the Framer and the Regulator. These information rents are necessary for the optimal regulation mechanism when the firm has superior information about its profitability before the time of signing the contract. Formal analysis can moreover show that the larger the activity level sought by the Regulator, the greater will the concomitant level of information rent paid to the firm be. Information rents therefore not only deduct from the Regulator's payoff, they also induce him to choose lower levels of activity for each value of  $\theta$ .

It can be noted that (6) is equal to (5) except for the last term on the left-hand side of (6). For any values of  $\psi$ ,  $\epsilon$  and  $\theta$ , and since  $C_{x\theta} < 0$ , the value of  $x$  that solves (5) is therefore greater than the value of  $x$  that solves (6). In equivalent circumstances, activity levels are lower under regulation than under public management. The Regulator must give the Private Enterprise informational rents to induce higher activity levels, rents which are not required under public management.

It can also be demonstrated that the activity level under the public option is more responsive to changes in marginal values than under regulation. The Public Enterprise responds more fully than does a regulated Private Enterprise to changes in the objectives of public officials, whether these changes reflect the public interest or merely the private agenda of the public official. This result appears by adding structure on some of the functions of the model; this structure is thought of as the *normal case* implying signing of the third derivative of the cost function and specifying its functional form.

It is thus more costly for the Regulator to influence the private firm's actions than it is for the Minister to alter the actions of the Public Enterprise. To the extent that the public official's objectives coincide with those of the Framer, this reduced flexibility lowers performance of the regulation option. Conversely, if the public official is pursuing his or her own private agenda the reduced flexibility raises performance.

To understand the factors that tip the balance in favour of Private or Public Enterprise from the Framers point of view, Figure 2 can be used. It compares the Framer's expected payoff under the public option,  $E[W^P]$ , with that under regulation  $E[W^R]$ . The figure shows that Public Enterprise is preferred if the public official's private agenda is sufficiently muted, that is if  $\alpha$  is sufficiently small. This also means that privatisation is welfare-enhancing if the public official's private agenda is sufficiently influential.



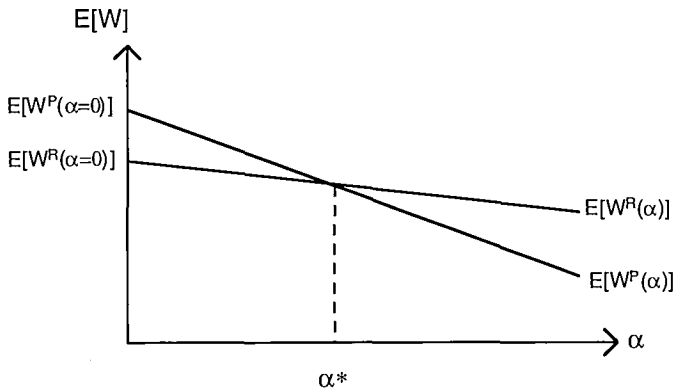


Figure 2 The effect of the public official's private agenda ( $\alpha$ ) on the Framer's payoff under Public Enterprise ( $E[W^P]$ ) and regulation ( $E[W^R]$ ); (cf. Shapiro and Willig 1991, p 73)

In order to establish the qualities of Figure 2, consider first the public official's payoff under the two options. The official clearly prefers Public Enterprise since this gives him an entirely free hand in choosing the maintenance activities. When  $\alpha=0$  the objectives of the Framer and the public official coincide. The Framer cannot do better than under public management; there is no reason to impose an agency problem on the public official so as to limit his pursuit of the private agenda. This establishes the relation in Figure 2 between  $E[W^P(\alpha)]$  and  $E[W^R(\alpha)]$  at  $\alpha=0$ .

It can also be proved that the  $E[W^P]$  curve falls more steeply than the  $E[W^R]$  curve. This is so if the *normal case* cost function as defined above is at hand and if the public official's private agenda places a constant marginal value on increased activity, ie if  $J(x,\epsilon)=\epsilon x$ . As the salience of the private agenda grows, the expected value of the Framer's objective function falls faster under public than it does under private management.

To summarise, the discussion has indicated that regulation of a Private Enterprise is more desirable than the Public Enterprise alternative the more significant is the private agenda of the public official and the less significant the private information concerning profitability. A poorly functioning political system, or absence of substantial private information at the operating level of the enterprise, imply that privatisation is superior to public enterprise.

### Analysis: discretionary vs. nondiscretionary governance

Consider also the distinction between the case discussed so far, namely a public official with complete freedom to handle his tasks—the discretionary regulation case—from a situation when the Framer gives the official no freedom to choose—the nondiscretionary case. If the Framer mandates the actions to be taken by a Minister, the latter is effectively removed as a decision maker. If a Regulator is instructed to use a specific mechanism, his role is passive and mechanical. He observes the contractible state of nature and follows the directives left by the Framer.

If the public official during the process from objective formulation to implementation receives private information that is pertinent to the public interest, then the Framer's objectives might be better served if that official is given some discretion. This same discretion would, however, also allow the public official to influence the enterprise in accordance with his private agenda, to the harm of the Framer's objectives.

The trade-offs between the different (combinations of) policies are complex. One example of a case that is clearly distinguishable is the following: Private Enterprise subject to nondiscretionary regulation is the best organisational form if there is no private information about public impacts

and all private information about costs is revealed only after the investment decision must be made.

The argument is as follows. With private cost information revealed only after investment, no information rents must be paid under regulation. With no rents, the discussion has established the equivalence between Private and Public Enterprise. Furthermore, with no private information about public impacts—consumer surplus, externalities etc. is so clear so that legally binding deals can be made based on these figures—the Framer has no reason to give any discretion to the public official. Finally, with nondiscretionary public management it is impossible to make activity levels responsive to cost conditions; this is in the nature of the removal of discretion. In the eyes of the Framer, a Public Enterprise is therefore inferior to nondiscretionary regulation that still allows the Private Enterprise discretion with respect to cost realisations.

A more general lesson can be drawn from the example. A Regulator of a Private Enterprise can be more effectively monitored and therefore more effectively constrained by the Framer than can a public Minister. This is so since the Regulator does not have access to private information on costs that is possessed by the Minister. With less private information, the Regulator is less able to disguise the (possible) pursuit of his private agenda.

## **DISCUSSION**

An earlier section presented the recent restructuring of road maintenance in Sweden and subsequent discussion has outlined a principal model for analysis of private/public options and its analytical properties for some specific situations. What are now the most important insights that the model can provide for our understanding of the merits of the new way to structure road maintenance activities?

Consider first one of the basic qualities of the model approach. Assume that there is no private information, neither about costs nor external benefits or private agendas. If this is so, there is no difference between private and public ownership. *Under the full-information framework a public authority is equally efficient as a private firm in its effort to maintain a road network.* The result has its interest in that most standard-type welfare analysis of optimal road policies more or less explicitly rests on full information models. Welfare analysis to derive optimal pricing and investment criteria have their merit in full information contexts but these models can typically not give guidance in the choice between alternative organisational road sector structures when information is asymmetric.

Secondly, two basic prerequisites for there to be a difference between public and private alternatives have been established. There must, first, be a cost of public funds because of fund-raising distortions and, secondly, there is non-contractible private cost information prior to investment. On the first of these prerequisites, most countries have problems to raise tax revenue in a non-distortive way. Transport sector cost-benefit manuals in Sweden even gives this an explicit value;  $k=1,25$ . And also the second requirement is met since an entrepreneur in charge of productive activities typically knows much more about production costs than outsiders do.

Consider, however—third—a situation where information asymmetries on costs may be less of a problem. Assume that the first time that a maintenance contract for some district is being competitively procured, the Production Division of VV is not allowed to bid. All bidders are then at equal footing since none has access to private information about the true qualities of the specific road network. If no bidder knows whether the roads up for contract is a ‘lemon’ deal or not, there is no information gains to be earned. This will, *ceteris paribus*, change the balance in favour of regulated Private Enterprise.

At future re-contracting dates the incumbent firm on the other hand has a clear information advantage. If the Regulator—here VV’s Management Division—tried to design an expected-cost contract it would risk losing the incumbent; this would happen if the firm knew that the network is in worse shape, or has inferior quality parameters as compared to other parts of the network. If, on the other hand, the incumbent accepts such a contract this means that the network

standard is not worse than average and it will typically make an 'excessive' profit. The stronger the possibility of information rents, the less interesting is the regulation option.

Under discretionary regulation it has, fourth, been established that private entrepreneurs are preferred to the traditional public administration organisation only under two prerequisites. First, the private agenda of the public official is strong; if this is so it is too easy for officials to 'hide' the 'true' nature of decisions taken and to pursue a policy that makes less than optimal use of maintenance resources. Secondly, the information about private cost is not impenetrable; if a private firm enjoys much information advantage, this would cost the regulator a lot more than under the 'traditional' organisation.

It is consequently possible that the use of private initiative in the sector could be a development in the wrong direction. This is so if preferences of the public official has little distortive influence on decision making. If, moreover, an incumbent private caretaker of a road district at the time for contract renewal has a strong information advantage, this firm could make considerable information gains which would render the private option costly to the society.

Fifth, the possibility of not giving complete freedom to a Regulator or a Minister has been discussed as the non-discretionary control case. Limited discretion could be an interesting way to cap idiosyncratic public-official preferences. It comes at the cost of making the official unable to use private information acquired during the process.

Think of the following case: externalities include environmental problems. Under discretionary regimes, the Regulator/Minister could motivate decisions on environmental grounds. Since such consequences are notoriously difficult to give precise values, it could be used as an excuse for instead meeting the official's personal objectives. Under non-discretionary regimes, the right to take environmental concerns could be removed from the Regulator/Minister and given to some other public official. The latter could be instructed to consider only environmental aspects within the framework of a separate regulatory system with taxes and/or payments for having specific activities undertaken. Removal of parts of the objectives from the road sectors public officials would control the possibility for these to fiddle with the motives for their action. It might tip the balance in favour of either option.

The text points to that a remuneration function  $T(\cdot)$  can be used to make private firms take social aspects into account and trade off these against their own costs for maintenance activities. Current practice in VV however seems to be that the Management Division assess the costs and benefits of alternative actions. Based on this assessment, an activity level is established and the firms are instructed to submit bids/cost estimates with this activity level as a target. If this is correctly understood, it could be a problem in that the Management Division/Regulator then assess (cost) information that it is not best equipped to make guesses over. More analysis of current practice is, however, required before it could be established that this is so.

## CONCLUSIONS

The paper has argued that detail specification of information asymmetries is instrumental for understanding trade-offs involved in the choice between different organisational regimes, *inter alia* in the road sector. The text has provided a scent of the types of results that might be conveyed by such analysis. This has for instance indicated that there may exist cases where the present strive in Sweden to use private firms to undertake road maintenance is a dead-end road. This would be so if public officials have no private agenda except for the objectives laid down by the public interest. It would also be so if the information asymmetries in the cost structure are so strong that the use of private entrepreneurs would simply be too costly. If, on the other hand, private agendas of sector officials are strong while cost asymmetries are less significant the introduction of the purchaser-provider paradigm is a step in the correct direction.

The paper is a first step on a research agenda aimed at investigating the principal nature of alternative ways to organise activities within the transport sector. Another road sector application will target the types of changes discussed by Newbery (1994). One issue raised in that paper

concerns the responsibility for investment in new, and care-taking of existing infrastructure on the one hand, and pricing/taxation of road use on the other. Should these two responsibilities be held within one agency or should they be separated along 'traditional' organisational lines?

The intuition from the present paper points to that under full information, choice of organisational design should not matter. If, on the other hand, information is asymmetric, joint location of the two tasks could provide an improved framework for efficiency-enhancing decision-making. Joint decisions on pricing and spending issues also raise the question of the eternal 'road fund' concept. Is there under an asymmetric information framework any new insights to be gained about whether break-even requirements for a road fund has any efficiency qualities?

In the Shapiro and Willig model it has been demonstrated that under some contexts it may be beneficial to remove decision making powers from a public official or to circumscribe his scope of authority. Could not this provide a basis for a more general discussion of which decision making powers that should stay with one specific public administration or regulatory function, and when it may be relevant to relocate these powers to other parts of the public sector. These types of issues are addressed in a separate paper; see Nilsson (1995).

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