Contracting out public transport services to vertical partnerships

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ABSTRACT

This paper studies the organisational structure of contracting out transportation operations to a vertical partnership between local authorities and a vertically integrated monopoly. Pricing decisions are delegated to the partnership operating in the downstream market as a socially concerned firm that maximises a weighted sum of social welfare and profits. The price for essential input required to produce each unit of the transportation service is determined by the monopoly in the upstream market for rolling stock and crew leasing. A forward ownership interest in the vertical partnership held by the monopoly yields a partial rebate of the downstream margin. In turn, the local authorities can extract the upstream monopoly rent via a franchise fee which can be determined *ex post*. Our theoretical model predicts that local authorities with a relatively high share in the partnership should decrease the net transfer from the budget by increasing the franchise fees if the upstream profit margins are high. This partial cost recovery and inappropriate compensation are interpreted as a system of pseudo-franchising contracts.

1. Introduction

In this paper, we build a theory that describes the financial mechanism of contracting out public transport services to a partnership between the local authorities (LA) and a transport monopoly. Our theoretical model predicts that the socially desirable financial scheme depends on the organisational form of the partnership. We consider the case of vertically related markets when an upstream monopoly (the firm) provides essential input (rolling stock and crew leasing) to a downstream joint venture company which is structured as a partnership co-owned by the benevolent local authorities and the firm. We call such an organisational form a *vertical partnership*, since a forward ownership interest held by an upstream firm may yield a partial rebate of the downstream margin making it optimal to set the non-regulated input price below the monopolistic level. The vertical partnership operates the suburban rail passenger transport (a downstream market) and its costs can be financed through public funds and user charges. Thus, this market is regulated at the local level by means of two independent instruments – tariffs for users and public subsidies. The infrastructure access charges are subsidised from the federal budget and not considered in the model.

Our main theoretical results crucially depend on the assumption that local authorities use tariffs and budget transfers independently. In particular, they are able to extract the upstream monopoly's rent via a franchise fee which can be set after the pricing decision of the monopoly take place and has the form of a negative *ex post* budget transfer. Intuitively, the franchise fee should increase with an upstream rent until the firm's participation constraint becomes binding. In turn, the downstream loss (if any) incurred

by the partnership is positively related to an upstream rent. Thus, if an upstream monopoly cannot be regulated directly, the government can still extract its rent by establishing a so called *pseudo-franchising* contractual framework. Specifically, when the local government faces fiscal constraints and only partially covers the gap between farebox revenues and the operational cost of the partnership, the non-compensated loss can be ultimately passed on to the monopoly through its ownership interest in the partnership. We interpret such a non-compensated loss as a franchise fee paid by the monopoly for the right to deliver its services at a non-regulated (input) price.

Our model provides a conceptual framework for the discussion of a continuum of alternative contracting scenarios in vertically related markets for public transport ranging from standard regulation to complete privatisation. We employ the same logic as in Auriol and Picard (2009) when considering the incentive compatibility constraint of the vertical partnership between the government and the private vertically integrated firm. We depart from their analysis by considering hybrid organisational arrangements (vertical partnership) that range from standard regulatory contracts to unregulated private monopoly. Our model focuses on government's incentives to use various forms of contracting out in the presence of fiscal constraints and high shadow cost of public funds.

2. Theoretical analysis

Consider a regulatory game between the government (LA), a vertically integrated transport monopoly and the partnership between the two. The monopoly provides essential input produced in the unregulated upstream market and sells it to the partnership which then delivers final services in the regulated downstream market. The role of the partnership is threefold. First, it eliminates the cost asymmetry between the LA and the firm via trusting relationships and allows us to consider a regulatory framework with complete information developed in Dementiev & Loboyko (2014). Second, being a joint venture between the government and the firm, it mediates public-private relations and, by design, performs as a socially concerned price-setter. Alternatively, one could interpret the mixed objectives of such a partnership as a regulatory regime with delegation of pricing decisions to a more commercially oriented entity as in Dementiev (2016). Third, the control rights in the partnership reflect the abilities of the parties to affect the distribution of total surplus by means of lump-sum transfers from the budget to the partnership and from the partnership to the firm. The latter consideration will be crucial for our results.

The monopoly firm incurs constant unit cost $v \geq 0$ as well as non-negative fixed cost $K \geq 0$ in the upstream market for essential input (rolling stock and crew lease) which is sold at a unit price $c \geq 0$ to a partnership. In turn the partnership produces at no cost a homogenous service (transportation) in the downstream market and sells it at a regulated unit price $P \geq 0$. To obtain, where possible, closed from solutions we consider a linear demand function in the final market $Q = 1 - P$ with the maximum willingness to pay normalised to 1. Due to our assumption of linear technology the demand for the

essential input is shaped by the same function, so every unit of transportation service in the downstream market requires exactly one unit of essential input in the upstream market.

Naturally, such a distinction between the stages of production in vertically related markets is irrelevant if an upstream monopoly is fully vertically integrated with the downstream firm and the final price P is regulated. However, it appears to be crucial for the case of *vertical partnership* when the share $\omega \in [0,1]$ of the downstream division of the vertically integrated firm is owned by the LA while $(1-\omega)$ belongs to the upstream firm. The price setting rule as well as profit sharing principles will then result from the organisational design of such a public-private agreement, which can be interpreted as a delegation of regulatory decisions to a more commercially oriented entity with predetermined balance of interests.

The social welfare function comprises of a weighted sum of the net consumer surplus, CS and the industry's profit, $\pi = \pi_F + \pi_P$, which sums up a profit of the vertically integrated firm, π_F, and a partnership's profit, π_P. The joint weighted surplus $CS + \alpha\pi$ is reduced by a lump-sum net transfer $(1+\lambda)T$ to account for an additional loss of social welfare λT due to distortionary taxes levied on consumers, where $\lambda \geq 0$ is the local cost of public funds. Redistributive parameter $\alpha \in [0,1]$ reflects the societal concerns for the producers' surplus which implies lower relative weight associated with the industry's profit in the extended social welfare objective function of a politically motivated regulator (see Gagnepain and Ivaldi (2017) for a model of political regulation and estimation of α and λ for the French urban transport industry). Using expression for the gross consumer surplus $CS(P) = (1-P)^2/2$ we may formulate the following social welfare maximisation problem:

$$\max_{P,T} W = \max_{P,T} \frac{(1-P)^2}{2} - (1+\lambda)T + \alpha\pi \text{ subject to } \pi \geq 0,\ P \geq 0$$

The benevolent regulator chooses a price-transfer combination (P, T) that solves this problem and is assumed to be able to use them independently as in Armstrong and Sappington (2006).

Following the idea of *ex post* contracting developed in Auriol and Picard (2009) we make a clear distinction between the *ex ante* and *ex post* transfers. This difference in timing of subsidies is essential for our explanation of different contracting regimes. Since the level of net transfer affects the firm's participation and incentive compatibility constraints we will discuss these issues separately after having obtained the closed form solutions for the optimal price levels and associated net transfers.

The players' objectives

The price setting decision is delegated to a partnership between the LA and the firm (as in Dementiev, 2016) with the following objective function:

$$\max_P U_P = \max_{T,P}\{\omega W + (1-\omega)\pi\} \text{ subject to } \pi \geq 0$$

In the case of full public ownership of the partnership, when $\omega = 1$, the maximand coincides with the social welfare function and we have a standard regulatory problem. At the other extreme, when $\omega = 0$, the regulator effectively maximises the profit of the partnership which is solely owned by the upstream firm. We will consider further a hybrid organisational structure of the partnership with $0 < \omega < 1$ which reflects not only greater commercial concerns in pricing decision but also the scope of vertical integration in the industry.

The simplest way to model vertical relations between the firm and its affiliate is to write down a consolidated profit of the firm as

$$\pi_F = (c - v)(1 - P) - K + (1 - \omega)\pi_P = V - K + (1 - \omega)\pi_P$$

where the partnership's profit is taken into account with the weight $(1 - \omega)\pi_P$. Importantly, the firm is not regulated in the upstream market thus it may set the input price c directly. However, the firm is assumed to receive financial support from the budget only indirectly through its interest in the partnership. In fact, the firm faces a trade-off between the two sources of revenues: the variable profit V and its interest in the partnership. An increase in the monopoly mark-up $(c - v)$ increases V but squeezes the profit margin in the downstream market. Reduced π_P may outweigh the first effect if the firm's interest in the partnership $(1 - \omega)$ is sizable (the LA's share ω is relatively low).

On the other hand, since the pricing decisions in the downstream market are delegated to the partnership, the regulated price P depends on its share structure. Intuitively, when the LA's share in the partnership decreases, it becomes more commercially oriented and tends to set higher P for any price level below the monopoly one. Formally, having delegated the price-setting decision to the partnership the regulator maximises the new objective function with the relatively higher weight ψ placed on the industry's profit:

$$\begin{aligned}\max_P\{\omega W + (1 - \omega)\pi\} &= \max_P\{\omega(CS - (1 + \lambda)T + \alpha\pi) + (1 - \omega)\pi\} \\ &= \max_P \omega(CS - (1 + \lambda)T + \psi\pi)\end{aligned}$$

where $\psi = \alpha + 1/\omega - 1$ decreases in ω. For a given level of lump-sum transfers T the optimal regulated price P_ψ in the downstream market is equal to

$$P_\psi(c) = \big(1 - \psi(1 + c)\big)/(1 - 2\psi)$$

and increases in ψ (see Dementiev (2016) for the formal proof of these formulae). As was mentioned above, the demand for essential input in the upstream services is also determined by this price and is equal to $(1 - P_\psi)$.

The partnership being a socially concerned for-profit contractor operating in the regulated downstream market collects farebox revenues $(P-c)(1-P)$ and receives a lump-sum net transfer payment T:

$$\pi_P = \big(P_\psi(c) - c\big)\big(1 - P_\psi(c)\big) + T$$

Apparently, for any $\omega < 1$, i.e. when transportations services are contracted out to the partnership, the regulator is able to set a higher price compared to the case with no delegation, because P_ψ decreases with ω. Still, socially optimal price P_ψ may be below marginal cost c causing operational losses of the partnership and requiring subsidies from the budget. Thus, by decreasing its interest in the partnership, the government may attempt to lessen its financial burden and reduce the subsidy that covers operational losses.

Here we make a crucial assumption, that the net subsidy from the budget $T = t - F$ comprises of the operational subsidy t which is determined *ex ante* and a (potentially negative) transfer F which is determined *ex post*. Operational subsidy follows a simple (variable) cost reimbursement rule: $t = -(P-c)(1-P)$ and can be internalised in the pricing decisions of the partnership and the firm. Having plugged this rule into the expression for π_F and taking into account that the quantity of the essential input demanded in the upstream market is equal to the quantity of services demanded in the downstream market, we obtain the following expression for the firm's profit:

$$\pi_F = (c-v)\left(1 - P_\psi(c)\right) - K + (1-\omega)\pi_P$$

$$= (c-v)\big(1 - \big(1 - \psi(1+c)\big)/(1-2\psi)\big) - K - (1-\omega)F.$$

For a given demand $Q\big(P_\psi\big)$ the upstream firm would prefer to increase the input price c up to the monopolistic level of any $0 < \omega < 1$. However, the regulated price P_ψ which determines the demand for input is based on the input price c and puts indirect regulatory pressure on the monopoly. Moreover, the monopoly's profit crucially depends on the ability of the regulator to extract the its upstream rent via the *ex post* transfer F. Importantly, the optimal input price that maximises the upstream variable profit V does not depend on F and equals to $c_\psi = (v+\psi)/2$. In the optimum, the firm's profit appears to the dependent on ψ:

$$\pi_F^* = \psi(\psi - v)(\psi + v - 2)/4(1-2\psi)) - K - (1-\omega)F = V - K - F + \omega F$$

which implies that it depends on the corporate structure of the partnership ω. Indeed, the sigh is ambiguous since $\frac{\partial V}{\partial \omega} < 0$ and F can be positive.

The ex post franchise fee

Now we can introduce an alternative interpretation of the parameter F (net financial result of the partnership) as an ex post franchise fee paid by the firm to the government

for the monopoly right to operate the non-regulated upstream market. Recall, that the budget transfer F represents uncovered losses of the partnership making its 'net financial result' negative. In case of gross subsides t being insufficient to cover all the operational losses, the residual financial burden F is divided between the shareholders in the proportion to their interests in the partnership.

We call it *pseudo-franchise fee* since it is determined ex post in an unusual way. In fact, a subsidy t can be internalised by the firm while the franchise fee F is unknown ex ante and is deemed to be an independent regulatory instrument to extract monopoly's rents, if necessary. This franchise fee being a part of the net budget transfer T to the industry is determined by the government fiscal constraints shaped by the partnership's objective function U_P. Indeed, the marginal effect of F on the partnership's objective function $\frac{\partial U_P}{\partial F} = (1+\lambda)dF - \psi dF$ is positive if the marginal social gain from the higher franchise fee $(1+\lambda)dF$ exceeds the weighted loss in the industry's surplus $-\psi dF$. In this case it is optimal for the society to increase F. This is the case when the local cost of public funds or the LA's share in the partnership are relatively high, so $1+\lambda > \psi = \alpha + 1/\omega_\psi - 1$.

In practice, it means that the government has incentives to cover the operational losses only partially and share the financial burden of public transport subsidisation with the monopoly, provided that its participation constraint is satisfied: $V - K \geq (1-\omega)F$. If it becomes binding, the variable profit of the firm is used to cover the fixed cost K and a franchise fee F. These findings are summarised in the following section.

3. Theoretical results

Proposition 1. The regulator will decrease the net transfer from the budget $T = t - F$ by increasing the franchise fees F, if the LA's share in the vertical partnership exceeds a certain threshold : $\omega > \omega_\psi = 1/(2+\lambda-\alpha)$.

When the LA's share in the partnership is relatively high for a given value of the local cost of public funds, it effectively puts higher weights to consumer surplus and performs more like socially oriented firm. In this case, minimisation of budget transfers becomes socially desirable policy. If and when the government has insufficient institutional capacity to extract monopoly's rent via ex ante franchise fees, these incentives result in an increase in uncovered losses of the partnership, which can be interpreted and an ex post franchise fees.

Fiscally constrained governments face an increase in the local cost of public funds, λ, that requires lower share of the government in the partnership. In practice, however, changes in corporate structures are rare and governments adjust their budgets via an ex post franchising scheme described above.

Proposition 2. For a given ω the firm maximises its variable profit V by setting the price for the essential input at $c_\psi = (v + \alpha + 1/\omega - 1)/2$ which decreases in ω.

Given the model parameters' restrictions, the variable profit V of the firm in the upstream market increases if its share in the partnership $(1-\omega)$ rises. Indeed, when the partnership is more commercially oriented the input price c_ψ approaches its monopolistic level. Naturally, this implies lower profit margins downstream. However, higher $(1-\omega)$ also implies higher share in the financial result of the partnership, and if it is negative it undermines the firm's financial position.

Corollary. There exists a continuum of corporate share structures of the partnership, such that $\omega_F < \omega < \omega_V$, and $\omega > \omega_\psi$, when the regulator can extract the upstream surplus profits of the firm via the *ex post* franchise fee given the firm's participation constraint $(1-\omega_F)F \le V - K$.

These theoretical findings are illustrated in Fig.1.

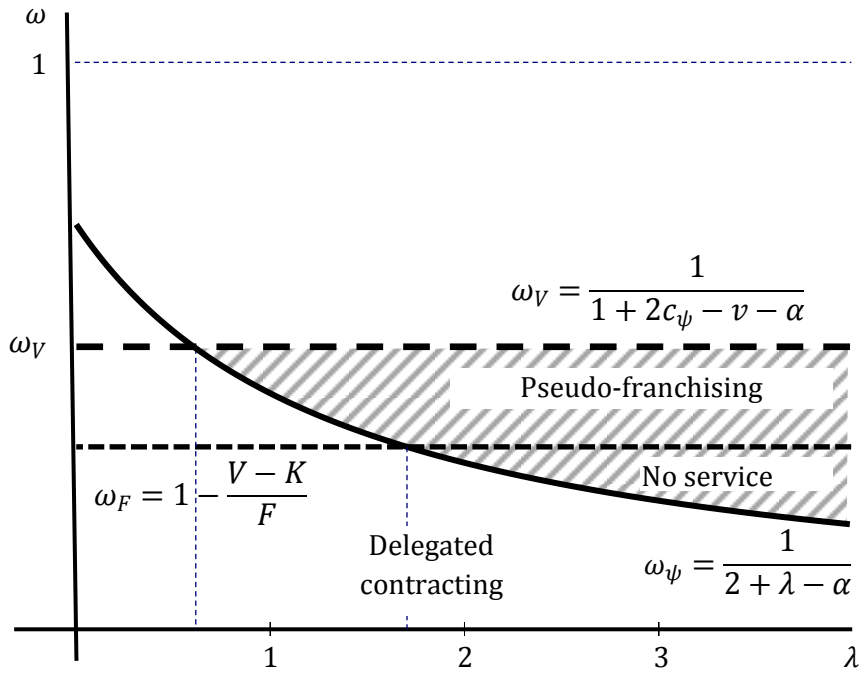

Figure 1. Contractual regimes for different LA's share in the partnership (ω) and local cost of public funds (λ).

4. Discussion and conclusion

This paper proposes a plausible explanation for the systematic loss of a public transport operator which is not fully covered from local budget. In the case of suburban rail transport in Russia, the existence of the subsidy ratio being less than 100% is interpreted as an attempt of the local authorities to extract the RZD's profit from the upstream market through an *ex post* franchise fee. An alternative interpretation of the observed non-compensated losses might be the following. The previous year negative financial result of an SPC with RZD's share of $(1-\omega)$ is consolidated in RZD financial statement with the corresponding weight. If it is negative it can be considered as a form of *ex ante* franchise fee, which is paid by the firm for the monopoly right to serve the regulated downstream market with relatively predictable operating profit. Moreover, the planned amount of the current year subsidy is often known in advance. Hence, one

may argue that RZD is able forecast the financial result and negotiate the scope of compensation *ex ante*. In any case, this amount is going to be determined exogenously and will not violate the optimum price in the upstream market. Still, such an informal regulatory framework (in the absence of explicit competitive tendering procedures or detailed conditions and requirement for the direct award contracts) could be described as a pseudo-franchising scheme.

When LA loses *de jure* corporate control in the partnership ($\omega < 0.5$) the firm is thought to have drastically improved its bargaining power in a regulatory game. As a result it is able to increase the essential input price c and reap the fruits in the upstream rather than the downstream market. However, the incentive to do this also depends on the cost parameter v and parameter α that captures the social preferences for redistribution.

A further decrease in the LA's share has two effects on the firm's profit. On the one hand, the lower ω, the higher is the effective weight ψ of the firm's profit in the partnership's utility function U_P thus the higher is the regulated price P_ψ in the downstream market. In turn, lower ω implies higher c and lower profit margin in the downstream market. In the extreme case when $\omega = 0$ the situation can be described as a regulatory capture since the price setting rule maximisation of $U_P = \pi_F$ and simply mimics the profit maximisation criteria. Naturally, the monopoly level of output is socially suboptimal in general, so the LAs would prefer to correct *ex post* the distribution of the total surplus. This can be done via pseudo-franchise fee F.

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