Thredbo

International Conference Series on Competition and Ownership in Land Passenger Transport

Stirred not shaken: competitive tendering and negotiated contracts in a mixed delivery of public transport services

Workshop 2A. Contracting and Concessions

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WS2 questions tackled

An important question that we don't answer in this paper:

- Is CT really selecting what it thinks it is selecting?

We answer 'YES' to the following WS2 questions:

- Is CT creating unnecessary complexities?
- Are CT only legal and procedural requirements creating problems and not intrinsic value as such?
- Do performance incentives really work?

We build a theoretical model to show:

- How do they work and trickle down from authority, via contracts, to managers and drivers?

The model illustrates how a mixed delivery of PT services can:

- be introduced as an optimal market structure alternative
- help use competitive governance mechanisms in PT
- sustain fiscal and market shocks

The story

Over 30 years the bus sector in Moscow has witnessed the regulatory cycle - a sequential change of the market and governance structures (see Gwilliam, 2008 and Dementiev & Han, 2020)

- The state monopoly
- The hybrid market with unregulated and fragmented mini-bus services
- The hybrid regulated market with service **quality** standards

Evolution of the organisational forms of Moscow land passenger transport.

N	Period	Organisational form	Description
1	Before 1991	State monopoly	All services by public operator
2	1991–1998	Hybrid: state operator plus free market	Basic services by public operator; additional services by private operators who enter the market freely and provide services without special regulation
3	1998–2006	Hybrid: state operator plus route licensing	Basic services by public operator; additional services by private operators who propose routes and achieve permits after the approval of authorities
4	2006–2016	Hybrid: state operator plus route franchising	Basic services by public operator; additional services by private operators who propose routes and achieve 5-year permits if authorities approve the route and if operators make best quality bid in competitive tender. No formal preference to the proposer of the route.
5	After 2016	Hybrid: state operator plus gross cost contracting	Basic services by public operator; additional services by private operators who work under competitive gross cost contracts for predefined routes and services

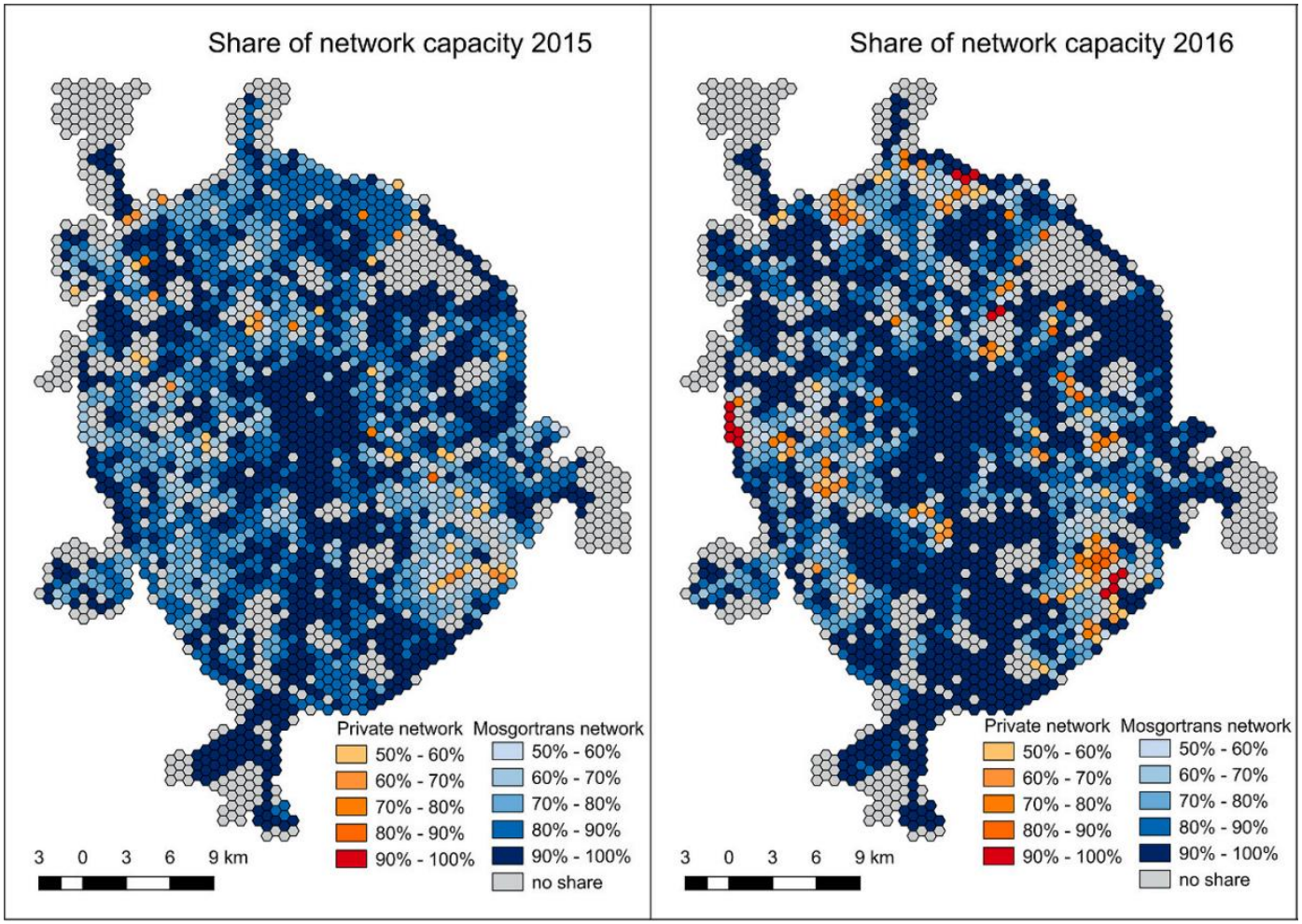
The reform

- Moscow PT authorities formalised the route tendering system in the bus market in 2016 to make it **gross cost contract**
- The idea was to make the *de facto* market structure legalised and ensure that is helps ‘eliminate the on-the-road competition between private operators and increase the **quality** of transport provision and the safety of vehicles’
- 2016 – A **‘New model of partnership with private operators’**
- 2022 – Public operator **Mosgortrans** increases its share

The market share is not stable

The 2016 bus market split between the public operator (Mosgortrans) and private operators has changed

In 2021 54 bus routes failed to be tendered out and were ultimately taken by Mosgortrans



Source: Ryzhkov and Sarzhan (2020)

The hybrid organisational model

The first results of the ‘New model’

The redesigned network had led to

- a more explicit separation of operating areas between Mosgortrans and the private operators
- the increase of Mosgortrans’s market share in the greater part of the network
- In 2022 Mosgortrans operates 636 routes with 5100 buses (~20% electric buses)

N	Criterion	2015	2016	2019
1	Routes[a]			
	Bus (private)	461	207[b] (−55%)	221[c]
	Bus (Mosgortrans)	607	545[d]	575
	Trolleybus (Mosgortrans)	99	95	48
	Tramway (Mosgortrans)	49	51	51
	Total	1216	898	895
2	Network length[a]			
	Bus (private)	7078 km	3527 km (−50%)	3839 km
	Bus (Mosgortrans)	11258 km	10405 km	11449 km
	Trolleybus (Mosgortrans)	2041 km	1963 km	979 km
	Tramway (Mosgortrans)	952 km	987 km	1044 km
	Total	21329 km	16881 km	17311 km
3	Network coverage[a]			
	Bus (private)	72%	54% (−25%)	56%
	Bus (Mosgortrans)	81%	81%	82%
	Trolleybus (Mosgortrans)	31%	31%	22%
	Tramway (Mosgortrans)	12%	12%	12%
	Total	85%	85%	85%
4	Fleet size[a]			
	Bus (private)	3771	1665 (−56%)	1784
	Bus (Mosgortrans)	4681	3786[d]	4582[d]
	Trolleybus (Mosgortrans)	1283	1226	627
	Tramway (Mosgortrans)	774	622	580
	Total	10509	7299	7573

Source: Ryzhkov and Sarzhan (2020)

The mixed delivery model

Assumptions

- Two firms, $i \in \{1,2\}$ operate the regulated PT market
- Ownership of each firm can be private and/or public
- They serve their own segments, δ and $1 - \delta$
- Each segment is regulated under marginal cost pricing, p
- No competition *in* the market
- A continuum of homogeneous consumers (passengers) have the same measure as the market share
- PT is a necessity, so production takes place even when there is a large negative shock

The mixed delivery model

Costs

- The firm i's quality of service has the value

$$v_i = s_0 + q_i$$

where s_0 is the minimum quality standard, and $q_i \geq 0$ is the incremental quality discretionary chosen by the firm

- Marginal cost of production

$$c_i = c_0 - e_i$$

where c_0 is the random component same for both firms, and $e_i \geq 0$ is cost-minimizing efforts

- Efforts are costly $C(q_i, e_i)$ where $C_q > 0, C_e > 0, C_{qq} > 0, C_{ee} > 0$
- Public and private firms treat the value of service differently thus their choice of quality-enhancing and cost-minimizing efforts differ

The mixed delivery model

Profits and social welfare

- The government has some redistribution concerns and in its social welfare W values consumer surplus CS more that profits

$$W = \theta(CS_1 + CS_2) + \Pi_1 + \Pi_2, \qquad \theta > 1$$

- Each market segment is weighted with the relative market share

$$CS_1 = \delta(v_1 - p) = \delta(s_0 + q_1 - p),$$

$$CS_2 = (1-\delta)(v_2 - p) = (1-\delta)(s_0 + q_2 - p)$$

$$\Pi_1 = \delta(p - c_1) = \delta(p - c_0 + e_1)$$

$$\Pi_2 = (1-\delta)(p - c_2) = (1-\delta)(p - c_0 + e_2)$$

Having plugged the respective functions into the expression for social welfare we obtain:

$$W = \delta(\theta q_1 + e_1) + (1-\delta)(\theta q_2 + e_2) + \theta s_0 - (\theta - 1)p - c_0$$

The mixed delivery model

The regulatory contract

- Due to cost padding private firms will always try to report the highest cost to be compensated
- The government suffers **information rent** when regulating a private firm at the upper bound of $c_0 \in [\bar{c} - \frac{1}{2}\triangle_H,\ \bar{c} + \frac{1}{2}\triangle_H\ ]$
- The quality of service is observable but not verifiable
- The government pays a transfer, T, to the private firm to incentivize quality-enhancing efforts and m to the public firm to incentivize cost-reducing efforts

The government's objective is to maximize the ex ante expected social welfare that accounts for the **shadow cost of public funds**:

$$SW = W - \tilde{C}(q,e) - \lambda T - \tilde{\lambda} m$$

where $\tilde{C}(e,q)$ denotes the cost of the private firm efforts and/or contractual payment to the public firm manager

Risks and rewards

The utility function of public manager decreases with efforts:

$$U(m_i, q_i, e_i) = -\exp\left[-r\left(m_i - \frac{1}{2}q_i^2 - \frac{1}{2}e_i^2\right)\right]$$

where r is public manager's absolute risk aversion

The monetary payoff m_i comprises of the fixed wage and bonuses:

$$m_i = \alpha + \beta(W + \varepsilon_w)$$

where α is a fixed monetary compensation

- β is a power of incentive scheme (contingent on social welfare)
- $\varepsilon_W \sim N(0, \sigma^2)$ reflects uncertainty, eg. economy shocks
- σ^2 is a measure of the moral hazard problem in the public firm

Take away for practitioners:

- Riskier economic environment (higher σ^2) makes the public manager rewarding scheme less intensive
- The government lowers β and the manager reduces efforts

Information effects of mixed delivery

When the private and public firms serve the same market

1) The government can **learn more about production cost** and reduce information asymmetry

$$c_0 \in \left[\bar{c} - \frac{1}{2}\triangle_L, \bar{c} + \frac{1}{2}\triangle_L\right], \qquad \triangle_L < \triangle_H.$$

2) The private firm's profit is observed as $\Pi_j + \varepsilon_\Pi$ and gives a **benchmark** in providing incentives **for the public firm manager**.

The monetary payoff m_i is contingent on both W and Π:

$$m_i = \begin{cases} \alpha + \beta(W + \varepsilon_w), & public\ delivery \\ \alpha + \beta(W + \varepsilon_w) + \gamma(\Pi_j + \varepsilon_\Pi), & mixed\ delivery \end{cases}$$

where $\varepsilon_\Pi \sim N(0, \sigma^2)$ reflects cost or demand shocks

The welfare and profit shocks are correlated

$$corr(\varepsilon_W, \varepsilon_\Pi) = \rho > 0$$

Higher ρ ensures that private profits provide better benchmark for the government

Model results

Proposition 1. When the government arbitrary splits the regulated market between the private and public operators, the mixed delivery model **does not always guarantee** higher quality and cost efficiency as compared to the public delivery option

Proposition 2. When $\tilde{\lambda} \geq \lambda$, then private delivery is always preferred to alternative schemes, otherwise the choice of optimal delivery option is ambiguous

Proposition 3. When $\tilde{\lambda} \ll \lambda$, then

- private delivery is preferable for high uncertainty parameter σ and low correlation ρ,
- mixed delivery is preferable for high for moderate uncertainty parameter σ and high correlation ρ,
- public delivery is preferable for low uncertainty parameter σ at any level of ρ

Sustainability of mixed delivery

Socially desirable delivery models and economic shocks

σ	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
2	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed
1.9	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed
1.8	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed
1.7	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed
1.6	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed
1.5	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed
1.4	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed
1.3	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed
1.2	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed	Mixed
1.1	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed	Mixed
1	Private	Private	Private	Private	Private	Private	Private	Private	Private	Mixed	Mixed
0.9	Private	Private	Private	Private	Private	Private	Private	Private	Mixed	Mixed	Mixed
0.8	Private	Private	Private	Private	Private	Private	Private	Private	Mixed	Mixed	Mixed
0.7	Private	Private	Private	Private	Private	Private	Private	Mixed	Mixed	Mixed	Mixed
0.6	Private	Private	Private	Private	Private	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed
0.5	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed
0.4	Public	Public	Public	Public	Public	Public	Public	Mixed	Mixed	Mixed	Mixed
0.3	Public	Public	Public	Public	Public	Public	Public	Public	Public	Public	Public
0.2	Public	Public	Public	Public	Public	Public	Public	Public	Public	Public	Public
0.1	Public	Public	Public	Public	Public	Public	Public	Public	Public	Public	Public
0	Public	Public	Public	Public	Public	Public	Public	Public	Public	Public	Public

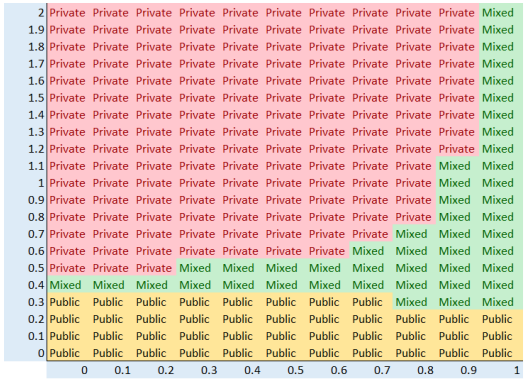
ρ

Model calibration: $r = 1, \theta = 1.1, \bar{c} = 1, \triangle_H = 1.5, \triangle_l = 1, c_0 = 1, s_0 = 1, \lambda = 1, \tilde{\lambda} = 0$

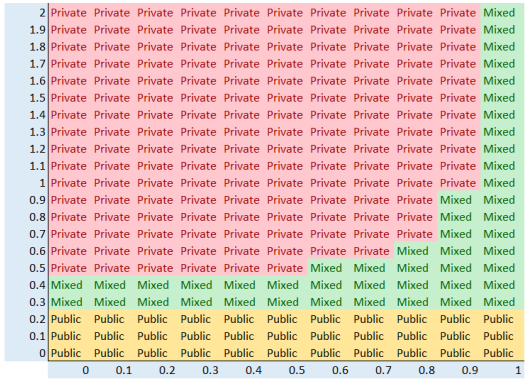
Sustainability of mixed delivery

Socially desirable delivery models and the social cost of public funds

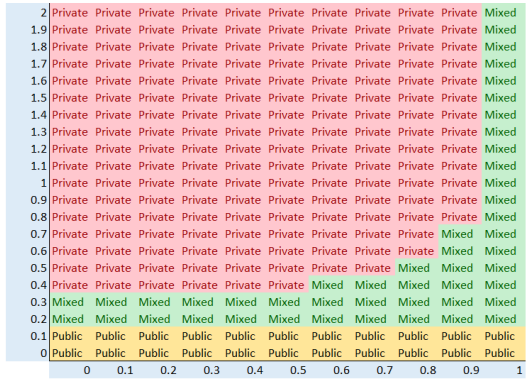
$\tilde{\lambda} = 0.1$



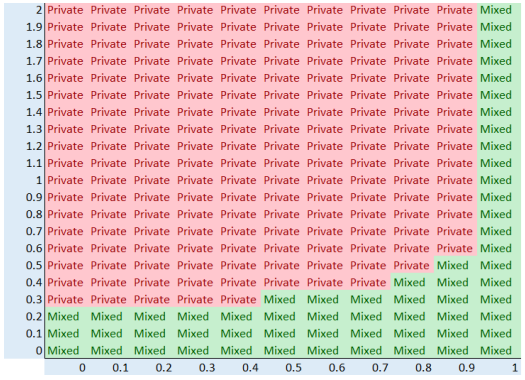
$\tilde{\lambda} = 0.2$



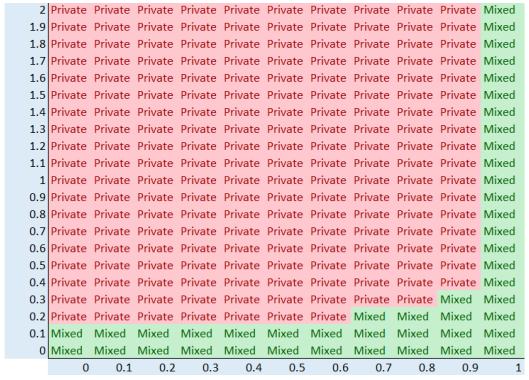
$\tilde{\lambda} = 0.3$



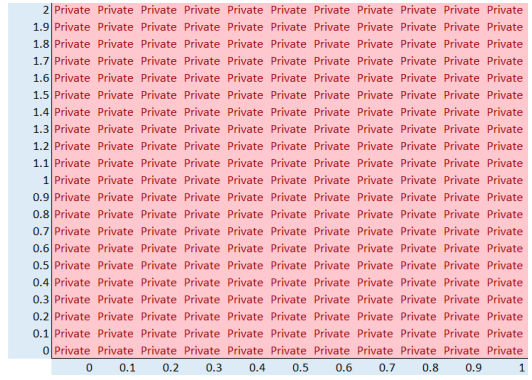
$\tilde{\lambda} = 0.4$



$\tilde{\lambda} = 0.5$



$\tilde{\lambda} = 0.6$



ρ

Model calibration: $r = 1, \theta = 1.1, \bar{c} = 1, \triangle_H = 1.5, \triangle_l = 1, c_0 = 1, s_0 = 1, \lambda = 1$

Conclusion

1. Mixed delivery model of public transport reduces information asymmetry and improves price regulation
2. The government can appropriately choose the mixed delivery structure of a regulated duopoly market to improve social welfare
3. If CT selects the most cost efficient bidder among private firms, its cost-reducing performance may provide a sound benchmark for the public firm operating the same market
4. Quality standards set by the public firm may provide a natural constraint for the private firm
5. Given the market split, higher uncertainty exacerbates the moral hazard problem and makes a mixed delivery system worth considering
6. If the performance indicators of the firms are highly correlated, such welfare improvement effects become stronger
7. High shadow costs of public funds makes mixed delivery less attractive
8. High market risks increase the optimal market share of the public firm